

## **ECONOMICS OF VOLATILITY SPILLOVERS ON CORPORATE EQUITY RETURNS: EVIDENCE FROM NIGERIA CORPORATE GOVERNANCE**

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### **ABSTRACT**

This paper examines the volatility spillovers on corporate equity returns: evidence from Nigeria corporate governance. First, we examined the unconditional patterns during the full sample (January 1990-December 2010) using a measure recently proposed by Diebold and Yilmaz (2012). Second, we made use of a dynamic analysis to evaluate net directional volatility spillovers for each of the eight sectors under study, and to determine whether there exist differences. Our analysis identifies a number of phases of interaction in those sectors (markets) particularly after the introduction of SEC's code of corporate governance in 2003; and also the likely effect of the recently introduced TSA account in Nigeria. We found a substantial spillover in returns (yields) in these sub-sectors particularly in the agro-allied industries. The spillover index and its components can be rationalized on a continuing basis as new data become available and can provide useful information to policymakers and analysts alike.

**Keywords:** Nigerian Corporate Governance, Spillover Index, Equity Returns, Forecast Error Variance Decomposition.

### **INTRODUCTION**

There is no doubt the effect of recent global financial crises not only permeated the Nigerian financial market but as well its corporate governance leading to not only loss of capital by investors but also human capital and rapid rise to speculative behaviours by investors (Suberu and Aremu; 2010). Expectedly, this of course led to a number intervention programs by the government in cushioning the said effect. Apparently, not much was made of the nature of interdependency amongst operating firms within the Nigerian corporate governance system in terms of corporate returns (Al-Faki, 2006). More importantly, there is yet an empirical study on volatilities and spillover effect on Nigeria corporate returns in spite of its relevance (see King et al., 1994; Forbes and Rigobon, 2002). Volatility reflects the extent to which market evaluates and assimilates arrival of new information. Spillovers; however, have been broadly classified into two: political spillover e.g. Arab Spring and economic spillover e.g. Global Financial Crisis, Syria-crisis Europe migration challenge. In the context of economics, the concept of spillover deals with the possibility of interdependence between or among markets such that a shock to one market may fuel unprecedented changes in another market. As a result, the analysis of its transmission pattern will sure provide useful insights into the characteristics, dynamics and nature of the returns on equities of sub-sectors in Nigeria corporate system. No doubt, the information congregated would help improve our understanding of yield evolution over time, thus providing an indicator for the vulnerability of the sector (markets). Against this background, we propose a simple quantitative measure of such interdependence and volatilities of returns which we term a spillover index. Kalemli-Ozcan et al., (2010) and Barnes et al., (2010), observed that highly integrated market with a low degree of fiscal federalism are responsible for speed, as well as amplitude, in the transmission of shocks.

We take note that the intensity of spillovers vary over time; hence, we considered as such in our analysis. Again the nature of any time variation is of potentially great interest and normally strikingly different for returns vs. volatilities (Diebold and Yilmaz; 2009). This simple but intuitive study will nonetheless be instructive on what to expect when the recent policy of Single Treasury Account (TSA) becomes operational in Nigeria with a view to corporate returns as well as the operation effect of 2003 SEC code of corporate governance. We equally take exception that our data is not of high frequency.

