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MODELLING THE RELATIONSHIP BETWEEN SECTORAL INDICES OF THE STOCK MARKET IN NIGERIA

(ALL SHARE INDEX VS. OTHER INDEX)

Olaniyan Sunday Michael[1]*, Abiola Bankole[2]

[1]Phd Student, Department of Actuarial Science and Insurance,
University of Lagos, Nigeria
[2]Associate Professor, Department of Actuarial Science and Insurance,
University of Lagos, Nigeria

ABSTRACT

This study investigated the relationship between the returns of the sectoral indices using correlations analysis and beta analysis on weekly index values of sectoral indices with a base value of 157 points of specific sectors at the Nigerian Stock Exchange (NSE) from 04 October 2013 until 30 September 2016. The result shows that returns across various sectors tend to be correlated which indicated that risk diversification would be difficult. All Share Index returns have a positive relationship with the vast majority of the sectoral indices indicating that many indexes performance is alongside the 'All-share index'. Finding from the beta analysis shows that some indices are more volatile than the market while some are less volatile than the market. This study will aid investors/portfolio managers in reducing their portfolio risk, getting safe returns, providing specific investment opportunities, and direction for suitable investment decisions for the Nigerian market using such sectoral indices

Keywords: Stock market, Sectoral index, Correlations analysis and Beta analysis

1.0 INTRODUCTION

A stock market index is shaped by choosing a group of stocks that are illustrative of the whole market or a predefined part of the market and it is also meant to confine the overall behavior of equity markets (Nagendra, Haritha & Ravi, 2014). No doubt, those stock markets mobilize domestic savings by improving the set of financial instruments accessible to savers to expand their portfolios (Vazakidis & Adamopoulos, 2009). It is additionally the support of capital market undertakings which fills in as a significant instrument to mobilize and allocate investment funds among contending clients and utilizations to the development of an economy (Abiy & Chi, 2014). These days, numerous investors and financial specialists are encouraged to invest their resources in the stock market due to its rate of development and high yielding. Stock markets

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are having a noteworthy role in enticing the investors when contrasted with other investment choices, for example, bank deposits, insurance, real estate, etc. (Akhila & Neeraja, 2018). Despite its importance, stock market crashes are becoming the norm of the day for almost all the economies of the world as most markets are recording considerable upward and downward movements (Joo & Bhat, 2016).

The Nigerian Stock Exchange has a broad Index known as All-Share Index (ASI) which measures the general stock market performance while it also has five Sectoral Indices that are used to gauge the sectoral performance and efficiency of the stock market. They are NSE 30, NSE Banking, NSE Consumer Goods (*Formerly Foods & Beverages)*, NSE Industrial goods, NSE Insurance and NSE Oil & Gas. The Nigeria stock market are not immune to the fluctuations in prices. The stock market indices have moved far relative to their preceding year's levels and markets suddenly become clearly unstable to the point where it may collapse (Olaniyi & Olabisi, 2011). Because of their exposure to foreign credit lines, the stock market and their loan customers were feared to be on the point of collapsing. Fluctuations of stock indices results into a problem of uncertainty which is common to all Stock Markets (Vincent & Bamiro, 2013). Investing in the stocks is rewarding, but not without some attendant risks. It is no secret that Nigeria is heavily exposed to fluctuations in oil prices; the 2016 recession serves as a painful reminder of how dangerous this exposure can be. In order to reduce the economy's susceptibility to volatile oil prices, diversification must occur to boost other sectors. For long-term investors, recognising undervalued opportunities could multiply initial investments and provide a stream of income, which can further be invested in more companies. Most investors have increasingly lost interest in the stock market due to the extended bearish sentiments witnessed in the market, though government and market regulators reforms has not make any headway, but investors can still take position in the market for future benefits sectors.

Relationship between stocks is a portfolio selection strategies in the stock market across the globe for a consistent superior performance for investors. Stock market sector analysis also provides the basis for benchmarking the performance of a particular stock or sector, as well as a guide to domestic and international diversification of investments. An investor would prefer stocks of those sectors which provide maximum return with minimum level of risk. Modern portfolio theory suggests that investors should construct a portfolio of multiple assets in order to get maximum return at a given level of risk (Markowitz, 1952). Analysing the performance of stock market sectors will reveal the nature of interaction between the sector, which will in turn form the basis for portfolio selection and investment decisions. Understanding of stock market indices and its fluctuations is important to stock experts and investors (Aromolaran, Taiwo, Adekoya & Malomo, 2016). A

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significant step in improving the understanding of the stock market is to study how the stock price movement of one stock affects the price of other stocks (Sharma & Banerjee, 2015). An approach to do this is to investigate the relationship between the overall prices of the various sectors. Analysing the performance of stock market sectors will reveal the nature of interaction between the sector, which will in turn form basis for portfolio selection and investment decisions. This study enhanced the understanding of the stock market as a whole and would also play a crucial role in investment decisions like portfolio management.

