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JOURNAL of Applied Economic Sciences

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# Stock Market Volatility and Non-Macroeconomic Factors: A Vector Error Correction Approach

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**Abstract:**

Macroeconomic and non-macroeconomic factors are considered important in measuring market volatility; therefore, cannot be ignored, and the level of impact of these factors needs be determined in different economies. This study considered the impact of non-macroeconomic factors that drive stock market volatility in a developing economy using Nigeria annual stock data from 1985 to 2016.

In order to achieve the objective, sets in this study, vector error correction model (VECM) is adopted. The impulse response function (RF) and the variance decomposition were used to determine the component of the VECM. Based on the VECM, a long run relationship was established between stock market volatility and non-macroeconomic variables considered. The empirical analysis revealed that gross domestic product, interest rate and the number of listed firms were found to decline in response to positive shock on stock market price volatility. The study recommended financial literacy of investors as it has the potential of boosting investment in the stock market. Investors are also encouraged to get their business listed on the stock exchange to improve diversification and stability in the stock market.

**Keywords:** stock market volatility; vector error correction model; non-macroeconomic factors; macroeconomic factors

**JEL Classification:** E44; G1; G4; O16

## Introduction

The stock market represents a financial market where funding is made available through the issuance, buying and selling of shares. The stock market aids capital formation and efficient allocation. Stock market development can be viewed as an all-round concept that can be assessed through liquidity, volatility, size, concentration and the extent of international integration (Garcia and Liu 1999). Adeniji (2015) explains stock price volatility as assessment of the degree of stock price movement. The fluctuation in the prices of stocks is a crucial ingredient in the stock market as it helps to influence the kind of returns that accrues to investors. In addition, fluctuations in stock prices are associated with macroeconomic behaviour in developed countries (Muradoglu *et al.* 2001). Stock market volatility is of great value to investors as it helps investors to effectively take advantage of any decline in the stock market to buy more stocks. Stock market volatility creates opportunity for long term investors as it aids their accumulation of a larger share of the market. It is a critical factor that investors watch out for in the process of portfolio management. Prempeh (2016) mentioned that stock prices are usually determined by some important macroeconomic variables such as exchange rate, interest rates, inflation, *etc*. Mahedi (2012) opined that macroeconomic variables have a significant role to play in stock returns performance. Stock price fluctuation is not only triggered by macroeconomic variables (Osisanwo and Atanda 2012). There are some other non-macroeconomic factors that affect the instability of stock prices, Xing (2004) identified non-macroeconomic factors like average education level of investors, market concentration, the relative size of the equity market and the numbers of firms listed as factors that drive stock market volatility. However, results from Xing (2004) is no

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longer recent, there is need to conduct an updated research on the validity of such factors in the light of the developing economies. Moreover, Nigeria was excluded from the emerging markets considered by Xing (2004). Can these non-macroeconomic factors impact on stock market volatility in the Nigerian context? A number of studies have been carried out to determine factors that impact significantly on stock market volatility in developed countries as well as emerging market, but the stock market in sub-Sahara Africa countries have been ignored (Tennant and Tracey 2014). Research on the non-macroeconomic factors that drive stock market volatility is still a grey area that needs to be explored. This study primarily aims at determining if non-macroeconomic factors also drive stock market volatility (SMV), and to what extent it drives SMV in the context of the Nigerian economy. The remaining part of this paper is organised as follows: Section Two, related studies are highlighted. Section Three, outlines the methodology, in section four, empirical analysis was done. Lastly, in Section five; conclusion was drawn and recommendations were made.

## 1. Literature Review

Stock price volatility reflects the behaviour of stock prices. Maku and Atanda (2009) stated that there are five schools of thought on stock price behavior, and the authors discussed these schools of thought accordingly, which are; the technical, the fundamentalist, the random walk hypothesis, the Behavioural and the Macroeconomic hypothesis schools. The first school is the technical school believes that share price movements can be forecast by examining its behavioural charts of past sequence of prices. The technical school believes that stock price behaviour can be projected through the usage of economic or financial data. This school maintains that the forces of supply and demand are the major determinant of security prices and that stock prices follow historical pattern which means that past prices can be utilised to predict future prices. The second school of thought is the fundamentalist School. This school of thought is rooted in fundamentals such as the underlying firm's performance. The fundamentalist believes that the prices of any security is the information content of its worth. They advocate that every security has an intrinsic value which may or may not be revealed in the prices of the security. Thus, a detailed analysis of companies' fundamentals (dividend declaration, earnings per share, merger and acquisition among others) will enhance the quality of investment decisions.

Random walk hypothesis school explained movement of stock price in terms of a probability distribution of varying possible outcome. This hypothesis considers movement of stock price as a random walk, that is, such price is difficult or can hardly be predicted. This assumption follows that investments are adjusted based following the new information investors received. Behavioural finance is a new approach to capital markets having crucial role in financial decision making process (Birau 2012). The behavioural school believes that market might not show economic basics under three conditions. In a situation where all the three conditions apply, the behavioural school assumes that pricing preferences in financial market can be weighty. The first condition is the irrational behaviour and it is based on the fact that investors conduct themselves irrationally when they are unable to process the information available to them while forming their expectation of the performance of a company in the future. The systematic pattern of behaviour is the second condition that is based on the fact that even if individual investors makes decision to buy or sell without considering economic basics, the effect on equity prices would be restricted. The third condition is limiting arbitrage in financial markets. This will help to avoid unusual bidding for shares that may cause an increase in price as investors might want to use a company's recent strong performance alone to make decision about future economic performance.

Finally, the macroeconomic hypothesis school is based on the role played by macroeconomic variables in shaping the price movement of assets. They acknowledged the fact that changes in interest rate is a vital factor in explaining return as variations in interest rate are connected with risk premia. The macroeconomic schools made an effort to study how sensitive stock prices react to changes in macroeconomic variables. The macroeconomic school suggests that stock prices are affected by variations in interest rate, inflation, money supply and other macroeconomic variables. The macroeconomic school utilised a general to equilibrium approach laying emphasis on the associations between sectors as being vital to the comprehending the macroeconomic time-series co-movement as well as persistence

### Empirical Literature

Some authors have worked on related subject matter being considered in this study as earlier stated. First, looking at the study carried out by Zakaria and Shamsuddin (2012), the authors analyzed the connection between stock market volatility and the volatility of macroeconomic variable using Malaysia stock market as a case study. The authors established both a weak association and absence of causality between stock market volatility and macroeconomic variable volatilities. The authors also confirmed that only interest rate and inflation have

relationship with stock market volatility. However, the authors underestimated the relationship as they did not consider possibility of structural break in volatility while establishing a relationship between the macro economy and the stock market.

