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# Are Linear and Nonlinear Exchange Rate Exposures Aggravating Agents to Corporate Bankruptcy in Nigeria? New Evidence from the "U" Test Analysis

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**ABSTRACT:** Several pioneering studies have established that the effect of exchange rate exposure to corporate entities in periods of the financial crisis is no longer linear. To this end, this study explores the position of this argument in a developing country like Nigeria and investigates if the phenomenon could lead to the escalation of corporate survival threats, particularly in crisis and non-crisis periods. In order to ensure this, we analyzed the data of 102 companies consisting of indigenous and multinationals entities' from 20 sectors of the Nigerian economy from1980-2011. The study employed the ARDL bounds test approach to cointegration and the "U" test methodologies in determining the linear and non-linearity effects of the exposural position of the selected entities' value. The findings of the study established the existence of non-monotonic relationships between the indigenous entities values and the exchange rate position. The "U" shape relationship was discovered to be the most aggravating agent to these entities survival threats. Surprisingly the relationship between the corporate value of multinational companies in Nigeria and official exchange rate (ERS) is only having a linear relationship. This means that these entities are not heavily exposed to the vagaries of exchange rate changes, meaning they cannot be threatened by bankruptcy in both the crisis and non-crisis periods, which is in contrast to the findings on indigenous entities. As a result of these findings, we recommend to policy makers, the establishment of exchange rate frame-work that is feasible towards enhancing productivity in the real sector corporate entities of the country.

**Keywords:** exposure; linear and non-linear; monotonic and non-monotonic; financial crisis.
**JEL Classifications:** F3; F4; G3

## 1. Introduction

New rising empirical evidence indicates that, the trend of exchange rate exposure, specifically to those corporate entities that have strong international economic linkages and integration in terms of products and global financial market participation is no longer linear. Within this framework, key empirical research findings have indicated that corporate profits are critically affected by currency movement through a significant exposural pass through via two principal channels, namely competitive effect and net worth or balance sheet effect. These effects combine to make the corporate financial structure too weak to withstand the exogenous shocks which in turn render the balance sheet of corporate entities fragile and susceptible to derelictions (Bénassy *et al.,* 2009; Prasetyantoko, 2007; Claessens *et al.*, 2000).

It is against this backdrop that this paper aims to investigate the effects of linear and non-linear exchange rate exposure in a developing country like Nigeria. The study wishes to contribute by determining (i) the effects of linear and non-linear exchange rate exposure in crisis and non-crisis periods (ii) whether this could be an aggravating agent to the survival threats of the selected entities (iii) an estimation of the nonlinearity effects of exchange rate exposure using the newly developed "U" shaped methodology. Following the introduction in section 1, in section 2 the paper focused on the theoretical and empirical literature reviews while, in section 3, we provided an

overview of the theoretical origin and complexities of the financial crisis. In section 4, the paper delineates the theoretical framework of the study, and section 5 consists of the methodology of estimating the model and section 6 presents the results and discussion. Finally, section 7 presents the conclusion, recommendation and policy implication.

## 2. Theoretical and Empirical Literature Review

The theoretical review of Shapiro (1974) became the pioneering research on exchange rate exposure literature. He argued that the values of multinational entities that operate within the niches of varied economic circles are susceptible to the repercussions of economic fluctuations. He continued to argue that, the likeliness of these entities to be influenced by the dynamics of foreign currency movement is absolutely a factor which is dependent on the level of inflation, or the degree of currency devaluation on the dollar value of these organizations; in comparison to the traditional historical accounting definition of the entities net current assets. Hodder (1982), in his empirical findings, established a landmark between corporate value and foreign currency exposure particularly those with international dealings. The trend continued up to the seminal work of Adler and Dumas (1984) who contradicted the findings of the two earlier researchers. They argued that corporate organisations that operate in domestic markets can also be influenced by exchange rate fluctuations. This finding was further validated by Jorion (1990). Luetherman (1991) studied how the hypothetical belief that local currency depreciation provides an advantage for the competitive possibility of the domestic country producers comparable to foreign competitors. The finding of the author was found to be contrary to the established hypothesis that depreciation of domestic currency strengthens the competitive abilities of domestic companies. He then argued that firms do not obtain significant or insignificant benefits from depreciation of their national currency. However, a large fall in the turnover of their industries was found as a result of the depreciation of the home currency. Complimenting this finding, Bodner and Gentry (1993) studied foreign currency influence at the firm level for Canada, Japan and USA. The findings of the authors revealed that real manufacturing entities' values in all the three countries are significantly exposed. In an attempt to confirm the above findings, Choi and Prasad (1995) devised a model that helped them to analyse the effect of the influence of foreign currency exposure on 409 U.S transnational companies. At the end, they established how movements in foreign currency tend to affect these companies overall net worth. The research also found 60% of the firms under their survey to be widely influenced by foreign currency variability. Following this interesting finding, Domely and Sheehy (1996) found a similar relationship in foreign currency variability and how widely it influences exports.

Supporting the work of Domely and Sheehy (1996), Miller and Reuer (1998) investigated the repercussions of the effects of the changes in industrial hedging methodologies and strategies of firm's exposure to foreign currency fluctuations. Their findings revealed that 13% to 17% of U.S real sector corporate entities are influenced by foreign exchange rate variability. The authors also indicated that the influence of foreign direct investment will reduce the degree of firm's exposure by stifling foreign exchange fluctuation. Similarly, Brunner and Himmet (2000) studied the mechanics of currency movement of German corporate entities with regard to the variability of German currency comparable with those in the US. The findings established how these companies are heavily influenced by a change in the Dutch Mark to the U.S Dollar. On the contrary, Choi and Cheol (2002) investigated the exposure of US firms operating in the Asian continents. Their seminal work came after the 1997 Asian financial crisis. The findings of the authors revealed that there were signs of both contemporaneous as well as lagged variations in the level of exposure particularly during the crisis period. The authors further asserted that the direction of foreign currency fluctuations are categorised into negative and positive coefficients and this means that there is a clear reflection of the dynamic nature of exchange rate movement. In another development, Aguiar (2004), in his empirical findings, indicated that the fall in the value of a national currency could affect corporate entities in two prominent directions; mostly through competitive effect and the total overall corporate value or balance sheet effect. The author continued to assert that, in some cases, depreciation has a competitive effect when it is followed by an increase in export which also spurs economic growth. However, if currency depreciation is followed by a decline in production, such as tradable or exportable goods, then corporate entities will be marred by a severe degradation of value due to contraction in earning stream.

Priestley and Ødegaard (2007), in their innovative empirical research work titled 'Linear and Nonlinear Exchange Rate Exposure', identified a flaw in the past theoretical literature and vast empirical studies, where they asserted that the dimension between the overall corporate net worth and exchange rate exposure generally has a nonlinear relationship. They established a number of theoretical models that demonstrated how a firm's exposural behaviour tends to be different when the currency is depreciating, in comparison to when it is appreciating. Bartram (2007), in his seminal empirical work studied the influence of foreign currency, and its management in relation to corporate cash flow positions. The author demonstrated how foreign exchange rate exposures can be managed to provide a hedging mechanism at the firm level. As a result of this, the residual net exposure on corporate entities will be economically and statistically negligible, and this will hold particularly, when operating cash flow positions of the firms are highly exposed to the industry risk position. Contrary to the work of Batram (2007), Simbanegavi and Wilander (2008) conducted a study that aimed to determine at which stage a minimum exchange rate pass-through is likely to have a direct link to grievous corporate exposure level. Hence, they argued that the relationship between exchange rate pass-through and exposure is likely to be positive across industries when and only if, cost functions differ across industries. In another significant research contribution, Choi and Jiang (2009) investigated how the collapse of the Bretton Woods arrangement was followed by varied continental financial economic systems the authors pointed out that, this produced ground breaking mechanism which saw the back ground for currency and market dis-unification which in turn led to the arousal of the current economic lingering of currency movement. As a result of this, it became an established fact that the influence of foreign currency on corporate entities will increase commensurate with its echelons of international dealings.