2.0 LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Markowitz's Portfolio Theory (MPT)

The first person to formalise portfolio risk, diversification and asset selection in a mathematically consistent framework is Markowitz. All that was required were asset return means, variances and covariance (Markowitz, 1952; 1991b). Although Financial Analysts and Economists were aware of risk, prior to Markowitz's risk measure whose was more concerned with standard financial statement analysis (Graham, 2003). Markowitz proposed a portfolio's risk is equal to the variance of the portfolio's returns. If we define the weighted expected return of a portfolio μ_p as

$$\mu_p = \sum_{i=1}^{N} w_i \mu_i \quad (1)$$

Then the portfolio variance σ_p^2 is

$$\sigma_p^2 = \sum_{i=1}^{N} \sum_{j=1}^{N} \sigma_{ij} w_i w_j \quad (2)$$

Where

- N is the number of assets in a portfolio;
- i, j are the asset indices and $i, j \in \{1, \ldots, N\}$;
- w_i is the asset weight, subject to the constraints:

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$$0 \leq w_i \leq 1$$

$$\sum_{i=1}^{N} w_i = 1$$

- σ_{ij} is the covariance of asset i with asset j;
- μ_i is the expected return for asset i.

Markowitz's portfolio theory was the first to explicitly account for portfolio diversification as the correlation (or covariance) between assets. From equation 2 one observes that σ_p^2 decreases as σ_{ij}without necessarily reducing μ_P.The MPT also introduced the idea of optimising portfolio selection by selecting assets lying on an efficient frontier. The efficient frontier is found by minimising risk σ_p^2 by adjusting w_i subject to the constraint μ_p is fixed; hence such portfolios provide the best μ_p for minimal risk (Markowitz, 1991a). Additionally, it can be shown that the efficient frontier follows a concave relation between μ_p and σ_p^2. This reflects the idea of expected utility concavely increasing with risk. Most portfolio managers apply a MPT framework to optimise portfolio selection (Rubinstein, 2002).

2.2 Empirical Review of Related Literature

A series of research has been done on the relationship between sectoral indices of the stock market, For instance, Kurisetti, Yeldandi and Perumandla (2018) provided insights to the financial specialist and portfolio managers in terms of diminishing portfolio risk and enhancing their earnings using cointegration, Vector Error Correction Model (long and short-run relationships) among some sectoral indices including CNX AUTO, CNX ENERGY, CNX FMCG, CNX IT, CNX PHARMA, and CNX BANK. The outcome shows that there is a long-run and short-run relationship among the sectoral indices. Sharma and Banerjee (2015) used correlation and autocorrelation analysis to study the relationship among different sectors of the Bombay Stock Exchange (BSE) using daily data for 8 years from 2006 to 2014. The result shows that there is a significant autocorrelation among the individual sectors and also strong cross-correlation among sectors. The discoveries likewise show that practically all sectors are highly related during large fluctuation periods and have only moderate correlation during normal periods.

Akhila and Neeraja (2018) examined a comparative analysis of sectoral indices in India as indexes such as the automobile sector, FMCG sector, banking sector, pharmaceutical sector, and media sector) returns are compared with Nifty 50. For the 5 year period under study, this study utilized correlation and beta analysis to investigate the relationship between sectoral indices on quarterly basis. The results

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show that sectors are performing well in gaining high returns but are underperformed as compared with the market.

Gupta (2017) explored the co-relationship amongst various sectoral indices which include Auto, Banking, Capital goods, Consumer durable, FMCG, Health Care, Metal Power, Realty, and Sensex of Bombay stock exchange using the daily index of all stock markets from 2001 to 2016. The correlation analysis shows that there is a positive correlation among various sectors when the investment period is less than five years however when the investment period is greater than equals to five years some sectors show a negative correlation in them. Banking Sector was seen as Granger causing most of the sector whereas IT Sector was seen as the sector not having long term relationships with any other sectors.