## **LITERATURE REVIEW**

With no universally acceptable definition of corporate governance amongst scholars; it was rather seen from three perspectives amongst scholars: shareholder, stakeholder and structural perspectives (Shleifer and Vishny, 1997; Aoki 2001) with each of these perspectives taking either a narrow (Donaldson, 1990; Shleifer and Vishny, 1997; Hussey, 1999; Mayer, 1997; Cadbury Report, 1992) or a broader (O'Donovan, 2003; OECD, 1999; Tricker, 2009; Solomon, 2007) view of the concept. From the point of view of the shareholder school, corporate governance is seen as the process of supervision and control intended to ensure that the company's management acts in accordance with the interests of shareholders (Farinha, 2003; Parkinson, 1994). Denis and McConnell (2003) were more elaborate as they viewed corporate governance as set of institutional and market-based mechanisms which induce self-interested controllers of a company to make decisions that take full advantage of the value of the company to its owners. Finally on this perspective, Shleifer and Vishny (1997) described corporate governance as a means in which suppliers of finance to corporations assure themselves of getting a return on their investment. This school of thought is anchored on the intrinsic conflict of interest between the principal (owners) and the agent i.e. professional managers. On the other hand, stakeholder school viewed corporate governance as an effective governance which largely depends not only on the alignment of the conflicting interest of owners and managers but also on the alignment between firm and environment within which it operates and do business (Filatotchev, 2009). Finally, the structural school considers the structure of governance itself. Solomon (2007) offers a broader standpoint on this by taking into account the overall societal interest, corporate governance according to the study is seen as the system of checks and balances, both internal and external to companies, which ensures that companies discharge their accountability to all their stakeholders and act in a socially responsible way in all areas of their business activities. Not only has efficient corporate governance relates with efficient corporate equity returns (Kiel and Nicholson; 2003) but how likely the varying extent to which shocks in these equity returns in Nigeria corporate governance would have spilled over amongst selves, particularly, drawing from the effect of the recent global financial crises (Diebold and Yilmaz 2009, 2012). The spillover index provides a measure of the relative importance of the cross-variance shares, and thus indicates the degree of interaction between or amongst the sectors (Yilmaz, 2009). Nigeria's corporate governance, like other emerging economies around the world, has obviously suffered collapse of numerous corporate entities in her short history of existence as an independent nation (Carney et al., 2011). These no doubt, are predominantly not unconnected with poor returns on (equities/assets) and board squabble (Duke and Kankpang, 2011). This speaks volume of the magnitude of corporate governance problem the country faces. Not until in 2003; the Nigeria Securities and Exchange Commission (SEC) issued the country's first codes of corporate governance.

Apparently, limited number of literatures existed on Nigeria's corporate governance and their interdependency (Duke and Kankpang, 2011; Babatunde and Olaniran, 2009; Al-Faki, 2006;

Okeke, 2007; Quadri, 2010). More importantly, there is yet to be a study focused on not only on the economics of returns on equity in Nigeria's corporate governance but also the possible volatility and spillover effect of such returns and its impact on the economy. One important feature of this study is the plausibility, and indeed likelihood, that these suspected spillover effect in the Nigeria corporate governance will have adverse or beneficial effects both endogenously and exogenously. It is important therefore, that policymakers, including SEC, CBN, etc., seek to use all available information to understand better the complex interactions that are occurring in this all important sector of the economy.

Few of the commonest performance measures used in corporate governance include; Return on Assets (ROA), Return on Equity (ROE) otherwise known as Tobin's q and Price Earning (PE) ratio. Specifically, the Tobin's q of a firm otherwise a proxy of the firm market value is one of the most popular firm performance measures that are widely used in corporate governance studies particularly in linking returns to firm's performance and growth (Chiang and Lin, 2007; Kim, 2007). This evaluative variable is seen as the most effective tracker of degree of interest configuration between the parties and the agency contract (Weir et al, 2002). Elsayed (2007) argued that Tobin's q as market value measure unlike accounting measures takes into account the fundamentals of firm which include risks and returns. In other words, it x-rays the marketability of equity holdings; providing effective measures that reflect the general state of firm institutional environment (Rhoades et al., 2001, Campbell and Mínguez-Vera, 2008).