An attempt was made by Lawal *et al.* (2016) to carry out an examination on stock market price volatility with exchange rate volatility and oil price volatility in the Nigeria economy. Using monthly data, the authors found that stock market volatility is caused by both exchange rate volatility and oil price volatility. It was suggested that the policy makers should focus policies that stabilise the exchange rate and guarantee the net oil exporting position for the economy. The authors however ignored the effect of stock price volatility on economic growth. Since the ultimate goal of any economy is to boost economic, pursuing policies that could help stabilise the exchange rate without considering economic growth would be seen as an exercise done in futility. Badshah, Alvi and Sayilir (2016) to contribute to the body of knowledge through the examination of the correlation between Karachi stock exchange (KSE) and macroeconomic variables. Adopting Vector Error Correction model (VECM), the authors established a long run co-integrated relationship among the variables and KSE. All the variables were also found to granger cause the KSE 100 index in the long run however in the short run, only foreign exchange granger cause KSE. The result of this study might not be really reliable as condition of using VECM was not met.

Using EGARCH technique, Xing (2004) made attempt to answer the question on why market volatility varies across countries. Measuring relationship across the selected countries, a negative relationship was found between average education level of investors and market volatility. The study also confirmed that number of firms listed, market industry concentration and the relative market size, may also be associated with volatility across countries. This study can be seen as obsolete as it utilised data that ended in the year 2000 and the Nigerian economy was not included in their analysis. In order to advance knowledge, Naik and Padhi (2012) explored the correlation between Indian stock market and macroeconomic variables. Using the VECM, a positive association was found to exist between stock prices and these two variables: money supply and industrial production however a negative link was found between stock price and inflation. Though, exchange rate and short term interest rate are unimportant determinant of stock prices. The authors could have utilised the autoregressive redistributive lag (ARDL) instead of the VECM as the variables have mixed roots. The precondition of using the VECM was not fulfilled.

Akinlo (2013) investigated the relationship between inflation and stock price index in Nigeria using data from 1986 to 2010. The author established the presence of long run connection between inflation and stock price index. The author concluded that in the long run and short run period, stocks are better inflation hedges. The result of this study might not be reliable as the multicollinearity problem was identified in the correlation test that was conducted and the author did not make attempt to resolve the issue. Yartey (2008) added to the empirical literature by examining both the macroeconomic and institutional determinant of stock market development. The study was based on data from 42 emerging countries, some determinants like stock market liquidity, banking sector development domestic investments were identified as being crucial to stock market development in emerging markets. It was also revealed that institutional determinants like quality of bureaucracy, political risk, law and order *etc*. are crucial determining factors of stock market development in emerging market. The study only identified the institutional and macroeconomic factors that determine stock market development without giving cognizance to whether non-macroeconomic factors also have impact on stock market development.

Akinlo (2014) utilised the VECM method to examine the association between the changes in oil price and stock market growth. Using annual data from 1981 to 2011, the study identified a long run association between stock market growth and the variables considered. Oil price was found to granger cause stock market development. The impulse response function revealed the brief positive effect of oil price on the stock market. The variance decomposition affirmed that the stock market development is heavily reliant on shock on oil price. The study would have been more robust if the author had incorporated other variables like the gross domestic product in their analysis since GDP is a very important macroeconomic variable that impacts stock market development.

The empirical review of literature above, the authors focused on how macroeconomic variable factors influences stock market volatility as one of the measures of stock market development. By implication, none of the authors identified the non-macroeconomic factors that may affect stock market volatility except for Xing (2004) who recognised average education level of investors, market industry concentration, relative size of the market and the number of listed firms as factors that drives stock market volatility. On the other hand, Yartey (2008) examined macroeconomic as well as institutional determinants impact on stock market development; however, the author ignored the non-macroeconomic factors that were singled out by Xing (2004). This study

seeks to add to literature by considering how non-macroeconomic factors also drive stock market volatility in the Nigerian economy.

## 2. Methodology

This study followed the empirical work of Xing (2004), in detecting the non-macroeconomic factors that drive volatility in Nigeria stock market. The background theory (macroeconomic hypothesis) of this study suggests that stock market prices are affected by changes in interest rate, inflation, money supply, and other macroeconomic variables. Okodua and Ewetan (2013) also advocate that macroeconomic variables are sufficient in establishing the long run direction of an economy. Moreover, non-macroeconomic factors cannot solely affect stock market performance without the influence of macroeconomic indicators; the study therefore incorporates gross domestic product and interest rate as macroeconomic variables in the model of Xing (2004). Gross domestic product has been confirmed by authors like Ibrahim and Aziz (2003) to be one of the most important factors that determines the stock market performance. In addition, Olokoyo *et al.* (2009) included this variable in their study. Interest rate has also been established to be one of the major variables which can exert significant effect on the stock market volatility (Waqar and Saifullah 2017). Thus the specific functional form of Xing (2004) adapted model is stated implicitly and explicitly in equation (1) and (2), respectively as follows:

$$SMV = f\left(GDP, INT, AEL, NLF, RSE, MIC\right) \tag{1}$$

*where*: SMV: Stock market price volatility; GDP: Gross domestic product; INT: Interest rate; MIC: Market industry concentration; AEL: Average education level of investors; RSE: Relative Size of equity market; NLF number of listed firms (total number of listed domestic firms).

$$SMV_t = \beta_0 + \beta_1 GDP_t + \beta_2 INT_t + \beta_3 AEL_t + \beta_4 NLF_t + \beta_5 RSE_t + \beta_6 MIC_t + \varepsilon_t \tag{2}$$

*where*: $\beta_0$ is the constant, $\beta_1$, $\beta_2$ $\beta_3$ $\beta_4$ are the coefficient of the variables, $\varepsilon$ is the error term.

$$\beta_1, \beta_6 > 0, \beta_2, \beta_3, \beta_4, \beta_5 < 0$$

The Stock market price volatility (SMV) is the dependent variable and it is proxied by all share index. The stock returns ($R_t$) are obtained by using the formula: $R_t$=Log $P_t$ - Log $P_{t-1}$ where $R_t$ is the stock market return in year t, Log is the logarithm and $P_t$ is the Nigerian stock price index at the end of current year t, while $P_{t-1}$ is the price index for the previous year.

The study utilised annual data for the period 1985 to 2016 for Nigeria. The data were sourced from secondary sources. The data used for 'All share index' was sourced from the Central Bank of Nigeria Statistical Bulletin and was used to measure stock market price volatility. For the macroeconomic variables, gross domestic product (GDP) was measured using the annual growth rate of GDP while interest rate (INT) was measured using the base lending rate. Both are sourced from the World Development Indicators of World Bank.