Fratzscher (2009), in his sharp research focus, conducted an investigation with the aim of ascertaining how the financial crises tend to trigger persistent and unprecedented foreign exchange rate movements. The findings of the author revealed that economic fundamentals and financial exposure are key aggravating agents to the transmission process. In essence, countries that have high direct financial exposure with the U.S and those that also have an insignificant reserve holding and persistent current account deficit suffer more when it comes to currency depreciation. In another dimension, Batram and Boardnar (2012) studied the link between estimating foreign currency exposure and returns on invested stocks mostly in non-financial companies for 37 countries. The authors discovered that 30% to 40% of most corporate entities operating in developing and emerging market economies like Brazil, South Africa, Indonesia, Argentina and Thailand are significantly influenced by foreign exchange rate exposure. The authors established that the menace of exchange rates on these countries' corporate profitability could in principle stem from an effect on the firms' cash flows or discount rate and that the impacts of the risk inherent in the exchange rate variability on stock returns is absolutely driven by a predominant position of corporate cash flow sway due largely to economic fundamentals prevailing in these countries.

In another development which comparatively studied the three regions of Africa, Asia and the Middle East, Rafindadi and Yusof (2014a) attempted to determine a common position that may be regarded as an entrepreneurial haven in periods of currency devaluation and currency collapse. The authors applied the concept of catastrophe theory modeling in their study. The theoretical findings concluded that, in theory, determining the best region that satisfied the full conditions of being an entrepreneurial haven in the respective periods under survey is virtually impossible. However, while using the empirical data of doing business provided by the World Bank, and by means of graphical representation, the authors discovered how the African region demonstrated some key characteristics that provided multiplicities of economic and other entrepreneurial opportunities as against the other two regions. In contrast to the earlier development, Rafindadi and Yusof (2014b) established that a moderate devaluation of the Nigerian local currency could have a stabilizing influence on the balance of payment problem facing the country particularly when productive resources are optimally utilised. As a result of this, the authors argued that a less contractionary monetary policy when combined with an appropriate exchange rate policy can enable the country to achieve more effectively the objectives of devaluation in Nigeria. They argued that moderate currency devaluation is cheaper than the imposition of a high interest rate pursued by the Central Bank. In their explanations, they pointed out that high interest rate will end up stippling economic growth prospects of the country in the long-run.

**3. Complexities of the Financial Crisis**

Financial crisis is a broad term commonly applied to continuums of economic situations, which combine to lead to the deteriorations of the value of the financial assets and financial institutions. It is a phenomenon that directly results in the loss of the quality of paper wealth, which in turn creates currency collapse, banking panics, financial asset bubbles, stock market crisis, and sovereign default, as well as the weakening of the prosperity of real sector corporate entities among others. The menace of the financial crisis inversely affects the national economy through persistent exchange rate instability, investment instability and a general market failure. This phenomenon substantially precipitates into massive financial dissaving; weakening of international and domestic trade, and often creates enormous capital repatriation by foreign investors. In his research findings, Cavallo *et al.* (2002) documented that during, any period of the financial crisis and currency collapse, corporate entities with substantial foreign currency liabilities tend to have whopping increases in the value of their gearing level relative to revenues, thereby, crippling insufficiently hedged debtors and leading to contractions of corporate fortunes, prospects and production optimality possibilities. In a more reliable and detailed explanation, Gerald (2010:2) established that financial crisis:

> *"In recent years, the pace of change and innovation in financial markets and institutions around the world has increased considerably in complexities as have the speed, volume and value of financial transactions. The period has also seen a greatly heightened degree of aggressive competition in the financial sector. All of this is taking place in the context of a legal and a regulatory framework which is increasingly outdated and ill-equipped to meet the challenges of the day. This has led to…concern that the fragility of the system has increased, in part because the degree of operational, liquidity and credit interdependency has risen sharply"*

Similar to the above, Merali (2009:1) stated that:

> *"The global financial system as a CAS illustrates the importance of network topology and diversity in system robustness and resilience. The density and complexity of the financial network led to profound structural vulnerabilities and amplified uncertainties in the pricing of assets, causing seizures in particular financial markets. Network feedback effects under pressure (hoarding of liabilities and fire-sales of assets) coupled with the dominant positions of leading players and the erosion of diversity in institutions' business and risk management strategies resulted in the current crisis."*

In another perspective, Kaminsky *et al.* (1997) documented that financial crises can be provoked by adverse world economic conditions that have to do with the market's failure to have a sustainable and steady international capital flows. The author further argues that crises in emerging markets are of a different nature when compared with crisis in mature markets. On the other hand, the crises in developing markets are critically worse if met with deteriorating economic fundamentals. Similarly, crises triggered exclusively by adverse shocks from international capital markets and crises from economies with immaculate fundamentals are found to be a mature-market driven phenomenon. In contrast, crises in emerging economies are triggered by myriad vulnerabilities while those in developing economies are triggered by the shallowness in the market, mono economic dependence and poor macroeconomic management. In all the three instances, the degree of the crisis severity, is usually measured by the range of output losses, the magnitude of the reserve losses of the central bank, and the depreciation of the domestic currency are key prominent factors used to gauge the extent of severity of most financial crisis. In essence the cumulative effects of the crisis totally depend on the dysfunctional causes of the crisis to corporate entities and how it affects other segments of the economy which constitutes the main stay of the system and subsystems. Kaminskey (2003) re-asserts that the degree of the severity of currency crises is directly linked to the nature of the crises. He documented that crises emanating from financial excesses will be having the worst effects on the real sector entities than the rest of the economic system and has the tendencies of triggering sudden stops. The author then laid a logical explanation on the models of most financial crisis. According to him, the models of currency crisis constitute a spectacular position of most financial crisis theorisation. In this respect, the theoretical assumptions of the first, second and third generation model of currency

crisis, possesses a threefold theorisation mechanics. For instance, the first-generation model of currency collapse argued that whenever, macroeconomic inconsistencies arise when fixed exchange rate regime is pursued the situation could lead to financial operational dysfunctionalities which impairs financial value. The theorisation of this model continued to re-echo the complications of fiscal deficits and broad monetary dilation as principal confluence and aggravating agents to currency collapse in the first instances (Krugman, 1979; Flood and Garber, 1984). On the contrary, the theorization of the second-generation model takes into consideration the effects of the myriads of countercyclical economic issues that relate to production optimality impediments which arise in an attempt to control monetary dilation by the Central Bank. This situation then creates a hindrance between credit facilities and the real sector entrepreneurial outlets. This situation in turn impedes on entrepreneurial supply and hence acts as a restriction on production, innovation and resources exploitation. The shortage of entrepreneurial supplies in turn breeds another crisis due to shortages in production activities, as a result of current account depletion that ginger currency misalignment, (Obstfeld, 1994; Eichengreen et al., 1997). The third-generation model has financial excesses as its main focal point of argument (Krugman, 1999 and Aghion et al., 2001 and 2004). The culmination of these three models piques economic sudden-stop which ends up creating international capital problems that are capable of transcending into general financial crisis issues nationally and or regionally. Apart from the above, Kaminsky (2000) suggested some key early warning signals of crisis which are presented in table 1.