Joo and Bhat (2016) analyzed and examined the relationship between IVIX and Sectoral Indices of NSE. The authors relied on Graphical analysis, Descriptive statistics, ADF test, Correlation and Regression performed on a time series data set ranging from 01/04/2009 up to 31/03/2015 to derive and detect the linkage. The findings shows that the Nifty Energy index seems to be immune to the volatility shocks while the Nifty Finance has a positive impact on IVIX and the same is confirmed by the multiple regression analysis.

Besarria, Nóbrega, Alves, Almeida, Monteiro, and Paula (2016) analyzed the volatility patterns and performance of the daily sectoral indexes of Bovespa's main stocks from 2011 to 2013. The results obtained from the conditional CAPM have shown that the betas significantly vary over time and shown an existing heterogeneity among portfolios. Concerning volatility analysis, it was seen that the volatility series of both UTIL and IEE indexes presented similar behavior and were more volatile than other indexes in the review period. The conditional correlation analysis showed that IEE and UTIL, INDX and UTIL, ICON and IMAT, IMOB, and IFNC have presented a strong correlation.

Nagendra, Haritha, and Ravi (2014) investigated the correlation between NSE NIFTY with other sectoral indexes. For data analysis correlation test has been used to find correlation between NSE Nifty monthly returns and Sectorial Indexes monthly returns during 2006 to 2010. The results show that NSE NIFTY monthly average returns for diverse periods are correlated with most of the sectoral indexes returns. It was concluded that NSE NIFTY influence the performance of sectoral indices performance.

Shanmugasundram and Benedict (2013) did a study to identify risk relationship in different time intervals between sectoral indices and CNX Nifty from 01/01/2004 to 30/04/2012. Two sample T-Test and One – way ANOVA between subjects was used

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to identify the risk factor difference across the risk of sectoral indices and CNX Nifty index. The results show that there is no difference in the Standard deviation among various sectoral indices. The One-way ANOVA within groups that there is a significant difference in the mean scores of various time intervals.

Philipp and Henri (2007) described the relationship of returns of NIFTY with the 9 selected sectorial indices using correlation analysis. To analyze the correlation, returns (daily) of the various indices were calculated from 01/01/2018 to 31/12/2018. The results have shown that in a given year IT index have outperformed the considered benchmark index NIFTY.

Durai and Bhadurai (2011) analyzed the correlation structure of the Indian equity markets (S & P CNX Nifty index) with that of world markets for the period 1997 to 2006. The logistic smooth transition regression (LSTR) model results for the conditional time varying correlation of S & P CNX Nifty with six Asian market and S & P CNX Nifty with four developed markets show that there is a significant regime shift in the year 2000 and there is a considerable increase in integration in the second regime. This indicates that the S & P CNX Nifty index is moving towards a better integration with other world markets but not at a very noteworthy phase.

3.0 RESEARCH METHODOLOGY

3.1 Data

The data used for this study include weekly index values of sectoral indices with a base value of 157 points of specific sectors at the Nigerian Stock Exchange (NSE) from 04 October 2013 until 30 September 2016. The data is gotten from Meristem Security Limited. The sectoral indices for this study include Banking, Insurance, Consumer Goods, Oil & Gas, Industrial, NSE (30) index, and all share index. The sectoral indices returns were calculated using the formula below:

$$Returns = \log_e\left(\frac{P_{t+1}}{P_t}\right) \quad (1)$$

3.2 Estimation Techniques

3.2.1 Unit Root Test

In order of investigating the unit root property of the data series, the Augmented Dickey-Fuller (ADF) test was utilized (Ogunmuyiwa, 2015). The test equations for both levels and first difference are formulated below:

For Levels

$$\Delta y_t = \alpha y_{t-1} + \sum_{i=1}^{m} \beta_1 \Delta y_{t-1} + \theta + y_1 + \varepsilon_1 \quad (2)$$

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For First Difference Level

$$\Delta y_t = \alpha y_{t-1} + \sum_{i=1}^{m} \beta_1 \Delta y_{t-1} + \theta + y_1 + \varepsilon_1 \quad (3)$$

Where y is the variable investigated for stationarity, M represents the no of lags and t depicts time.