Studies have shown significant correlation between firm performance in Nigeria and the Nigeria corporate governance mechanism (Babatunde and Olaniran, 2009). Musa (2005) held that commercial banks performance is significantly associated with market value measured by Return on Equity (ROE). Similarly, Sunday (2008) established that Nigeria corporate governance is positively associated with firms' return on equity (ROE). More importantly, returns on equities often come about with remarkable regularity; besides, they quite exhibit resemblance across markets (see Chen *et al.*, 2009). However, in crises periods, for instance, the crises in the global financial markets, sharp decline in international oil market price alongside the recent refugee crises in Europe etc., returns in equities would expectedly oscillates raising concern for volatility and spills concern in the market. Naturally, one would like to be able to measure and monitor such spillovers across the sectors of the market, both to provide "early warning systems" for emergent crises for the asset portfolio holders, and to track the progress of extant crises (Diebold and Yilmaz; 2009). More so, Giordano et al. (2013) observed greater attention being paid by investors in crisis to macroeconomic and fiscal environment; in what they call "wake-up call" contagion. Although, a substantial body of literature utilized different extensions of Diebold and Yilmaz (2012)'s methodology to examine spillovers and transmission effects in stock, foreign exchange, oil markets, returns etc., however, none to the best of our knowledge has been used on equity returns within the Nigeria corporate governance system.

## METHODOLOGY

Here, we utilized the DY framework to measure assets returns volatility spillovers amongst the eight key sub-sectors of Nigerian corporate governance undergoing reforms, particularly since the release of 2003 SEC code of corporate governance. This is of fastidious concern, expectedly volatility spillovers across asset classes or across investment portfolios in any emerging economies' corporate governance due to any form of reforms or such as the effect of the global financial crisis which began in 2007 would surely be of important business

decision criterion (see Kalemli-Ozcan *et al.*, 2010 and Barnes *et al.*, 2010). The study made use of 78 firms listed on the Nigerian Stock Exchange (NSE) as at the end of 2010 financial year which were equally classified into eight sub-sectors. Specifically, relevant data (return on equity) in respect of each of the listed companies were collected for period between 1<sup>st</sup> January, 1990 and the financial year ended 31<sup>st</sup> December, 2010. Specifically, data relating to firm's return on equity (ROE) were collated from its annual reports where applicable and some from NSE fact book in event of missing data. We examined the monthly volatilities of returns on the equity for 21-year period. The equity yield (returns) in Food and Beverage was preferred as the benchmark as it relatively maintained stable return over the period reviewed. The above is a common practice in literature since it would provide the best appraisal for a risk-free rate. As a result, food and beverage sector returns will not be examined separately like the other remaining seven sub-sectors.

The study adopted Diebold and Yilmaz (2009, 2012) which utilizes the generalized VAR framework and organizes the variance decomposition output to produce both a total spillover index and its components. Put differently; it is based on forecast error variance decompositions from vector autoregressions (VARs) and are usually are invariant to the variable ordering. It can be used to measure the spillovers in returns or return volatilities (or, for that matter, any return characteristic of interest) across individual assets, asset portfolios, asset markets, etc., both within and across countries, revealing spillover trends, cycles, bursts, etc.

The spillover index provides a measure of the relative importance of the cross-variance shares, or spillovers, and thus indicates the degree of interaction between the variables (Forbes and Rigobon; 2002). This is because the generalized forecast error variance decompositions for each variable in the system, provides the relative contribution of own variable shocks (own-variance shares) and other variables shocks (cross-variance shares) to the variance of the forecast error for each variable in the VAR framework quantified and displayed in a tabular or graphical form. The total volatility spillover index captures the level of cross-sector returns spillovers by measuring the contribution of the spillovers of volatility across the entire sector to the total forecast error variance. However, to examine the spillover effects from and toward a specific sub-sector, we use directional volatility spillovers. Specifically, the directional volatility spillovers received or transmitted by sector *i* from all other sector *j* or to all other sector *j* are properly identified. With these therefore, we know with certainty the transmitter or receiver sector(s) which often explains their level of vulnerabilities.