**Table 1. Reliable Early Warning Signals of Crisis**

| | | Warning is issued when: |
|---|---|---|
| 1 | Real exchange rate Misalignment | • The home currency is overvalued (i.e. exchange rate misalignment). |
| 2 | The home currency is overvalued(i.e. exchange rate misalignment). | • M2 multiplier<br>• Domestic credit-to-GDP ratio<br>• Domestic and external financial liberalisation |
| 3 | Bank runs | • Dwindling Bank deposits |
| 4 | Monetary policy | • "Excess" M1 Balance |
| 5 | Current account problems | • Low Exports<br>• Excessive Imports<br>• Deteriorating Terms of trade |
| 6 | Capital account problems | • Reserves<br>• M2-to-reserves ratio to low<br>• Wide Real interest rate differential<br>• World real interest rate<br>• High Foreign Debt<br>• Excessive Capital Flight<br>• High Short-term Foreign Debt |
| 7 | Growth slowdown | • Low Output<br>• High Domestic real interest rate<br>• Lending-to-deposit interest rate ratio<br>• Stock Market index decline |

Sources: Kaminsky (2000)

## 4. Theoretical Framework

The linking theories that led to the empirical modeling and conceptualisation of this paper are based on the institutional theory of corporate bankruptcy propounded by Walters (1957) which asserts that a corporate entity is widely seen as a reservoir of cash holding (value). The firm is then considered as being in bankruptcy threats (going concern problem) only and only if the reservoir (value) becomes empty possibly through systematic risks factors or other factors that may arise to affect the entity. In this respect, we follow the conceptual framework of Han shin and Stulz (2000) and the theoretical model of Benoit *et al.* (2013) and Brownless and Engle (2012) the authors in their theoretical model show how the value of $N$ firm can be affected by its $r_{it}$ the return of firm i at time t.

through periods of crisis or rising economic uncertainties, they continued to argued that the market return is the value-weighted average of the total firm return $rmt = \Sigma_{i=1}^{N} \omega_{it} r_{it}$ where $\omega_{it}$ denote the relative total corporate value in this context. Following to this, the concept of systematic risk can affect an entity i through systematic risk as measured by Expected Shortfall (ES) of the system equation proposed by Acharya et al (2010). By definition, the ES is a position where the firm value can be affected at an α % level and also the expected return in the worst scenario can also be affected by α%. Theoretically this can be expressed in the following equation form:

$$ES_{mt}(C) = E_{t-1}(r_{mt} \mid r_{mt} < C) = \sum_{i=1}^{N} \omega_{it} E_{t-1}(r_{it}(r_{mt} \leq C) \ldots\ldots 1$$

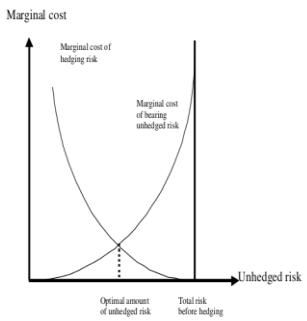
$$MES_{it} = (C) = \frac{\partial ES_{mt}(C)}{\partial \omega_{it}} = E_{t-1}(r_{mt} \leq C) \ldots\ldots .. 2$$

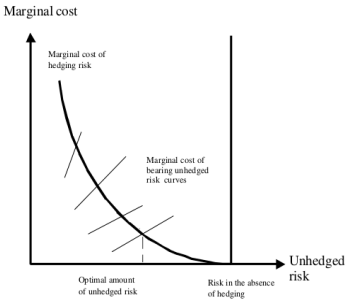
The MES is a coherent risk measure formulated by Artzner *et al* (1999) this measures the increase in the risk of an entity which is measured by ES which try to identify the level of a firm's risk factor to the entirety of the risks factors inherent in the financial system. These can also be extended by the following System Expected Shortfall SES as in:

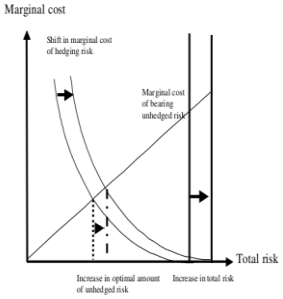
$$\frac{SES_{it}}{W_{it}} = kL_{it} - 1 - E_{t-1}(r_{it}(\Sigma_{i=1}^{N} W \angle k \Sigma_{i=1}^{N} A_{it} \ldots\ldots 3$$

Where $L_{it}$ the leverage is $(\frac{A_{it}}{W_{it}})$, $A_{it}$ refers to the total asset of the firm and $W_{it}$ is the total corporate value in this study. According to Acharya (2010) the above term can also be expressed in a linear form: $SES = (k\ L_{it} - 1 + \theta\ MES_{it} + \Delta_i)\ W_{it}$ ……..4. Where θ and $\Delta_i$ are constant term. Graphically, we use the concepts of Han shin and Stulz (2000) in demonstrating how firm value and risk can arise to escalate the total corporate risk to bankruptcy. These concepts are graphically illustrated in:

Figure 1 Figure 2 Figure 3



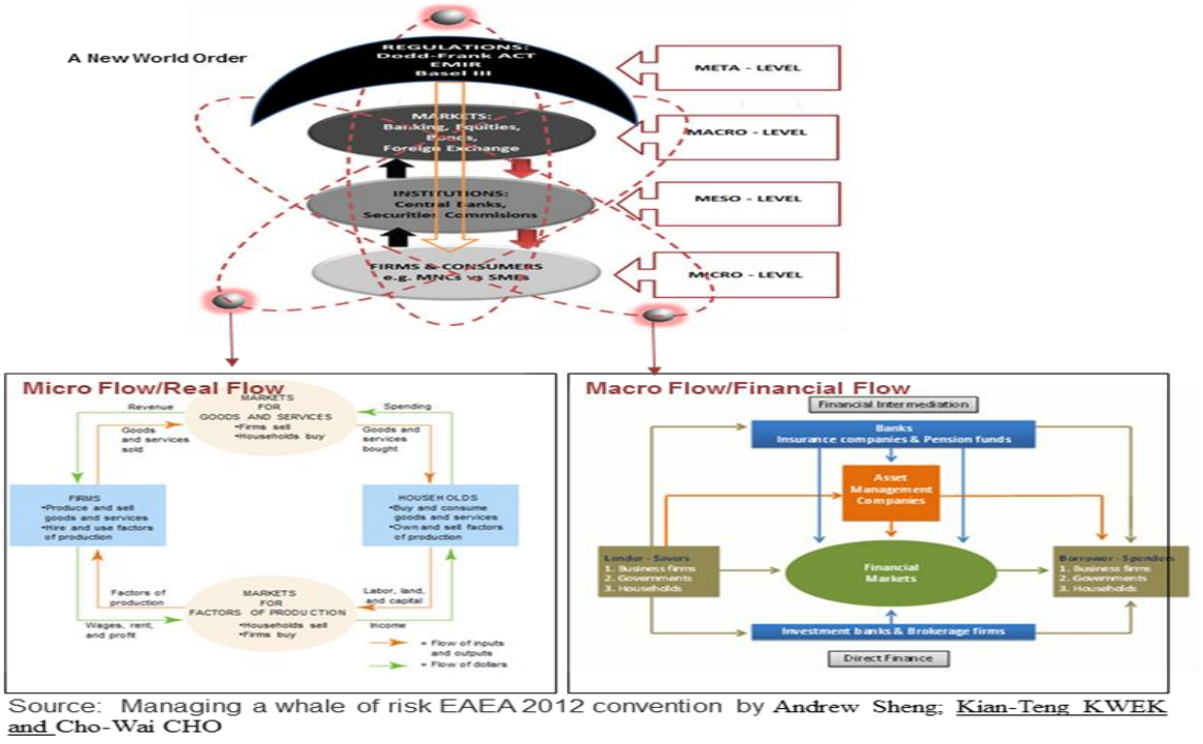




In the above figures, figure 1 explains the assumption that marginal cost of bearing unhedged risk is increasing the unhedged risk, while the marginal cost of hedging risk is decreasing in unhedged risk. While figure 2 explains the assumption that all firms have the same marginal cost function of hedging risk, but have different marginal cost functions of bearing unhedged risk as the risk factors continued to escalate. Finally, in figure 3 the impact of optimal unhedged risk increase to the firm's risk stream. .Meaning that **a**s the firm's unhedged risk increases, the marginal cost for a given amount of risk reduction is kept the same so that the marginal cost curve of hedging risk shifts to the right. As the firm's unhedged risk increases, the marginal cost of bearing unhedged risk is kept constant for each level of unhedged risk.

In figure 4, a description of the ecosystem is provided by trying to depict the high level of inter-connectedness between the economic system and its subsystems. Following this, an assumption is made by using the anatomy of an economic system to be synonymous with that of an atom. The other inter connectedness here is refered to as the nucleus these consists of the markets (macro-level) and the firms (micro-level). accordingly, the red elements (herein called electron) that revolve around the markets tend to create a macro-flow, whereas the orbit that revolves around the firms

creates the micro-flow. the diagramme is aimed at showing how the science within the macro-flow, which is the financial sector, affects the micro-flow, which is the real sector during the periods of financial crisis, thereby, stiffling investment oppcoortunity and creating a stringent position to the real sector. As a result of this development, the circular flow diagram, and the macro flow diagram depict the influence of the financial system on real sector entities and how this can affect organisational cash flows through a whalesome systematic risk effects, thereby, heralding to the possibility of bankruptcy as clearly demonstrated by the graphs presented in the theoretical frameworks.

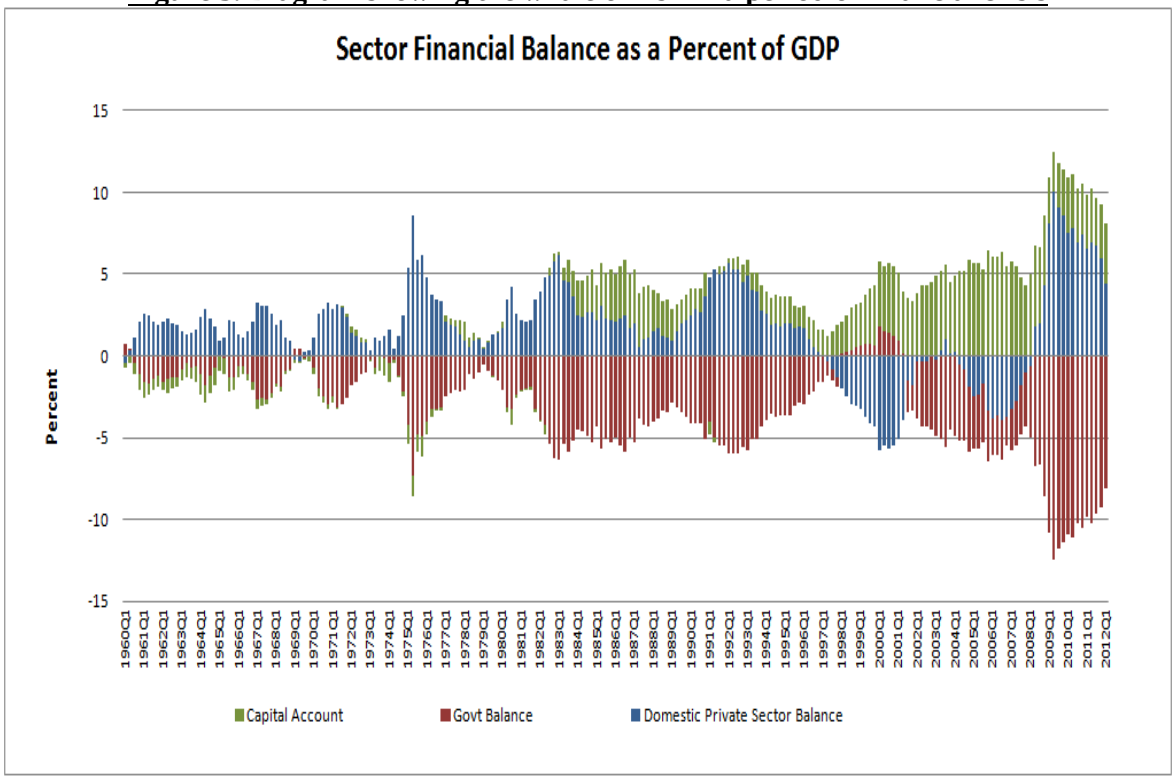
**Figure 4. A description of the effects of the financial crisis to the ecosystem**




Source: Managing a whale of risk EAEA 2012 convention by Andrew Sheng; Kian-Teng KWEK and Cho-Wai CHO

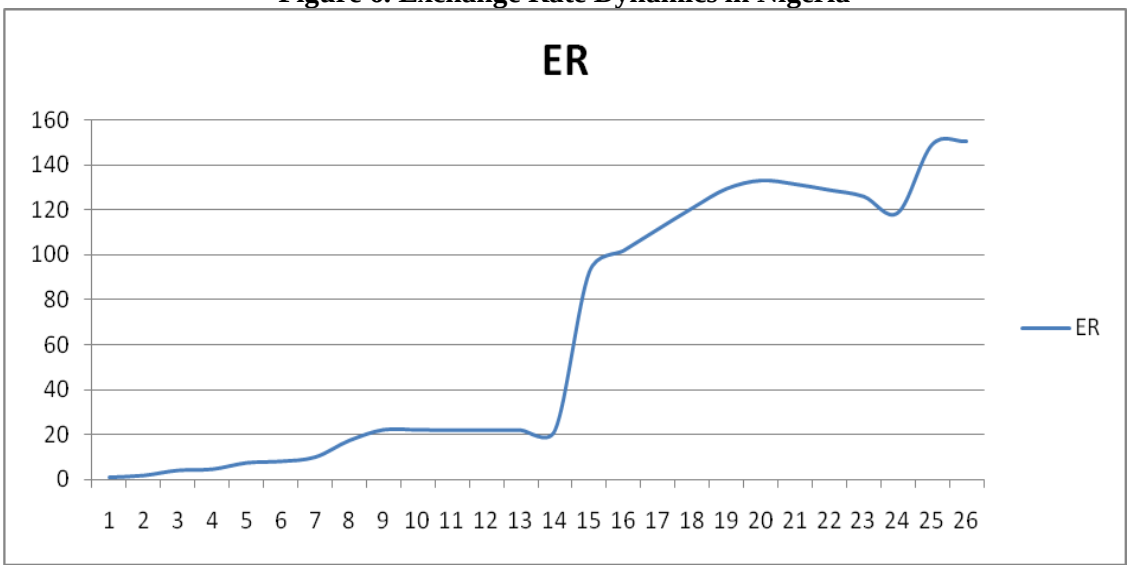
Figure 5 shows the dynamic behaviour of whalesome systematic risk that is commonly found during periods of the financial crisis using an example from the US. This diagram was captured in order to depict how financial imbalances tend to increasing over time in periods of financial crisis. The diagram demonstrate how these imbalances could permeate national and regional trading patners of the US and result in global financial economic issues to affect both indigenous and multinational entities. Note that when the rest of the world (ROW) is a net lender, the domestic U.S. economy is a net borrower. These financial imbalances also suggest that the size of imbalances have waxed and waned overtime, but the waxing motion gets larger overtime, forming a whale-like shape in repetitive motion, thereby, spilling all over the global ecosystem as described in the figure thus yielding a contagious effect to the rest of the global financial system. Figure 6 on the other hand shows the dynamic behaviour of the official exchange rate system in Nigeria.