The average education level of investors (AEL) was measured using the school life expectancy and it was sourced from United Nations Organization for Education, Science and Culture, (UNESCO); the number of listed firms (NLF) was measured using the number of domestic listed firms and it was sourced from the world development Indicators of World Bank. The logarithm value of the non-macroeconomic variables (average education level of investors, and number of listed firms) were used. This is to keep in line with Roll (1992) and Xing (2004). Market industry concentration (MIC) is also known as industry concentration. The Herfindahl – Hirschman Index was used to measure industry concentration:

$$IND_i = \sum_{j=1}^{n} \left( \frac{MVIND_{ij}}{CAP_i} \right)^2$$

*where* $IND_t$ is the industry concentration measure for the country, MVINDij is the market value of industry j (j= 1, 2….n) in the country *i*, *n* is the number of industries considered for the country and CAP is country i's total market capitalisation.

The Relative Size of the Equity market (RSE) is measured by ratio of total market capitalisation (CAP) to gross domestic product (GDP) multiplied by hundred. Following Xing (2004), the relative size of the equity (RSE) market is computed as follows: RSE = CAP/GDP x100

## 3. Estimation Technique and Empirical Results

### Estimation Technique

Vector autoregressive (VAR) is considered to model the factors which stock market volatility in Nigeria is driven. The VAR model is sufficient in providing an efficient way of establishing variables under consideration. The VAR model has been confirmed to be credibly useful for making a description of the dynamic behaviour of economic and financial time series, particularly in forecasting. The VAR are easily applied as all variables are treated as endogenous variable, therefore there is no need of figuring out which variable(s) is endogenous and which is exogenous. The VAR takes advantage of decomposition (VDs) and impulse response function (IRFs) to determine the impact of a given variable on itself and all variables. In order to have a good estimate in VAR, it is required that the time series data is subjected to co-integration test and should be found to integrated of order 1 [(1)], existence of co-integration justifies the use of Vector Error Correction model (VECM) in estimating IRFs and VDs. The VECM works with VAR in such a way that it limits the long run behaviour of variables that are endogenous and converges to their co-integrating relationships while giving room for short run amendment dynamics.

The error correction term is taken as co-integration term since deviance from the long run equilibrium is adjusted gradually via a series of partial short run amendments. The time series properties of the variables (see Table 3) under study revealed a co-integrated, non-stationary series that are all integrated of order 1 [I (1)]. Thus, following Ndako (2010), the VECM specification adopted in this study is specified as:

$$\Delta SMV_t = \phi_1 + \alpha_{11} ECT_{t-1} + \sum_{i=1}^{\rho-1} \beta_{11i} \Delta SMV_{t-i} + \sum_{i=1}^{\rho-1} \beta_{12i} \Delta GDP_{t-i} + \sum_{i=1}^{\rho-1} \beta_{13i} \Delta INT_{t-i} + \sum_{i=1}^{\rho-1} \beta_{14i} \Delta AEL_{t-i} + \sum_{i=1}^{\rho-1} \beta_{15i} \Delta NLF_{t-i} + \varepsilon_{1t} \quad (3)$$

$$\Delta GDP_t = \phi_2 + \alpha_{21} ECT_{t-1} + \sum_{i=1}^{\rho-1} \beta_{21i} \Delta SMPV_{t-i} + \sum_{i=1}^{\rho-1} \beta_{22i} \Delta GDP_{t-i} + \sum_{i=1}^{\rho-1} \beta_{23i} \Delta INT_{t-i} + \sum_{i=1}^{\rho-1} \beta_{24i} \Delta AEL_{t-i} + \sum_{i=1}^{\rho-1} \beta_{25i} \Delta NLF_{t-i} + \varepsilon_{2t} \quad (4)$$

$$\Delta INT_t = \phi_3 + \alpha_{31} ECT_{t-1} + \sum_{i=1}^{\rho-1} \beta_{32i} \Delta SMPV_{t-i} + \sum_{i=1}^{\rho-1} \beta_{33i} \Delta GDP_{t-i} + \sum_{i=1}^{\rho-1} \beta_{34i} \Delta INT_{t-i} + \sum_{i=1}^{\rho-1} \beta_{35i} \Delta AEL_{t-i} + \sum_{i=1}^{\rho-1} \beta_{36i} \Delta NLF_{t-i} + \varepsilon_{3t} \quad (5)$$

$$\Delta AEL_t = \phi_4 + \alpha_{41} ECT_{t-1} + \sum_{i=1}^{\rho-1} \beta_{41i} \Delta SMPV_{t-i} + \sum_{i=1}^{\rho-1} \beta_{42i} \Delta GDP_{t-i} + \sum_{i=1}^{\rho-1} \beta_{43i} \Delta INT_{t-i} + \sum_{i=1}^{\rho-1} \beta_{44i} \Delta AEL_{t-i} + \sum_{i=1}^{\rho-1} \beta_{45i} \Delta NLF_{t-i} + \varepsilon_{4t} \quad (6)$$

$$\Delta NLF_t = \phi_5 + \alpha_{51} ECT_{t-1} + \sum_{i=1}^{\rho-1} \beta_{51i} \Delta SMPV_{t-i} + \sum_{i=1}^{\rho-1} \beta_{52i} \Delta GDP_{t-i} + \sum_{i=1}^{\rho-1} \beta_{53i} \Delta INT_{t-i} + \sum_{i=1}^{\rho-1} \beta_{54i} \Delta AEL_{t-i} + \sum_{i=1}^{\rho-1} \beta_{55i} \Delta NLF_{t-i} + \varepsilon_{5t} \quad (7)$$

*where*: $\phi$ is the constant, $\beta$ is the coefficient of the variables, $\Delta$ is the first difference of variables, $ECT_{t-1}$ is the error correction term lagged one period. Other notations are as earlier defined. Impulse response function and variance decomposition were applied in order to examine the relationship among the variables

### Empirical Results

In what follows, a descriptive statistics and correlation analysis of variables were discussed. This is immediately followed by the unit root, co-integration tests, and Granger causality test. The results are presented and discussed in the last section.

### Descriptive Statistics

The descriptive statistics of the variables used in this study is presented in Table 1. The result indicates positive skewneses for almost all the variables (GDP, INT, AEL and MIC) except SMV, NLF and RSE that are negatively skewed. The kurtosis value of all the variables shows that the data follows normal distribution as the kurtosis values are all greater than 3 except AEL, MIC and RSE that have kurtosis value less than 3. A look at the probability value for the Jacques Bera test confirm normality of more than half of the distribution with the exception of AEL, MIC and RSE.