3.2.2 Correlations

Correlation, which is the linear relationship between two or more variables is used in advanced portfolio management. It is measured by the correlation coefficient, which runs in the interval $-1 \leq \rho \leq +1$. According to Nagendra, Haritha, and Ravi (2014), a correlation coefficient of +1 (Perfect positive correlation) implies that the index moves in the same direction. On the other hand, a correlation co-efficient of -1 (Perfect negative correlation) implies that the index moves in the opposite direction. Likewise, a correlation value of zero implies that indexes do not correlate.

It is mathematically expressed as;

$$r_{xy} = \frac{cov(X,Y)}{\sigma_x \sigma_y} \quad (4)$$

According to the modern portfolio theory, if an investor wants to retain the yield at the same level and reduce the variance/risk by decentralized investment, investor is expected to select the securities which are not perfectly positively correlated (Kurisetti, Yeldandi & Perumandla, 2018).

3.2.3 Beta

Beta is a measure of the security's volatility as compared to the market as a whole**.** The beta coefficient is a measure of the risk arising from exposure to the general market as opposed to idiosyncratic factors. The use of beta as a measure of systematic risk permeates all levels of financial analysis. According to Gardner, McGowan, and Moeller (2010), a higher beta value means that a stock index moves more than the market and a lower beta value suggested that returns for a stock index move less than the market. The former are aggressive stocks and the latter are defensive. Beta represents the tendency of a security return to respond to swings in the market.

It is mathematically expressed as;

$$\beta = \frac{cov(R_A,R_M)}{var(R_M)} \quad (5)$$

$$where \quad R_M = market\ return, R_A = stock\ return$$

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The interpretation of different cases of beta

Value of Beta	Interpretation
Beta(A)<0	Stock moves in the opposite direction to the movement of the market i.e. **(DEFENSIVE)**
Beta(A)=0	Movements of the stock and the market are uncorrelated
0<Beta(A) ≤1	Stock moves in the same direction as the market, volatility of stock can be less than the volatility of market i.e. **(NEUTRAL)**
Beta(A)>1	Stock moves in the same direction as the market but with greater volatility i.e. **(AGGRESSIVE)**

4.0 RESULT AND DISCUSSION

4.1 Descriptive statistic of data

Table 1: Descriptive analysis of stock index returns

Statistics	All share index	NSE 30 Index	Banking Index	Insurance Index	Consumer Goods Index	Oil/Gas Index	Industrial Goods Index
Mean	-0.001071	-0.001347	-0.001040	-0.000134	-0.001428	0.005113	-0.000390
Median	2.29E-05	-0.000243	-0.001937	-0.000106	-0.001459	0.003911	-0.000574
Maximum	0.169002	0.179101	0.239680	0.065114	0.151443	0.164169	0.142287
Minimum	-0.130251	-0.135223	-0.186731	-0.096417	-0.126514	-0.147148	-0.198760
Std. Dev.	0.035496	0.037137	0.050555	0.021372	0.036665	0.051925	0.039331
Skewness	0.341136	0.277971	0.509795	-0.376826	0.088109	0.510914	-0.641472
Kurtosis	8.982708	8.449001	6.810867	5.254288	6.165367	3.975188	9.900382
Jarque-Bera	235.6789	195.0045	101.1548	36.72373	65.32889	12.96831	320.1979
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.001527	0.000000
Sum	-0.167103	-0.210109	-0.162246	-0.020916	-0.222703	0.797635	-0.060782
Sum Sq. Dev.	0.195295	0.213774	0.396145	0.070797	0.208371	0.417907	0.239780
Observations	156	156	156	156	156	156	156

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Table 1 describes the sample characteristics of the returns of the sectoral indices in Nigeria. The result shows that majority of the sectoral indices have negative mean returns excluding the Oil/Gas Index. Insurance and Industrial Goods indices are negatively skewed which is an implication that investors have a greater chance of extremely negative outcomes. Positive skewness for other sectors imply frequent small negative outcomes, and extremely bad scenarios are not as likely. The kurtosis shows a leptokurtic distribution (Kurtosis > 3) which is an implication that if an investor is going to lose, he/she will lose very big and vice versa. Industrial Goods index has the least returns while the Banking Index has the highest maximum returns. The result also shows that all the indices are not normally distributed at 1% and 5%.