**Figure 5. Diagram showing the whale of risk in a period of financial crisis**




Notes: Negative imbalance implies net borrowing and positive imbalance implies net lending. Capital Balance also represents Rest of the World (ROW). Source: Flow-of-Funds data in : Managing a whale of risk EAEA 2012 convention by Andrew Sheng; Kian-Teng KWEK and Cho-Wai CHO

**Figure 6. Exchange Rate Dynamics in Nigeria**




## 5. Data, Methodology and Model Specification

In this section two models of secondary data were collected from the periods of 1980 to 2011 (32years). First, the annual financial reporting data of quoted companies from the Nigerian Stock Exchange Market (NSE) is the principal sources of data for estimating the corporate value of both indigenous and multinational entities operating in Nigeria. In the estimation of corporate value, the study applied the price earnings ratio. Following this development, 5 quoted companies were selected from 20 different listed real sectors of the Nigerian Stock Exchange Market (NSE) while 2 additional companies were added from the indigenous entities making a total of 102 companies. The addition of

2 more companies arose as a result of the sample size and the method of sample selection criteria adopted in the study. The basic rule applied for a company to be selected in this study is that it must have an international trading background that falls within the beginning to the end of the periods under investigation. The stratified random sampling selection method was used where the number of the entities in the sector exceeded the required number of companies to be selected. (The data collected for this part of the study was obtained from the published books of the NSE company accounts, African Financials, Private Sector Accounts Unit under the office of the Director of statistics CBN and Meristem Stock Brokers publications). The second sets of data used in the study are on the respective official exchange rates. After this the study made use of two most widely traded currency by these companies in international trade in Nigeria and these are the United State Dollar USD and the Great British Pound Sterling GBP. The data on the official exchange rate of these two currencies were obtained from the Central Bank of Nigeria, taking the same coverage of 1980 to 2011, similar to that of the financial reporting data.

In order to ensure a robust outcome, the study used the autoregressive distributed lag (ARDL) bounds test approach to cointegration by Pesaran *et al.* (2001) in the analysis of the dynamic effects of the linear exchange rate position to corporate entities in Nigeria. This procedure was used in order to examine the long-run and short-run dynamics among the variables. In addition to that, the study found that (i) after selecting the lags order of the model, the cointegration relationship can be estimated easily by using the OLS technique meaning that the ARDL model satisfies the general requirements of OLS estimation criteria; (ii) as opposed to Johansen and Juselius procedure, the ARDL test procedure is applicable irrespective of whether the variables under study are I (0) or I (1) or mutually cointegrated, and (iii) the test is efficient in small and finite data size, however, this test procedure will not be applicable if I (2) series exists in the model. In addition, ARDL model corrects sufficiently omitted lag variable bias (Inder, 1993). The model of this study is as follows:

$$\ln CORL = \beta_0 + \sum_{i=1}^{p} \gamma_i \ln CORL_{t-i} \sum_{j=0}^{q1} \delta_j \ln TRD_{1t-j} + \sum_{l=0}^{q2} \varphi_l \ln ER_{2t-l} + \sum_{m=0}^{q3} \eta_m \ln ERS_{t-m} + \sum_{r=0}^{q4} \omega_r Crisis_{t-r} + \varepsilon_t \quad (1a).$$

$$\ln CORM = \beta_0 + \sum_{i=1}^{p} \gamma_i \ln CORL_{t-i} \sum_{j=0}^{q1} \delta_j \ln TRD_{1t-j} + \sum_{l=0}^{q2} \varphi_l \ln ER_{2t-l} + \sum_{m=0}^{q3} \eta_m \ln ERS_{t-m} + \sum_{r=0}^{q4} \omega_r Crisis_{t-r} + \varepsilon_t \quad (1b).$$

Using the error correction model, the short-run dynamics can be specified as follows:

$$\Delta \ln CORL = \beta_0 + \sum_{i}^{p} \gamma_i \Delta \ln CORL_{t-i} + \sum_{j}^{q} \delta_j \Delta \ln TRD_{1t-j} + \sum_{l}^{q} \varphi_l \Delta \ln ER_{2t-l} + \sum_{m}^{q} \eta_m \Delta \ln ERS_{3t-m} + \sum_{r=0}^{q} \omega_r \Delta Crisis_{t-r} + + \vartheta emc_{t-1} + \varepsilon_t \quad (2a).$$

$$\Delta \ln CORM = \beta_0 + \sum_{i}^{p} \gamma_i \Delta \ln CORL_{t-i} \sum_{j}^{q} \delta_j \Delta \ln TRD_{t-j} + \sum_{l}^{q} \varphi_l \Delta \ln ER_{t-l} + \sum_{m}^{q} \eta_m \Delta \ln ERS_{t-m} + \sum_{r=0}^{q4} \omega_r Crisis_{t-r} + \vartheta emc_{t-1} + \varepsilon_t \quad (2b).$$

Where, CORL refers to the corporate value of local companies in Nigeria, while CORM refers to Corporate value of multinational companies operating in Nigeria and TRD is Trade openness, ER means the Official exchange rate While ERS is the Quadratic of official exchange rates and Crisis is a Dummy for crisis years t = time (i = 1, 2 3...n) (taking 1980, as pre crisis era, and 2007/2008 as crisis era and 2011 as post crisis era) ε = Error term for equation one. The model estimation procedure are as follows**:** First, we estimate equation (1) under OLS approach and then, we conduct the Wald Test or F-test for joint significance of the coefficients of lagged variables for the purpose of examining the existence of long-run relationship among the variables.

The null hypothesis ($H_0$): $\beta_1 = \beta_2 = \beta_3 \ldots N = 0$, establish that there is no cointegration among the variables, was compared against the alternative hypothesis ($H_a$): $\beta_1 \neq \beta_2 \neq \beta_3 \neq .. N \neq 0$. The F statistics is then compared with the critical value (upper and lower bounds) given by Pesaran *et al.* (2001). If the F-statistic is above the upper critical value, the null hypothesis of no cointegration is rejected which indicates that long-run relationship exists among the variables and converse will be the case, if the F-statistic is smaller than the lower critical value, in that respect the null hypothesis cannot be rejected and this is implying that there is no cointegration among the variables. However, if the F-statistic lies between lower and upper critical values, the test is inconclusive. In the second step, after establishing the existence of cointegration relationship among the variables, long-run coefficient of the ARDL model can be estimated. Note that the asymptotic critical value bounds will be obtained from Table F in appendix C, (Pesaran and Pesaran, 1997, p.478). In this process, we use SIC criteria for selecting the appropriate lag length of the ARDL model for all the variables except the crisis dummy. Apart from that, the study conducted key diagnostic tests which comprise of testing for the serial correlation, functional form, normality, and the heteroscedasticity (Pesaran and Pesaran, 1997). To ensure the stability of the variables the study performed two tests of stability for the long-run coefficients together with the short-run dynamics, following the suggestion by Pesaran (1997) to check the stability of short and long-run parameters of selected ARDL model after estimating the error correction model the study applied the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) tests.