Table 1. Descriptive Statistics

| | GDP | SMV | INT | NLF | AEL | MIC | RSE |
|---|---|---|---|---|---|---|---|
| Mean | 4.631304 | 0.181326 | 18.79291 | 5.13534 | 1.712091 | 0.708875 | 0.592258 |
| Median | 4.649226 | 0.21676 | 18.06625 | 5.231094 | 1.702759 | 0.687283 | 0.826982 |
| Maximum | 33.73578 | 0.690181 | 31.65 | 5.379897 | 1.860802 | 0.974013 | 3.424605 |
| Minimum | -10.7517 | -0.781015 | 9.433333 | 4.564348 | 1.549146 | 0.45225 | -3.120488 |
| Std. Dev. | 7.152142 | 0.291842 | 4.276887 | 0.252365 | 0.07817 | 0.191423 | 2.303119 |
| Skewness | 1.683833 | -0.989881 | 0.510516 | -1.282025 | 0.318046 | 0.146459 | -0.313007 |
| Kurtosis | 10.37623 | 5.024913 | 4.661031 | 3.25977 | 2.537393 | 1.526745 | 1.670069 |
| Jarque-Bera | 87.66668 | 10.69297 | 5.06871 | 8.85578 | 0.824823 | 3.008377 | 2.880812 |
| Probability | 0.000000 | 0.004765 | 0.079313 | 0.01194 | 0.662052 | 0.222198 | 0.236832 |
| Observations | 32 | 32 | 32 | 32 | 32 | 32 | 32 |

*Source:* Author's computation using EViews 9

## Correlation Analysis

As a preface to the unit root and co-integration tests, the correlation among the variables in this study is examined. The results are highlighted in Table 2a and 2b below. From Table 2a, it was found that the problem of multicollinearity exists considering the correlation coefficient between RSE and NLF which was high with a value of 83.6 percent. Moreover, MIC and RSE include variables that are computed from other variables in the data set. For instance, capitalisation is used to compute both MIC and RSE. Also, GDP which is one of the macroeconomic variables is also included in the computation of RSE. It is thus advisable to drop the variables to avoid the problem of multicollinearity. After the variables were dropped, the correlation analysis was repeated and the result can be seen in Table 2b. Stock market price volatility (SMV) was found to be positively related to interest rate (INT) and average education level of investors (AEL) but negatively correlated with gross domestic product (GDP), and number of listed firms (NLF). The correlation between explanatory variables confirms that multicollinearity is not an issue.

Table 2a. Correlation Analysis

| | SMV | GDP | INT | AEL | NLF | RSE | MIC |
|---|---|---|---|---|---|---|---|
| SMV | 1 | | | | | | |
| GDP | -0.11481 | 1 | | | | | |
| INT | 0.351347 | 0.142634 | 1 | | | | |
| AEL | 0.224743 | 0.274522 | -0.07128 | 1 | | | |
| NLF | -0.24915 | 0.325405 | 0.301241 | 0.194233 | 1 | | |
| RSE | -0.39896 | 0.281548 | -0.09943 | 0.162284 | 0.835727 | 1 | |
| MIC | 0.105474 | 0.106257 | 0.52845 | 0.20568 | 0.508692 | 0.072029 | 1 |

*Source:* Author's computation using EViews 9

Table 2b. Correlation Analysis after dropped variables

| | SMV | GDP | INT | AEL | NLF |
|---|---|---|---|---|---|
| SMV | 1 | | | | |
| GDP | -0.11481 | 1 | | | |
| INT | 0.351347 | 0.142634 | 1 | | |
| AEL | 0.224743 | 0.274522 | -0.07128 | 1 | |
| NLF | -0.24915 | 0.325405 | 0.301241 | 0.194233 | 1 |

*Source:* Author's computation using EViews 9

## Unit Root Test

In order to formally test for the presence of unit roots in all the variables to be used in this study, the Phillips Perron (PP) test) was utilised. Though, there are numerous avenues of testing for unit root according to macroeconomic literature. According to Phillips Perron (1988), the PP test is sensitive to structural variation that occurs in the mean of a stationary variable which is not covered in the test and in order to escape the bias in the usual unit root test towards acceptance of null of unit root. From Table 3, the result of the unit root test revealed that after first difference of all the variables, they were found to be stationary. It is thus safe to conclude that the variables are integrated of order one I (1). The implication of the result is that a long term relationship could be

present between the variables as all of the variables have unit roots and required differencing in order to make them stationary. This calls for co-integration analysis to establish the existence of long term relationship between the variables.

Table 3. Unit root test at 5% level of significance with intercept and trend

| Series | PP (levels) | Order of Integration | Remark | PP (First difference) | Order of Integration | Remark |
|---|---|---|---|---|---|---|
| GDP | -4.605 | I(0) | Stationary | -24.69 | I(1) | Stationary |
| SMV | -4.289 | I(0) | Stationary | -12.58 | I(1) | Stationary |
| INT | -3.113 | I(0) | Non-stationary | -6.337 | I(1) | Stationary |
| AEL | -2.937 | I(0) | Non-stationary | -5.836 | I(1) | Stationary |
| NLF | -0.165 | I(0) | Non-stationary | -4.131 | I(1) | Stationary |
| Critical Values | -3.56 | | | -3.563 | | |

*Source:* Author's computation using EViews 9

## Co-integration test

The precondition of Johansen co-integration was fulfilled since the variables were found to be non-stationary at levels. The variables were only stationary after first difference. This calls for the establishment of the presence of a long run connection among the variables using the Johansen co-integration test. This test identifies the number of long run relationship in existence among the set of integrated variables.

The optimal lag length used for the co-integration test was based on the Akaike Information criterion (AIC). The optimal lag length of three was selected. The study found that the trace statistics had five co-integrating equations and three co-integrating equations for Max-eigenvalue test at 5% level of significance. The null hypothesis can therefore be rejected to accept the alternative hypothesis of the presence of co-integrating vectors. Thus, the presence of a long run relationship is confirmed among the variables. (see Table 4)

Table 4. Johansen Co-integration test

| Hypothesized no of CE(s) | Eigenvalue (5%) | Trace Statistic (5%) | 0.05 Critical Value | Eigenvalue (5%) | Max Eigen Statistic (5%) | 0.05 Critical Value |
|---|---|---|---|---|---|---|
| None *(**) | 0.952838 | 219.620700 | 69.818890 | 0.952838 | 85.516560 | 33.876870 |
| At most 1 *(**) | 0.932224 | 134.104200 | 47.856130 | 0.932224 | 75.363200 | 27.584340 |
| At most 2 *(**) | 0.761500 | 58.740960 | 29.797070 | 0.761500 | 40.134800 | 21.131620 |
| At most 3 * | 0.382427 | 18.606150 | 15.494710 | 0.382427 | 13.494840 | 14.264600 |
| At most 4 *(**) | 0.166854 | 5.111311 | 3.841466 | 0.166854 | 5.111311 | 3.841466 |
| * denotes rejection of the hypothesis at the 5% level for Trace statistic | | | | | | |
| (**) denotes rejection of hypothesis at 5% level of Max-eigen statistic | | | | | | |
| Trace test indicates 5 co-integrating eq,(s) at the 0.05 level | | | | | | |
| Max-eigenvalue test indicates 3 co-integrating eqn(s) at the 0.05 level | | | | | | |

*Source:* Author's computation using EViews 9

## Granger Causality Test

In order to check for the presence of causality, the Granger causality was utilised and the test revealed a one-way causality from interest rate to stock market price volatility, Number of listed firms was also found to granger cause stock market price volatility. A unidirectional causality was also found from average educational level of investors to gross domestic product, *see* Table 5.