4.2 Unit Root Result

Table 2: Summary of unit root test results

Variables	Order of integration	ADF test statistics	Critical ADF Statistics at 1%	Critical ADF Statistics at 5%	Critical ADF Statistics at 10%
All share Index	I(0)	-11.52879	-2.58007	-1.94291	-1.61533
NSE 30 Index	I(0)	-11.34792	-2.58007	-1.94291	-1.61533
Banking Index	I(0)	-12.86519	-2.57997	-1.94290	-1.61534
Insurance Index	I(0)	-14.79092	-2.57997	-1.94290	-1.61534
Consumer Goods Index	I(0)	-12.73192	-2.57997	-1.94290	-1.61534
Oil/Gas Index	I(0)	-12.65348	-2.57997	-1.94290	-1.61534
Industrial Index	I(0)	-10.71196	-2.58007	-1.94291	-1.61533

From Table 2 above all the sectors are stationary in their level difference form, which is integrated at order zero (0). At this order of integration, their ADF test statistics are greater than their critical value at 1%, 5%, and 10% critical ADF statistics in their

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absolute terms. All variables are examined and found stationary at level form. It can be concluded from this test that the movements of the sectoral indices over time do not follow a random walk. Therefore, it assumes the past movement or trend of a sectoral index can be used to predict its future movement.

4.3 Correlation Analysis

Table 4: Correlation Results

	ASI	NSE 30 Index	Banking Index	Insurance Index	Consumer Goods Index	Oil/Gas Index	Industrial Index
All share index	1	.991**	.854**	.506**	.875**	.518**	.869**
NSE 30 Index	.991**	1	.889**	.522**	.900**	.524**	.828**
Banking Index	.854**	.889**	1	.503**	.708**	.393**	.618**
Insurance Index	.506**	.522**	.503**	1	.470**	.353**	.372**
Consumer Goods Index	.875**	.900**	.708**	.470**	1	.447**	.674**
Oil/Gas Index	.518**	.524**	.393**	.353**	.447**	1	.424**
Industrial Index	.869**	.828**	.618**	.372**	.674**	.424**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Correlation analysis was performed to investigate the degree of association between sectoral indexes i.e. to ascertain how fluctuations in a particular portfolio or asset influence the recurrence and intensity of oscillations of other portfolios or stocks (Besarria, Nóbrega, Alves, Almeida, Monteiro & Paula, 2016). The results generally show that returns across various sectors and markets tend to be positive and statistically significant. With regards to the correlation between 'All Share Index' and other sectoral indices, the results show that NSE 30 Index has the highest correlation with 'All Share Index' at 0.991, followed by Consumer Goods Index with 0.875 while Insurance Index has least correlation with 'All Share Index' at 0.506. It has been found that all the six indexes returns are moving along with the 'All Share Index'. The correlation analysis depicts that the Insurance Index is the best performing sector because it has the lowest correlation (r=0.506) to the All-share Index. The correlation among sectors seems to be in similar direction, which is an indication of no risk diversification.

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4.6 Beta Analysis

Table 6: Beta Result

Sectoral Index	Beta Value	Remark
NSE 30 Index	1.03640	Aggressive
Banking Index	1.21603	Aggressive
Insurance Index	0.30491	Neutral
Consumer Goods Index	0.90346	Neutral
Oil/Gas Index	0.75802	Neutral
Industrial Index	0.96244	Neutral

The measure of the sensitivity of the sector was done with market Beta Coefficients. The results show that the beta coefficient of the NSE 30 Index (β=1.03640) and Banking Index (β=1.03640) are more volatile than the market. On the contrary, Insurance Index (β=0.30491), Consumer Goods Index (β=0.90346), Oil/Gas Index (β=0.75802) and Industrial Index (β=0.96244) are less volatile than the market.

5. CONCLUSIONS

This study investigated the relationship between the returns of the sectoral indices and the market using unit root test, correlations analysis and beta analysis on weekly index values of sectoral indices with a base value of 157 points of specific sectors at the Nigerian Stock Exchange (NSE) from 04 October 2013 until 30 September 2016. The correlation result shows that 'All Share Index' has a positive relationship with the vast majority of the sectoral indices indicating that many indexes performance is alongside the 'All-share index'. The correlation result are likewise shows that sectors are highly correlated with each other. Based on these findings, it should be noted that the construction of a portfolio of assets composed by shares of correlated indexes does not allow the risk diversification (Besarria, Nóbrega, Alves, Almeida, Monteiro & Paula, 2016). The result from the beta analysis revealed that some indices are more volatile than the market while some are less volatile than the market. This study will aid investors/portfolio managers in reducing their portfolio risk, getting safe returns from the sectoral index, providing specific investment opportunities and direction for suitable investment decisions for the Nigerian market using such sectoral indices.

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