**The U test methodology**

Lind and Mehlum (2010) argued that it is clear that nonlinear relationships exist in economic theory, and such relationships are also frequently tested empirically. However, the way they are tested in modern times is fraught with flaws. As a result, the newly invented U shape test of a nonlinear relationship aims to remedy these deficiencies. The main focus of the U shape model rest on its parsimonious attempt to determine the points where the given relationship of variables (i.e. dependent and independent) is decreasing at low values within a certain interval and or increasing at high values and what are the magnitude of the effects on the dependent variable, within a given interval, and particularly when the distribution of the estimated slope at any point is readily discernible. The operational adequacy of the U test is based on the likelihood ratio test which is known as the Sasabuchi-Lind-Mehlum (SLM) Test. To accomplish the test, we have to estimate the following model:

$$CORL_i = aER + bER_i^2 + Z_i C + \varepsilon_i,$$

$$\text{CORM}_i = \alpha\text{ER} + b\text{ER}_i^2 + \text{Z}_i\text{C} + \varepsilon_i$$

The estimation must contain the level of the explanatory variable (i.e. C) and a non-linear term, either quadratic or inverse (i.e. $ER^2$). The test determines which of the two is used and report test results from the test of the hypothesis that the relationship is decreasing at the start of the interval and increasing at the end or vice versa. Within this, then it is required to conduct joint hypothesis test: $H_0: (a + b2ER_{min} \leq 0) \cup (a + b2ER_{max} \geq 0)$ against the alternative hypothesis $H_1: (a + b2ER_{min} > 0) \cup (a + b2ER_{max} < 0)$ Here $ER_{min}$ and $ER_{max}$ represent the maximum and minimum value of corporate value. If the null hypothesis is rejected, confirms the existence of U shape and the given values are the extent or magnitude of the effects on the dependent variable.

**Table 2. Descriptive statistics**

| | Corporate value for MNC | Corporate value for Local Com | Exchange rate | Export | Import |
|---|---|---|---|---|---|
| Mean | 2.39E+08 | 2.74E+09 | 55.98809 | 49788.89 | 850671.6 |
| Median | 2.09E+08 | 5.78E+08 | 21.89065 | 12420.95 | 262470.6 |
| Maximum | 9.49E+08 | 2.49E+10 | 150.2980 | 289152.6 | 3958618. |
| Minimum | -5.04E+08 | -7.17E+08 | 0.617708 | 203.2000 | 5069.700 |
| Std. Dev. | 2.79E+08 | 6.35E+09 | 58.12292 | 77733.99 | 1178970. |
| Observations | 32 | 32 | 32 | 32 | 32 |

**Table 3. Unit root test result**

| | ADF GLS | ADF GLS |
|---|---|---|
| | Intercept & trend I (0) | Intercept & trend (1) |
| CORL | -3.85*** | -5.43*** |
| CORM | -3.96*** | -7.23*** |
| TRD | -2.22 | -7.70*** |
| ER | -2.01 | -4.88*** |

Table 3, presents the results of the unit root tests, and these were performed on the series to check the properties of the data, specifically the stationarity of each variable. This was done in order to ensure that no variable is I (2) so as to avoid spurious result, and ensure no variable exceed the integrated order of I (1). The applied unit root test considered both constant and trend, and Table 3, exhibits that all the variables are stationary at I (1) and I (0). The presence of this mixed order of integration allows the use of the ARDL cointegration approach rather than the Johansen and Juselius approach. As can be seen from Table 3, all the four variables were found to be stationary at I (0) except TRD and ER.

The estimation procedure of the ARDL cointegration approach was conducted based on the OLS in addition to this, the optimum lags length for the ARDL was selected based on SIC. The results of the calculated F statistics for each variable were done after normalization presented in Table 4. As can be seen from Table 4, the calculated F-value was higher than the upper bounds of the critical value at 1% level. Thus, the null hypothesis of no cointegration was rejected.

**Table 4. Result of bounds test**

| Dep. Var. | SIC Lag | F-statistic | Probability | Outcome |
|---|---|---|---|---|
| $F_{CORL}$(CORL\|ER, ERS, TRD) | 3 | 7.580 | 0.000*** | Cointegration |
| $F_{CORM}$(CORM\|ER, ERS, TRD) | 3 | 3.636 | 0.015** | Cointegration |

** at 5%, ***at 1% * at 10%

As can be seen from Table 4, the calculated F-value was higher than the upper bounds of the critical value at 1% level. Thus, the null hypothesis of no cointegration was rejected. Note: Asymptotic critical value bounds are obtained from Table F in appendix C, Case II: intercept and no trend for k=5 (Pesaran and Pesaran, 1997, p.478). Lower bounds I (0) = 2.39 and Upper bound I (1) = 3.38 at 5 % significance level.

**Table 5. Estimated long-run coefficients using the ARDL approach (2, 1, 3, 0, 0) selected based on Schwarz Bayesian Criterion 1980 to 2011. The dependent variable is LCORL**

| Regressor | Coefficient | Standard Error | T-Ratio[Prob] |
|---|---|---|---|
| ER | 0.151 | 0.131 | 4.946[0.000] |
| ERS | 0.005 | 0.914 | 5.599[0.000] |
| TRD | 0.317 | 0.070 | 4.487[0.000] |
| CRISIS | 1.472 | 0.662 | 0.137[0.030] |
| C | -0.871 | 3.863 | -0.225[0.824] |

The estimation was performed using Micro fit software.

Table 5 contains the estimated result of the linear exchange rate exposure which established the findings on the long-run relationship between corporate value of local companies and official exchange rate (ER). This result reveals that the coefficient of square term of ERS is positive and significant which means that initial increment of ER positively affects the corporate value of local

companies. In addition, local companies also benefit from trade openness as the coefficient is positive and significant. This result suggests that whenever, trade openness dwindles the corporate value of local companies suffers. The findings also show that crisis has positive effects to the local corporate values in the long-run.

**Table 6. Error Correction model for indigenous corporate value model (2, 1, 3, 0, and 0) selected based on Schwarz Bayesian criterion 1980 to 2011. The dependent variable is dLCORL**

| Regressor | Coefficient | Standard Error | T-Ratio[Prob] |
|---|---|---|---|
| dLCORL1 | -0.328 | 0.132 | -2.474[0.022] |
| dER | 0.165 | 0.294 | 0.563[0.580] |
| dERS | 0.190 | 0.002 | 0.095[0.925] |
| dERS1 | -0.003 | 0.822 | -3.928[0.001] |
| dERS2 | -0.003 | 0.898 | -3.706[0.001] |
| dTRD | 0.009 | 0.132 | 3.846[0.001] |
| dCrisis | -0.859 | 0.411 | 0.341[0.003] |
| C | -1.396 | 6.206 | -0.225[0.824] |
| ecm(-1) | -0.602 | 0.206 | -13.764[0.000] |
| ecm = LCORL+0.65198*ER0.0051188*ERS0.31777*TRD+1.4723*CRISIS +0.87128*C | | | |

The estimation was performed by the researchers using Micro fit software.