Table 5. Statistically significant result of Granger Causality Tests

| Null Hypothesis | Obs | F-statistic | Prob. |
|---|---|---|---|
| INT does not Granger Cause SMV | 28 | 2.41572 | 0.0846* |
| NLF does not Granger Cause SMV | 28 | 2.42301 | 0.0839* |
| AEL does not Granger Cause GDP | 28 | 2.43673 | 0.0826* |

*Note:* * signifies 10% level of significance
*Source:* Authors computation using EViews 9

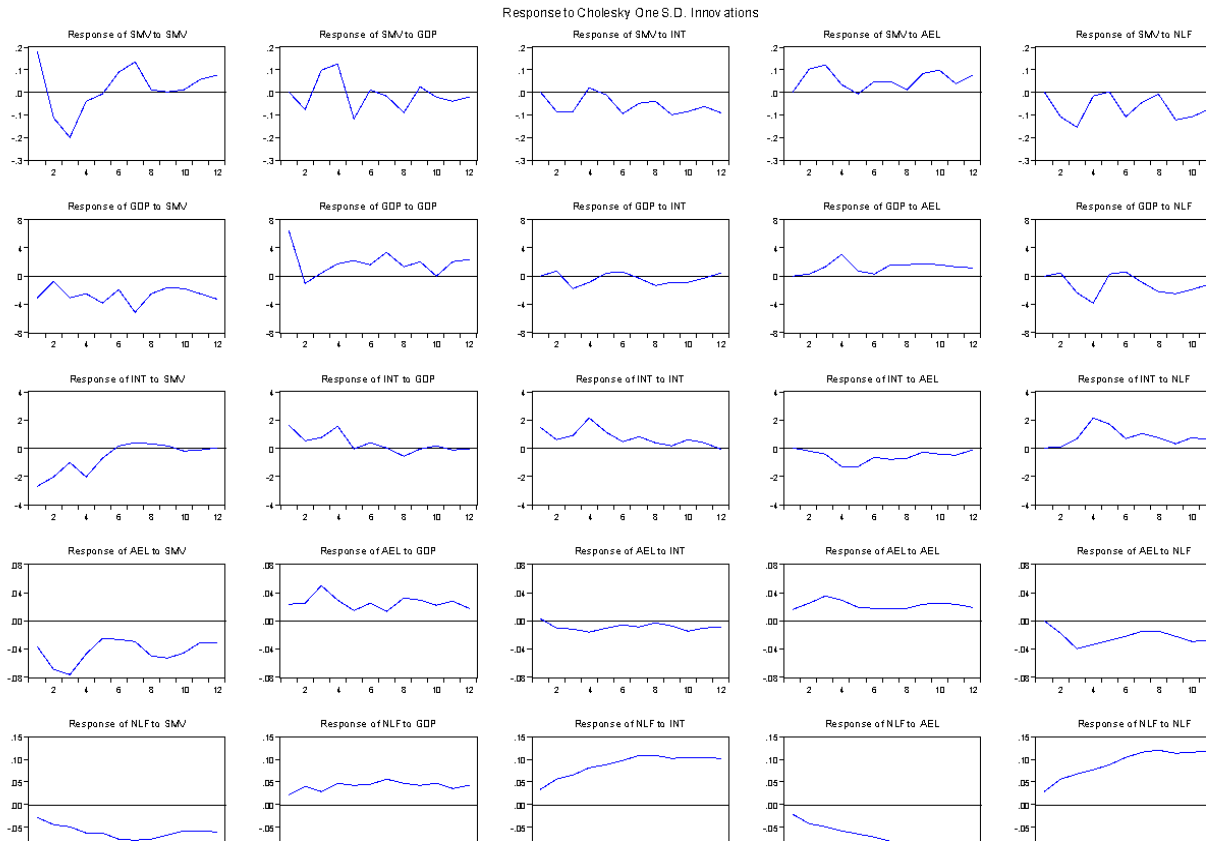
## Presentation of Results from Vector Error Correction Model

Following the difficulty associated with interpreting the individual coefficients of the error correction model in the dynamic properties of the model are analysed through the examination of the impulse response functions (IRF) and the variance decompositions (VDs) as suggested by Sims (1980).

## Impulse Response Function (IRF)

The IRF trace the dynamic response to the effect of shock in one variable upon itself and on all other variables. In what follows, the IRF is reported in graphic formats. Figure 1 reveals the results of the impulse responses of the variables to one standard deviation of shock to each of the variables in the system. In this study, the focus is on the response of stock market price volatility (SMV) to one standard deviation of shock to Gross domestic product (GDP), Interest rate (INT), Average education level of Investors (AEL), Number of listed firms and vice versa. From the first row of the impulse response shown in Figure 1, it was established that a one standard deviation shock applied to stock market price volatility results to positive response on stock market volatility in the 1st period which is immediately followed by a negative impact till the 5th period. The positive impact rose steadily and peaked in the 7th period but waned up till the 8th period with a steady positive movement till the 10th period. It then resumed a positive upward trend till the 12th period. Also, a one standard deviation shock applied to GDP produces a fluctuating positive and negative impact on stock market price volatility. The positive fluctuations peaked in the 4th, 6th and 9th period while the negative fluctuation were peaked in the 2nd, 5th, 8th, and 11th period. Interest rate has a fluctuating negative impact on stock market price volatility in almost all the periods except for a positive impact in the 4th period. Also, a one standard deviation shock applied to average education level of investors produces a positive fluctuating effect on the stock market price volatility in almost all the periods except for a negative drop in the 5th period. Finally, the numbers of listed firms have a negative fluctuating impact on stock market price volatility in all the periods.

Figure 1. Plot of Impulse Response function




*Source:* Author's computation using EViews 9

### Variance Decompositions (VD)

The variance decomposition assesses the percentage of forecast error variance in one variable explained by shocks in itself and the other variables. Thus, in order to determine the magnitude of the effect, the variance decompositions (VD) was analysed. The result of the variance decomposition for stock market price volatility is presented in Table 6 below. It was found that shock to SMV explained about 55.8% of shocks to stock market volatility in the 1st period declining in effect to about 39% in the 6th period; it rose to 42% in the 7th period before it dropped to 31.6% in the 12th period. This can be regarded as own shock. The VD also revealed that a shock to GDP explained about 7.7% of shock to stock market price volatility in the 1st period with increasing effect to about 21.9% in the 5th period with rate interchanging between 19% and 17.97% from the 6th period to the 9th period. The variation dropped from 17.97% to 15% in the 12th period. The variation to interest rate caused a decreasing impact on stock market price volatility in the short run from 8.6% to 6.9% in the medium term but an increasing impact result in the medium from 9.7% to 14.7% in the long term. A shock to average education level of investors result to an increasing magnitude on the stock market price volatility in short run from 12.7% to 13.1%. The medium term recorded a decreasing marginal impact from 12.2% to 11.4% which was immediately preceded by an increasing effect on stock market volatility from 11% to 14%.