### Empirical methodology

The starting point of the analysis is the following *p*-order, *N*-variable Vector Autoregressive (VAR) model:

*p*

$$x_t = \sum_{i=1}^p \Phi_i x_{t-i} + \varepsilon_t \quad (3.1)$$

*i*= 1

Where  $\varepsilon_t \sim iid(0,)$  is a vector of independently and identically distributed errors. The key to the dynamics of the system is the moving average representation of model (3.1), which is given by

$$x_t = \sum_{i=1}^p A_i \varepsilon_{t-i} \tag{3.2}$$

Where the  $N \times N$  coefficient matrices  $A_i$  are estimated by the recursion  $A_i = \Phi_1 A_{i-1} + \Phi_2 A_{i-2} + \dots + \Phi_p A_{i-p}$ . With  $A_0$  being an  $N \times N$  identity matrix and with  $A_i = 0$ , for  $i = 0$ . Diebold and Yilmaz (2012) use the generalized VAR framework of Koop *et al.* (1996) and Pesaran and Shin (1998), in which variance decompositions are invariant in terms of the variable ordering.

In the generalized VAR framework, the shocks to each variable are not orthogonalized; consequently, the sum of each row of the variance decomposition matrix does not add to unity. Using the normalized elements of the decomposition matrix of equation 3.2 above, we construct the total volatility spillover index:

$$S^g(H) = \frac{\sum_{i \neq j}^N \theta_{ij}^g(H)}{\sum_{i,j=1}^N \theta_{ij}^g(H)} \cdot 100 = \frac{\sum_{i \neq j}^N \theta_{ij}^g(H)}{N} \cdot 100. \tag{3.3}$$

This index captures the level of cross-sectoral spillovers on returns by measuring the contribution of the spillovers of volatility across all sectors to the total forecast error variance. To examine the spillover effects from and toward a specific country, we use directional volatility spillovers. Specifically, the directional volatility spillovers received by market  $i$  from all other markets  $j$  are defined as follows:

$$S_i^g(H) = \frac{\sum_{j=1, j \neq i}^N \theta_{ij}^g(H)}{\sum_{i,j=1}^N \theta_{ij}^g(H)} \cdot 100 = \frac{\sum_{j=1, j \neq i}^N \theta_{ij}^g(H)}{N} \cdot 100. \tag{3.4}$$

In a similar fashion, the directional volatility spillovers transmitted by sector  $i$  to all other sectors  $j$  are defined as follows:

$$S_j^g(H) = \frac{\sum_{i \neq j}^N \theta_{ij}^g(H)}{\sum_{i,j=1}^N \theta_{ij}^g(H)} \cdot 100 = \frac{\sum_{i \neq j}^N \theta_{ij}^g(H)}{N} \cdot 100. \tag{3.5}$$

The net directional volatility spillover provides information on whether a sector is a receiver or a transmitter of volatility in net terms. We obtain the net spillover from sector  $i$  to all other sectors  $j$  by subtracting equation (3.5) from equation (3.4). Thus, the net directional volatility spillover is given by the following:

$$S^g_{ij}(H) = S^g_{ij}(H) - S^g_{ji}(H) \quad (3.6)$$

To examine the net pairwise volatility spillover between sectors  $i$  and  $j$ , we compute the difference between the gross volatility shocks transmitted from market  $i$  to market  $j$  and those transmitted from  $j$  to  $i$ :

$$S^g_{ij}(H) = \frac{\theta^g_{ij}(H)}{N \sum_{i,k} \theta^g_{ik}(H)} - \frac{\theta^g_{ji}(H)}{N \sum_{j,k} \theta^g_{jk}(H)} \cdot 100 = \frac{\theta^g_{ij}(H) - \theta^g_{ji}(H)}{N} \cdot 100 \quad (3.8)$$

We also tested for the stationarity of the series. This is because using non-stationary series heightens the instability of the forecast error variance decomposition shares between variables which would normally often fail to settle down as the forecast horizon lengthens, thus rendering the information content of the decompositions largely void or otherwise, first-differences of these yield spreads are used after all (Diebold and Yilmaz; 2012).