Table 6 reports the results of Error Correction model for indigenous corporate value using the ARDL model (2, 1, 3, 0, 0) selected based on Schwarz Bayesian criterion from 1980 to 2011. The dependent variable is dLCORL. The results from Table 6 reports that CORL is positively affected by previous year's CORL in the short-run as the coefficient of CORL is positive and significant. However, the different terms of ER and ERS do not have any impact on dCORL but the previous two years of ERS have had a short term negative impact on dCORL. Likewise, short-run, changes in trade openness have positive impact on dCORL. Moreover, crisis was also found to have negative effect on dCORL in the short-run. The estimate of $ECM_{t-1}$ is negative and statistically significant. The negative value of ECM is theoretically correct, which shows the speed of convergence from short-run toward the long run. It implies that short-run variations are corrected by 60% speed of adjustment towards equilibrium after any shock every year.

**Table 7. Diagnostic tests**

| | |
|---|---|
| R-Squared= .654 | R-Bar-Squared 0.632 |
| A:Serial Correlation CHSQ(1) 0.69101.406] | B:Functional Form CHSQ(1) 2.1932[.139] |
| C:Normality CHSQ(2) 1.2571[.533] | D:HeteroscedasticityCHSQ(1) 4.2689[.390] |

A: Lagrange multiplier test of residual serial correlation; B: Ramsey's RESET test using the square of the fitted values; C: Based on a test of skewness and kurtosis of residuals; D: Based on the regression of squared residuals on squared fitted values.

**Figure 7. Diagramme showing the plot of Cumulative Sum of Square CUSUM**

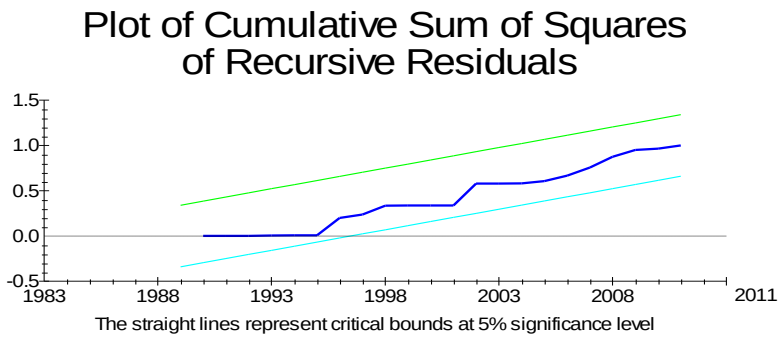


**Figure 8. Diagramme showing the plot of Cumulative Sum of Recursive (CUSUMQ)**

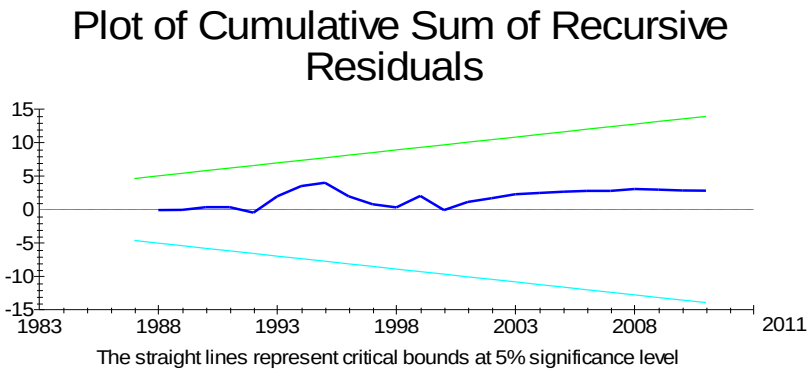



Table 8 reports the relationship between the corporate values of multinational companies (CORVM). The results in the table show that the official exchange rate is having a linear relationship in the long-run, and it has a positive and significant coefficient of ER this indicates that an increase in ER affects CORVM. However, the impact of TRD on CORVM is inconclusive, while CRISIS was found to have positive and significant long-run effects on CORVM.

**Table 8: Estimated Long-run Coefficients using the ARDL Approach (1, 0, 0, and 0) selected from 1980 to 2011 Dependent variable is CORVM**

| Regressor | Coefficient | Standard Error | T-Ratio[Prob] |
|---|---|---|---|
| ER | 0.138 | 0.052 | 3.621[0.015] |
| TRD | -0.192 | 0.157 | -1.227[0.232] |
| CRISIS | 0.060 | 9.435 | 2.938[0.070] |
| C | -13.048 | 10.225 | -1.276[0.214] |

In Table 9 the study discovered that the short-run, ER has had a positive and significant impact on CORVM in the short-run. However, the dynamic effects of TRD and CRISIS are found to be inclusive in the case of Nigeria's multinational entities. The coefficient of ECM is negative and significant indicating that it adjusts 14% per year towards short-run equilibrium after any economic shock.

**Table 9. Error correction model for multinational companies operating in Nigeria**

| Regressor | Coefficient | Standard Error | T-Ratio[Prob] |
|---|---|---|---|
| Der | -0.126 | 0.052 | -2.422[0.023] |
| Dtrd | -0.176 | 0.151 | -1.162[0.256] |
| dCRISIS | 0.329 | 8.634 | 0.038[0.970] |
| C | -11.932 | 9.974 | - 1.196[0.243] |
| ecm(-1) | -0.014 | 0.198 | -4.604[0.000] |
| ECM = LCORM -.13833*ER + .19278*TRD -.36036*CRISIS -13.0486*C | | | |

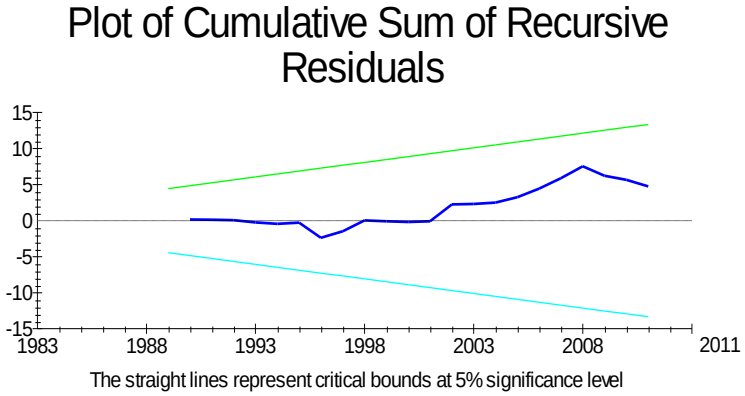
**Table 10. Diagnostic tests**

| | |
|---|---|
| R-Squared .7320 | R-Bar-Squared .7184 |
| * A:Serial Correlation*CHSQ (1)= .69101[.506] | B:Functional Form *CHSQ (1)= 2.1932[.539] |
| * C:Normality *CHSQ (2)= 1.2571[.533] | D:Heteroscedasticity*CHSQ (1)= 4.2689[.460] |

A: Lagrange multiplier test of residual serial correlation; B: Ramsey's RESET test using the square of the fitted values; C: Based on a test of skewness and kurtosis of residuals; D: Based on the regression of squared residuals on squared fitted values.