Table 6. Variance Decomposition

| Variance Period | Decomposition S.E. | SMV | GDP | INT | AEL | NLF |
|---|---|---|---|---|---|---|
| 1 | 0.17980 | 100.0000 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 2 | 0.28418 | 55.81119 | 7.70627 | 8.62290 | 12.74236 | 15.11728 |
| 3 | 0.42030 | 48.59483 | 8.85697 | 7.92236 | 13.87463 | 20.75121 |
| 4 | 0.44301 | 44.51957 | 16.22201 | 7.30968 | 13.12046 | 18.82828 |
| 5 | 0.45914 | 41.46002 | 21.91811 | 6.86001 | 12.23379 | 17.52807 |
| 6 | 0.49188 | 39.27192 | 19.14844 | 9.72031 | 11.53846 | 20.32087 |
| 7 | 0.51593 | 42.27207 | 17.49129 | 9.66883 | 11.41528 | 19.15253 |
| 8 | 0.52570 | 40.75448 | 19.85821 | 9.87424 | 11.03809 | 18.47499 |
| 9 | 0.55523 | 36.53574 | 17.97344 | 11.97615 | 12.19851 | 21.31616 |
| 10 | 0.58053 | 33.44401 | 16.58417 | 13.16663 | 13.91108 | 22.89410 |
| 11 | 0.59409 | 32.77078 | 16.29882 | 13.67838 | 13.74468 | 23.50733 |
| 12 | 0.61938 | 31.56665 | 15.12851 | 14.73687 | 14.01482 | 24.55316 |
| Cholesky Ordering: SMV GDP INT AEL NLF | | | | | | |

*Source:* Authors computation using EViews 9

### Discussion of Results

Following the analysis, the result shows that in the long run, average education level of investors is found to have a positive relationship with stock market price volatility. By implication, the more educated the investors in the market, the more volatile is the market. The average education level of investors can thus be seen as a vital non macroeconomic variable that influences stock market price volatility in Nigeria. This is however contrary to the work of Xing (2004) that reported a negative correlation. It was also established that in the long run, that number of listed firm has a negative impact on stock market price volatility. This denotes that the more the firms that are listed in the Nigerian stock market, the more diversification that is expected in the market which drives down the prices of stocks in the market. The more firms are listed in the stock market, more stability follows. This result agrees with the study carried out by Xing (2004).

The two macroeconomic factors, namely, interest rate and GDP have negative effect on stock market price volatility. The implication of the negative association between interest rate and stock market price volatility is that higher interest rate would directly impact on returns on stock prices, causing prices to drop as theory has stated. The negative connection between gross domestic product and stock market price volatility implies that increase in economic activity may not boost stock market activities in Nigeria. This may not come as a surprise as investors have lost confidence in the economy as a result of the Nigeria's exchange rate fluctuation. This is contrary to theoretical expectation and the empirical works of Akinlo (2013) that established a positive link between stock market development and economic growth.

## Conclusion

The study empirically examined the non-macroeconomic factors that drive stock market volatility in the Nigerian economy. The study incorporated macroeconomic variable into the model and it was established that both non-

macroeconomic factors (Average Education Level of investors and number of listed) and macroeconomic factors (gross domestic product and interest rate) have long run impact on stock market price volatility. The results show that gross domestic product, interest rate, average education level of investors number of listed firms and stock market price volatility are co-integrated. Thus, stock market price volatility has long run relationship with both macroeconomic and non-macroeconomic variables. The result from Granger causality test show there is a unidirectional causality from interest rate to stock market price volatility. Also, a one-way causality from number of listed firms to stock market price volatility was found. Average education levels of investors also have a unidirectional causality with gross domestic product.

The IRFs show that average education level of investors increases steadily in the long run in response to a positive shock on stock market price volatility. However, Gross domestic product, interest rate, number of listed firms all decreased in response to positive shocks on stock market price volatility. In the long run, the VDs established that Interest rate had a positive impact on stock market volatility. Average education level of investors was also found to have an increasing effect on stock market price volatility. However, gross domestic product was confirmed to have a decreasing impact on stock market price volatility in the long run. The findings of this study are useful for policy makers especially in creating awareness about the crucial impact of non-macroeconomic factors on stock market volatility in the Nigerian economy. It is also recommended that financial literacy should be encouraged amongst investors as it could impact on the level of investment the investors in the stock market are involved in. Also, investors should be encouraged to get their businesses listed on the stock exchange thereby boosting diversification and stability in the stock market.

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## References

[1] Adeniji, S. 2015. An Empirical Investigation of the Relationship between Stock Market Prices Volatility and Macroeconomic Variables' Volatility in Nigeria*. European Journal of Academic Essays,* 2(1): 1-12.

[2] Akinlo, O. 2013. Stock Prices and Inflation: Evidence from Nigeria. *American Journal of Economics*, 3(6): 260-267.

[3] Akinlo, O. 2014. Oil Price and Stock Market: Empirical Evidence from Nigeria. *European Journal of Sustainable Development,* 3(2): 33-40.

[4] Babajide, A., Lawal, A, Somoye, R. 2016. Stock Market Response to Economic Growth and Interest Rate Volatility: Evidence from Nigeria. *International Journal of Economics and Financial Issues,* 6(1): 354-360.

[5] Badash, W., Alvi, M., and Sayilir, O. 2016. Macro-Economic Variables and Their Impact on Stock Exchange: A Study of Pakistan (KSE 100 Index). *Journal of Research in Business, Economics and Management,* 5(5): 704 – 716.

[6] Birau, F. 2012. The Impact of Behavioural Finance on Stock Markets. *Annals of the Constantin Brâncuşi University of Târgu Jiu. Economy Serie*s, 3: 45-50.

[7] Engle, R. F., and Granger, C. W. 1987. Cointegration and Error Correction: Representation, estimation and testing. *Econometria,* 55: 251-276.

[8] Garcia, V., and Liu, L. 1999. Macroeconomic Determinants of Stock Market Development. *Journal of Applied Economics,* II (1): 29-59.

[9] Ibrahim, M., and Aziz, H. 2003. Macroeconomic variables and Malaysian equity market: A view through Rolling subsamples. *Journal of Economics Studies*, 30(1): 6-27.

[10] Johansen, S., and Juselius, K. 1990. Maximum likelihood Estimation and Inference on Cointegration – With Applications of the Demand for Money. *Oxford Bulletin of Economics and Statistics*, 169-210.