## RESULTS

The table below presents the total volatility spillovers computed for the whole sample. The off-diagonal column sums (labelled “Contributions to others”) or row sums (labelled “Contributions from others”), are the “to” and “from” directional spillovers, expressed in percentage form, with each row summing up to 100. The “from minus to” differences are the net volatility spillovers. In addition, the total volatility spillover index appears in the lower right corner of the spillover table. It is approximately the grand off-diagonal column sum (or row sum) relative to the grand column sum including diagonals (or row sum including diagonals), expressed as a percentage. It measures what proportion of the forecast error variance in the system of variables is attributable to off-diagonal elements (i.e. Cross variance shares) and provides a gauge of spillovers in the system, in this case, Nigeria corporate government. As can be seen, we obtained 69.91% as the total volatility spillover index among the eight sub-sectors investigated; so that little above two-thirds of the forecast error variance is explained by the shocks across the sub-sectors. However, the remaining 30.09% is explained by idiosyncratic shocks.

Table 1: Total Spillover Index and Components: Full Sample Estimation (%)

	F/B_R	Agro_R	Auto_R	Brew_R	Build_R	Colg_R	Health_R	Chem_R	(A) Contribution from others	(C) Net contribution
<b>F/B_R</b>	<b>52.3</b>	24.71	8.2	7.33	6.14	18.35	0.8	7.12	82.65	5.49
<b>Agro_R</b>	22.31	<b>40.32</b>	0.67	5.01	10	15.14	12.8	20.92	87.85	25.2
<b>Auto_R</b>	1.81	2.31	<b>28.32</b>	4.36	3.85	10.89	6.68	11.55	41.45	-0.93
<b>Brew_R</b>	12.56	16.1	6.1	<b>26</b>	3.79	20.72	12.19	12.3	83.76	-31.83
<b>Build_R</b>	7.26	12.13	6.65	7.89	<b>64.4</b>	11	2.3	14	61.27	-16.74
<b>Colg_R</b>	8.42	20	7.24	10.54	9.18	<b>36</b>	7.38	12	74.76	18.94
<b>Health_R</b>	23.45	15.1	10	9	1.81	3.39	<b>72</b>	4.97	68.22	-25.15
<b>Chem_R</b>	12.33	12.7	1.62	7.8	9.76	14.21	0.92	<b>42</b>	59.34	23.52
<b>(B)Contribution to others</b>	88.14	113.05	40.52	51.93	44.53	93.70	43.07	82.86	559.30	
<b>Contribution including own</b>	140.44	153.37	78.84	77.93	108.93	129.7	115.07	124.86	<b>Total spill index</b> 69.91%	

Note: for each sub-sector row, the non-diagonal entries in the body of the table represent spillovers (in percentage terms) from other countries while the diagonal (bold) entries represents that attributed to the sector's own shocks. The entries in column A represent the sum of the off-diagonal entries in each row. Correspondingly, the entries in row B comprise the sum of the off-diagonal elements in each sector column. The entries in column C represent the subtraction of the related sectors' entry in row B less its entry in column A.

From table 1, in column A, automobile sub-sector is seen as the sector with the lowest spillover from other sectors (with a value of 41.45%). Similarly, it has the lowest spillover over to others (with a value of 40.52% in row B). In contrast, Agro-allied sub-sector has the highest pairwise spillover to other sectors (with a value of 113.05 in that column B) and from others (87.85%). The above suggests that the sub-sector is likely the most activities-dominant and volatile of the sectors studied. Given the development level of Nigerian economy, it is not surprising that agro-allied sector would relatively exert strong interaction with other sectors. The off-diagonal entries equally indicate that it has strong bidirectional interaction with food and beverages, conglomerates and chemical sub-sectors. Apparently, they are currently seemingly indispensable sub-sectors in the Nigeria corporate system via development of the economy in general in terms of level of activities and investments.