The regression for the underlying ARDL equation fits remarkably well where it shows the $R^2$=73%. Similarly, the diagnostic test shows the absence of serial correlation, functional form misspecification and non-normal errors. The presence of heteroskedasticity as reported in Table 10 was supported in Shrestha and Chowdhury, (2005) where the authors stated that due to the existence of mixed order of integration i.e., I(0) and I(1), it is natural to detect heteroscedasticity. Finally, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) of the model indicate the stability of the variables over the sample period. This is shown below in figure 9 and 10 respectively.

**Figure 9and 10. The plot of Cumulative Sum of Recursive (CUSUMQ) and Cumulative Sum of Square CUSUM for model 2 respectively.**



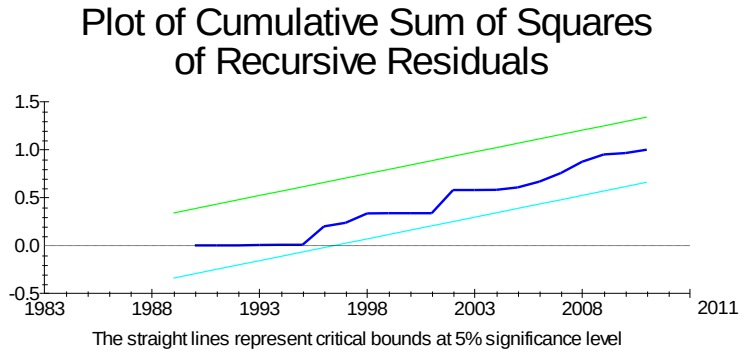




**Table 11. The U test for non-linearity relationship**

| | CORL | CORVM |
|---|---|---|
| Slope at $ER_{min}$ | -0.50**<br>(-1.90) | -0.06<br>(-0.23) |
| Slope at $ER_{Max}$ | 0.61**<br>(2.14) | 0.34<br>(1.18) |
| SLM test for inverse U shape | 1.91 | 0.24 |
| P Value | 0.033 | 0.408 |

Table 11 shows the results of the U test analysis. In the Table the study discovered that the relationship between the corporate values of local companies and the official exchange rate squared to be non-monotonic. More specifically the study discovered that the U-shape (nonlinear) relationship is the most aggravating agent towards bankruptcy with respect to the indigenous corporate entities in Nigeria. In addition to that, the analysis in table 5 revealed that indigenous (local) entities are more exposed to the official exchange rate (ER and ERS) in both crisis and non-crisis periods. However, the

results in table 6 persistently showed how the indigenous companies are significantly exposed to bankruptcy in the short-run.

Surprisingly, the relationship between the corporate value of multinational companies operating in Nigeria and the official exchange rate (ERS) is found to be linear. This means that these entities are not heavily exposed to the dynamics of exchange rate. In other words they cannot be threatened by bankruptcy in the short-run. However, the study discovered that in the periods of crisis any significant change in the official exchange rate can affect CORVM. This is as discovered in Table 8 where ER is found to have a positive and significant coefficient indicating that an increase in ER affects CORVM but not at an alarming degree that may warrant the possibilities of facing bankruptcy threat. This finding may be due to the dramatic drop in the value of international currencies and fall in demand. Additionally, the degree of exchange rate overvaluation across continental trading environment may equally culminate in having an impact irrespective of the multinational trading background of an entity. This is as clearly maintained by the literature and several other empirical research findings. Coinciding with these findings, and following further investigations, we found that while the corporate value of the local entities to the official exchange rate in Nigeria is non-monotonic. In a more specific investigation we discovered that the U shape (non-linear) relationship is the most aggravating agent to their survival threats.

## 7. Conclusions, Recommendations and Policy Implications

This study used time series data from 1980-2011 to determine the effect of exchange rate exposure on indigenous and multinational companies operating in Nigeria. This was done in a bid to uncover if linear and non-linear exchange rate exposure can threaten the value of the selected entities towards bankruptcy in crisis and non-crisis periods. The result of the analysis revealed that indigenous entities are more exposed to the official exchange rate (ER and ERS) in both crisis and non-crisis periods, this can be seen from the analysis in table 5 and 6 which showed how the coefficient of square term of ERS was found to be positive and significant, meaning that initial increment of ER positively affects the corporate value of local companies. In addition to this development, local companies were found to derive significant benefit from the trade openness of the country. This can be seen from the same table 5 where the coefficient of the variable TRD is positive and significant. The implications of this finding may suggest the possibilities of whenever, the trade openness of the country dwindle the corporate value of local companies may suffer. In another perspective which compounds the direction of the earlier findings on local companies is the result established by the dummy variable on crisis. In that finding the study discovered that crisis has had positive effects on the local corporate values in the long-run, same inferences were found with respect to the nonlinear exchange rate exposure of the local companies.

Surprisingly, the relationship between the corporate value of multinational companies in Nigeria and official exchange rate (ERS) is only having a linear relationship. This means that these entities are not heavily exposed to the vagaries of exchange rate changes, meaning they cannot be threatened by bankruptcy in both the long-run and the short-run, but they could face a significant change in their balance position during periods of crisis, particularly if the official exchange rate changed significantly. In addition to that, the study discovered crisis to have a positive long-run effects on the corporate value of the multinational companies. To support the direction of these results, the findings of the U test analysis reveals the coefficient of exchange rate (ER) to be negative but significant which establish the existence of a non-monotonic relationship between corporate values of the local companies and the exchange rate changes in Nigeria. In addition to this finding, it was further discovered from the U test analysis that the degree of exposure of the respective corporate values is within the range of 61% for the indigenous companies and 31% for the multinational companies (see table 11). Simultaneous with these results, and on a further analysis, the study discovered that the corporate value of the local entities' to the official exchange rate in Nigeria is more exposed towards bankruptcy as compared with the multinational companies.

The major implication of these findings to the Nigerian economy is that, a continuous change in the value of the national currency could affect the performance of the country's indigenous entities in two prominent directions, mostly through competitive effect and the balance sheet effect. As a result of these, the recent devaluation of the Nigerian currency necessitated by the dwindling oil

revues of (2014) has the possibility of impairing the competitive wherewithal of the indigenous entities thus providing them with the strategic option of either to repatriate to any national business environment which is cheaper to operate or in other cases face the threat of bankruptcy i.e. the balance sheet effects. These twin problems will eventually lead to profound repercussion on national productivity and exports, these will in turn aggravate the already soaring unemployment level of the country, fall in government revenue sources, possible escalation in the high costs of doing business and consumption due largely to the continued sway in foreign exchange which may possibly lead to further devaluation of the national currency and an eventual derailment of the country's economic growth prospects. This is because, if currency depreciation is followed by a continued decline in national productivity, such as tradable or exportable goods, then corporate entities could equally be marred by severe degradation in their respective value as discovered in this study which is also in line with the direction of the extent literature. As a result of these developments, this study insist on the recommendation provided by Rafindadi and Yusof (2014c) where the authors argued that policy makers should establish exchange rate frame-work that is consistent, efficient and effective in enhancing productivity within the real sector economy. In addition to that, the study is of the view that Nigeria in the current millennium need to diversify its economy through the use of knowledge management i.e. to take advantage of the existing over 200 public and private universities in the country and commit them towards varied research endeavour that will strategically devise and impart innovative entrepreneurial skills and encourage entrepreneurial participation among the teeming graduates. This was among the strategies adopted by most of the Asian Tigers in the 80's to get rid of their economic doldrums. This will in our view help in opening up the economy in all spheres of productive endeavour and ensure sustainability.

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