[11] Lawal, A.I., Somoye, R.O.C., and Babajide, A.A. 2016. Impact of Oil Price Shocks and Exchange Rate Volatility on Stock Market Behavior in Nigeria. *Binus Business Review*, 7(2): 171-177. DOI: http://dx.doi.org/10.21512/bbr.v7i2.1453

[12] Maku, O., and Atanda, A. 2009. Does Macroeconomic Indicators Exert Shock On the Nigerian Capital Market? Available at: http://mpra.ub.uni-muenchen.de/17917/MPRA Paper No. 17917.

[13] Mahedi, M. 2012. Impact of the Macroeconomic Variables on the Stock Market returns: The Case of Germany and the United Kingdom. *Global Journal of Management and Business Research,* 12(16): 23-34.

[14] Maysami, R. C., Howe L.C., and Hamzah M. A. 2004. Relationship between Macroeconomic Variables and Stock Market Indices: Cointegration Evidence from Stock Exchange of Singapore's All-S Sector Indices *Jurnal Pengurusan*, 24: 47-77.

[15] Menike, L. 2006. The Effect of Macroeconomic Variables on Stock Prices in Emerging Sri Lankan Stock Market. *Sabaragamuwa University Journal*, 6(1): 50-67.

[16] Muradoglu, G., Metin, K., and Argac, R. 2001. Is There a Long-Run Relationship between Stock Returns and Monetary Variables: Evidence from an Emerging Market? *Applied Financial Economics,* 11: 641–649.

[17] Naik, P. and Padhi, P. 2012. The Impact of Macroeconomic Fundamentals on Stock Prices Revisited: Evidence from Indian Data. *Eurasian Journal of Business and Economics,* 5 (10): 25-44.

[18] Ndako, B. 2010. Financial Development, Economic Growth and Stock Market Volatility: Evidence from Nigeria and South Africa. An Unpublished PhD Thesis submitted to Department of Economics, University of Leicester, UK.

[19] Nishat, M. and Shaheen, R. 2004. Macroeconomic factors and Pakistani equity market. *The Pakistan Development Review*, 43(4): 619-637.

[20] Okodua, H. and Ewetan, O. 2013. Stock Market Performance and Sustainable Economic Growth in Nigeria: A Bounds Testing Co-integration Approach. *Journal of Sustainable Development,* 6(8): 84-90.

[21] Olokoyo, F. O., Osabuohien, S.C. and Salami, O A. 2009. Econometric Analysis of Foreign Reserves and Some Macroeconomic Variables in Nigeria. (1970–2007). *African Development Review*, 21(3): 454–475.

[22] Osisanwo, B. G., and Atanda, A. A. 2012. Determinants of stock market returns in Nigeria: A series analysis. *African Journal of Scientific Research*, 9(1): 478-496.

[23] Phillips, P., Perron, P. 1988. Testing for a unit root in time series regression. *Biometrika,* 75(2): 335 – 346.

[24] Prempeh, K. B. 2016. Macroeconomic Variables and Stock Price Volatility in Ghana. Online at https://mpra.ub.uni-muenchen.de/70545/MPRA Paper No. 70545.

[25] Roll, R. 1992. Industrial Structure and the Comparative Behaviour of International Stock Market Indices, *Journal of Finance*, 47(1): 3-41.

[26] Sims, C.A. 1980. Macroeconomics and reality. *Econometrica,* 48(1): 1-49.

[27] Tennant, D., and Tracey, M. 2014. Financial Intermediation and Stock Market Volatility in a Small Bank Dominated Economy. *The Journal of Developing Areas,* 48(4): 73-95.

[28] Waqar, K. and Saifullah, K. 2017. Effects of Macroeconomic Variables on the Stock Market Volatility: The Pakistan Experience. *International Journal of Econometrics and Financial Management*, 5(2): 42-59.

[29] Xing, X. 2004. Why Does Stock Market Volatility Differ across Countries? Evidence from Thirty-Seven. International Markets. *International Journal of Business*, 9(1): 84-103.

[30] Yartey, C. A. 2008. The Determinants of Stock Market Development in Emerging Economies: Is South Africa Different? International Monetary Fund, Working paper (32): 1-31.

[31] Zakaria, Z., and Shamsuddin, S. 2012. Empirical Evidence on the Relationship between Stock Market Volatility and Macroeconomics Volatility in Malaysia. *Journal of Business Studies Quarterly*, 4(2): 61-71.

Appendix. Return to Scale of CBs and IBs

| Bank | RTS | | | | | | | | | | Count bank (%) | | | Count bank (No.) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | CRS | IRS | DRS | CRS | IRS | DRS |
| Bank Dhofar SAOG | CRS | CRS | DRS | CRS | DRS | DRS | DRS | CRS | DRS | DRS | 0.4 | 0 | 0.6 | 4 | 0 | 6 |
| Bank Muscat SAOG | DRS | DRS | DRS | DRS | DRS | DRS | DRS | CRS | DRS | DRS | 0.1 | 0 | 0.9 | 1 | 0 | 9 |
| National Bank of Oman | DRS | DRS | DRS | DRS | DRS | DRS | DRS | CRS | CRS | CRS | 0.3 | 0 | 0.7 | 3 | 0 | 7 |
| Ahli Bank SAOG | CRS | CRS | CRS | IRS | IRS | IRS | CRS | CRS | IRS | IRS | 0.5 | 0.5 | 0 | 5 | 5 | 0 |
| HSBC Bank Oman SAOG | DRS | DRS | CRS | IRS | IRS | DRS | DRS | CRS | IRS | IRS | 0.2 | 0.4 | 0.4 | 2 | 4 | 4 |
| Ahli Bank QSC | DRS | DRS | DRS | DRS | DRS | DRS | DRS | CRS | DRS | DRS | 0.1 | 0 | 0.9 | 1 | 0 | 9 |
| Commercial Bank QSC | DRS | DRS | DRS | CRS | CRS | CRS | CRS | IRS | DRS | DRS | 0.4 | 0.1 | 0.5 | 4 | 1 | 5 |
| Doha Bank QSC | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0 | 1 | 0 | 0 | 10 |
| Qatar National Bank SAQ | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0 | 1 | 0 | 0 | 10 |
| Arab National Bank | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0 | 1 | 0 | 0 | 10 |
| Riyad Bank SJSC | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0 | 1 | 0 | 0 | 10 |
| Samba Financial Group SJSC | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0 | 1 | 0 | 0 | 10 |
| Saudi British Bank SJSC | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0 | 1 | 0 | 0 | 10 |
| Banque Saudi Fransi SJSC | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0 | 1 | 0 | 0 | 10 |
| Saudi Investment Bank SJSC | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0 | 1 | 0 | 0 | 10 |
| National Bank of Bahrain | DRS | DRS | DRS | DRS | DRS | DRS | DRS | CRS | IRS | IRS | 0.1 | 0.2 | 0.7 | 1 | 2 | 7 |
| BBK BSC | DRS | DRS | DRS | DRS | DRS | DRS | DRS | CRS | DRS | DRS | 0.1 | 0 | 0.9 | 1 | 0 | 9 |
| Al Ahli Bank of Kuwait | DRS | DRS | DRS | DRS | DRS | DRS | DRS | CRS | DRS | DRS | 0.1 | 0 | 0.9 | 1 | 0 | 9 |
| Burgan Bank SAKP | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0 | 1 | 0 | 0 | 10 |
| Commercial Bank of Kuwait | DRS | DRS | DRS | DRS | DRS | DRS | DRS | CRS | DRS | DRS | 0.1 | 0 | 0.9 | 1 | 0 | 9 |
| National Bank of Kuwait | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0 | 1 | 0 | 0 | 10 |
| Gulf Bank KSCP | DRS | DRS | DRS | DRS | DRS | DRS | DRS | CRS | DRS | DRS | 0.1 | 0 | 0.9 | 1 | 0 | 9 |
| Bank of Sharjah PJSC | IRS | IRS | IRS | IRS | DRS | DRS | DRS | IRS | IRS | IRS | 0 | 0.7 | 0.3 | 0 | 7 | 3 |
| Mashreqbank PSC | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0 | 1 | 0 | 0 | 10 |
| National Bank of Fujair | DRS | DRS | CRS | IRS | DRS | DRS | DRS | IRS | IRS | IRS | 0.1 | 0.4 | 0.5 | 1 | 4 | 5 |