In terms of the directional spillovers to others all through the full sample, our results suggest that volatility in conglomerates returns is the second highest contributing to the sectors' forecast error variance with (93.70%), followed by food and beverages yields with (88.14%), chemicals yields (82.86%) etc. On the other hand, directional spillovers received from others, agro-allied industry appears to be the sub-sector that received the highest percentage of shocks from other countries (87.85%) followed by Brewery (83.76%), food and beverages (82.65%) and the Conglomerates (74.76%). Automobiles received the lowest percentage (41.45) of shocks from other sub-sectors, followed by chemical sub-sector (59.34%) and building (61.27%).

Finally, we calculate the difference between the column-wise sum (the "Contribution to others") and the row-wise sum ("Contribution from others") to obtain the "net directional

volatility spillovers". Agro-allied industry (25.2 points), chemical (23.52 points), Conglomerates (18.94) and food and beverages (5.49 points) are net transmitters of equity yield shocks to other sectors under study, while only automobile (-0.93 points) received very low percentage of yield shocks in net terms; brewery (-31.83 points), health (-25.15 points), building (-16.74 points) are definitely the leading net receivers of equity yield shocks over the full period. The above equally suggest the level of vulnerabilities these sub-sectors could be in terms of reform and policy issues.

## CONCLUSIONS

The recent reforms in non-oil sector of the Nigerian economy, and current introduction of Treasury Single Account (TSA) underlined that the cross-sectoral transmission of shocks can be feasible and rapid in the Nigeria corporate governance system, where trade and financial inter-linkages thrives and where confidence effects have been shown to be an important transmission mechanism. The spillover index methodology can provide useful information to not only investors, policymakers but to other market observers and analysts. Its changing value over time can be quickly updated given the immediate availability of end-of-period equity yield information.

An emphasis on the fundamentals of each sector can help distinguish one from another and thus help avoid returns shocks contagion i.e., behaviour unrelated to fundamentals but occurring. Studies have shown that investors during crisis to macroeconomic and fiscal conditions of any nation pays greater attention to what goes on in the corporate governance of such nations on what they call "wake-up call" contagion (Giordano et al; 2013). This reassures investors as to the long-term returns sustainability and competitiveness.

It is hopeful, though subtle, the findings of this paper may moderately further our understanding of the level and transmission mechanism of volatility spillovers across the selected sub-sectors of the Nigerian economy. They may also be of use to market regulators in their attempts to formulate resourceful policies for tackling returns and financial uncertainties, tension transmission etc., particularly during periods of turbulence.

## REFERENCES

- Babatunde M. A. & Olaniran O. (2009) The effect of internal and external mechanism on governance and performance of corporate firms in Nigeria. *Corporate Ownership & Control*, Vol.7(2):330-344.
- Barnes, S., Lane, P. R., & Radziwill, A. (2010) Minimizing risks from imbalances in European Banking; Working Paper 828, Economics Department, Organization for Economic Cooperation and Development.
- Cadbury, S. A. (1992) Report of the Committee on the Financial Aspects of Corporate Governance. London: Gee & Co. Ltd.
- Campbell, K., & Mínguez-Vera, A. (2008) Gender Diversity in the boardroom and firm financial performance. *Journal of Business Ethics*, 83, 435-451.
- Carney, M., Gedajlovic, E., & Sur, S. (2011) Corporate governance and stakeholder conflict. *Journal of Management and Governance*, 15(3), 483-507.
- Chen, R., Dyball, M. C., & Wright, S. (2009) The link between board composition and corporate diversification in Australian corporations. *Corporate Governance: An International Review*, 17(2), 208-223.
- Diebold, F.X., & Yilmaz, K. (2009) Measuring Financial Asset Return and Volatility



- Spillovers, with Application to Global Equity Markets. *Economic Journal*, 119,158:171.
- Diebold, F.X. & Yilmaz K. (2012) Better to Give than to Receive: Predictive Directional Measurement of Volatility Spillovers. *International Journal of Forecasting*, 28, 1, pp. 57-66.
- Elsayed, K. (2007) Does CEO duality really affect corporate performance? *Corporate Governance: An International Review*, 15(6), 1203-1214.
- Filatotchev, I., & Boyd, B. K. (2009) Taking stock of corporate governance research while looking to the future. *Corporate Governance: An International Review*, 17(3), 257-265.
- Forbes, K., and Rigobon, R. (2002) No Contagion, Only Interdependence: Measuring Stock Market Co-movements. *Journal of Finance*, 57, pp. 2223-2261.
- Giordano, R., Pericoli, M., & Tommasino, P. (2013) 'Pure' or 'Wake-up-call' Contagion? Another Look at the EMU Sovereign Debt Crisis." *Banca d'Italia Temi di Discussione* 904.
- Kalemi-Ozcan, S., Papaioannou, E., & Peydró-Alcalde, J. L. (2010) What lies beneath the Euro's effect on financial integration? Currency risk, legal harmonization, or trade? *Journal of International Economics* 81, 75-88.
- Kiel, G. C., & Nicholson, G. J. (2003) Board composition and corporate performance: how the Australian experience informs contrasting theories of corporate governance. *Corporate Governance: An International Review*, 11(3), 189-205.
- Kim, Y. (2007) The proportion and social capital of outside directors and their impacts on firm value: evidence from Korea. *Corporate Governance: An International Review*, 15(6), 1168-1176.
- Koop, G., Pesaran, M., & Potter, S. (1996) Impulse Response Analysis in Non-linear Multivariate Models. *Journal of Econometrics*, 74, pp. 119-147.
- Musa, F. I. (2005) Impact of corporate governance on the performance and value of banks in Nigeria: An agency approach, *Nigerian Journal of Accounting Research* Vol. 1(4) 1-15.
- Okeke, E. N. M. (2007) Corporate governance in Nigeria the status quo, *Corporate Governance: An International Review*, Vol. 15(2) 173- 193.
- Pesaran, M., & Shin, Y. (1998) Generalised Impulse Response Analysis in Linear Multivariate Models. *Economics Letters*, 58, pp. 17-29.
- Quadri H. A. (2010) Conceptual framework for corporate governance in Nigeria-challenges and panaceas *PM World Today* Vol XII (IX).
- Rhoades, D. L., Rechner, P. L., & Sundaramurthy, C. (2001) A meta-analysis of board leadership structure and financial performance: are "two heads better than one"? *Corporate Governance: An International Review*, 9(4), 311-319.
- Suberu O.J. & Aremu O.S. (2010) Corporate governance and merger activity in the Nigerian banking industry, *Journal of Economics*, Vol. 1(2) 91-97.
- Solomon, J. (2007) *Corporate Governance and Accountability*. West Sussex, England: John Wiley & Sons, Southern Gate.
- Tricker, B. (2009) *Corporate Governance principles, policies, and practices*. Oxford: Oxford University Press.
- Weir, C., Laing, D., & McKnight, P. J. (2002) Internal and external governance mechanisms: their impact on the performance of large UK public companies. *Journal of Business Finance & Accounting*, 29(5 & 6), 579-611.

**Technical Appendix:**

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**Returns are computed as follows:**

$$\begin{aligned}r_t &= 100 * \Delta \ln(p_t) \\ &= 100 * \ln(p_t) - \ln(p_{t-1}) \\ &= 100 * \ln(p_t / p_{t-1})\end{aligned}$$

Note:  $P_t$  equals the current value of the equity returns

**Measurement of Volatility; DY approach:**

$$\sigma^2 = 0.361 [\ln(p_t^{\max}) - \ln(p_t^{\min})]^2$$

This measure requires high and low returns.