| Bank | RTS | | | | | | | | | | Count bank (%) | | | Count bank (No.) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | CRS | IRS | DRS | CRS | IRS | DRS |
| National Bank of Abu Dhabi | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0 | 1 | 0 | 0 | 10 |
| Union National Bank PJSC | DRS | DRS | DRS | DRS | DRS | DRS | DRS | CRS | DRS | DRS | 0.1 | 0 | 0.9 | 1 | 0 | 9 |
| United Arab Bank PJSC | IRS | IRS | IRS | IRS | IRS | IRS | DRS | IRS | IRS | IRS | 0 | 0.9 | 0.1 | 0 | 9 | 1 |
| Abu Dhabi Commercial Bank | DRS | CRS | CRS | CRS | DRS | DRS | DRS | CRS | DRS | DRS | 0.4 | 0 | 0.6 | 4 | 0 | 6 |
| Emirates NBD Bank PJSC | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0 | 1 | 0 | 0 | 10 |
| Invest Bank PSC | DRS | IRS | CRS | IRS | CRS | CRS | CRS | IRS | IRS | IRS | 0.4 | 0.5 | 0.1 | 4 | 5 | 1 |
| National Bank of Ras Al Khaimah | CRS | CRS | CRS | CRS | CRS | CRS | CRS | CRS | CRS | CRS | 1 | 0 | 0 | 10 | 0 | 0 |
| National Bank of Um Al Qaiwain | DRS | IRS | DRS | IRS | IRS | IRS | IRS | IRS | IRS | IRS | 0 | 0.8 | 0.2 | 0 | 8 | 2 |
| | | | | | | | | | | | 0.14 | .14 | 0.73 | 45 | 45 | 240 |
| Masraf Al Rayan QSC | CRS | CRS | CRS | CRS | CRS | IRS | CRS | CRS | CRS | CRS | 0.9 | 0.1 | 0 | 9 | 1 | 0 |
| Qatar Islamic Bank SAQ | IRS | DRS | DRS | IRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0.2 | 0.8 | 0 | 2 | 8 |
| Qatar International Islamic | DRS | IRS | IRS | IRS | CRS | IRS | CRS | CRS | IRS | IRS | 0.3 | 0.6 | 0.1 | 3 | 6 | 1 |
| Bank Albilad SJSC | DRS | DRS | DRS | IRS | IRS | IRS | CRS | CRS | CRS | IRS | 0.3 | 0.4 | 0.3 | 3 | 4 | 3 |
| Al Rajhi Banking & Inv. | CRS | DRS | CRS | CRS | CRS | CRS | DRS | CRS | CRS | DRS | 0.7 | 0 | 0.3 | 7 | 0 | 3 |
| Bank Aljazira JSC | CRS | DRS | IRS | IRS | IRS | IRS | IRS | CRS | IRS | CRS | 0.3 | 0.6 | 0.1 | 3 | 6 | 1 |
| Bahrain Islamic Bank BSC | IRS | CRS | CRS | CRS | CRS | CRS | CRS | IRS | CRS | IRS | 0.7 | 0.3 | 0 | 7 | 3 | 0 |
| Ithmaar Bank BSC | DRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | IRS | DRS | 0 | 0.1 | 0.9 | 0 | 1 | 9 |
| Khaleeji Commercial Bank | IRS | IRS | CRS | IRS | IRS | IRS | IRS | IRS | CRS | CRS | 0.3 | 0.7 | 0 | 3 | 7 | 0 |
| Al Salam Bank Bahrain BSC | IRS | CRS | IRS | CRS | CRS | CRS | CRS | CRS | CRS | CRS | 0.8 | 0.2 | 0 | 8 | 2 | 0 |
| Boubyan Bank KSCP | DRS | IRS | IRS | IRS | IRS | IRS | IRS | IRS | IRS | IRS | 0 | 0.9 | 0.1 | 0 | 9 | 1 |
| Kuwait Finance House KSCP | DRS | DRS | DRS | IRS | DRS | DRS | DRS | CRS | CRS | DRS | 0.2 | 0.1 | 0.7 | 2 | 1 | 7 |
| Kuwait International Bank | DRS | DRS | IRS | IRS | IRS | IRS | IRS | IRS | CRS | CRS | 0.2 | 0.6 | 0.2 | 2 | 6 | 2 |
| Abu Dhabi Islamic Bank | DRS | DRS | IRS | DRS | DRS | CRS | CRS | DRS | DRS | DRS | 0.2 | 0.1 | 0.7 | 2 | 1 | 7 |
| Dubai Islamic Bank PJSC | DRS | DRS | IRS | DRS | DRS | DRS | DRS | DRS | DRS | DRS | 0 | 0.1 | 0.9 | 0 | 1 | 9 |
| Sharjah Islamic Bank PJSC | DRS | DRS | IRS | IRS | IRS | CRS | CRS | CRS | CRS | DRS | 0.4 | 0.3 | 0.3 | 4 | 3 | 3 |
| | | | | | | | | | | | 0.33 | 0.3 | 0.34 | 53 | 53 | 54 |

*Notes:* CRS: constant return to scale, IRS: increasing return to scale, DRS: decreasing return to scale

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