Systemic Risk and Dynamics of Stock Prices: A Short and Long Run Analysis from Nigeria Capital Market

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Abstract

This study examined the effect of systemic risk on the dynamics of stock prices in Nigeria capital market. The objective was to investigate the dynamic effect of systemic risk on stock prices traded on the floor of Nigeria stock exchange. Time series data was sourced from Central Bank of Nigeria Statistical Bulletin from 1990-2017. Stock prices were modeled as the function of prices risk, liquidity risk, interest rate risk and exchange rate risk. Multiple regression with ordinary least square properties of co-integration was used to examine the relationship between the dependent and the independent variables. The study found price and liquidity risk have positive effect on stock price while interest rate and exchange rate risk have negative effect on stock prices of equities traded on Nigeria stock exchange. It concludes that systemic risk has significant effect on stock prices and recommends, among others, that the management of the capital market should ensure that the operating environment is risk minimum to ensure appreciable stock prices by developing strategies and policies aim at managing the systematic risk in the operating environment and engage a regular environmental impact assessment on systemic risk, to avert it's negative effect on stock prices.

Keywords: Systemic Risk, Stock Prices, Short and Long Run, Nigeria, Capital Market

INTRODUCTION

The history of risk taken can be traced to the existence of man. Relocating a tribe from one place to another in order to find food and hunting dangerous animals have been daily decisions in the pre-civilization era. The decisions at that time have been most probably based on historic data and gut feeling. This immeasurable justification on decisions stayed mostly the same also on the historic era until the concept of probability was invented. While the gamblers that lived in Ancient Greece had the concept of numerals and could determine the number of possible outcomes they strongly believed that the outcome of games was determined by gods. Zigrand (2014) opined that the concept of modern arithmetic, numbers and symbols, came from Hindus during the Dark Ages and that it made the analysis of games possible in the 16th century.

There has been aged long divergence among behavioral finance scholars on the factor that determine stock prices. The fundamentalist argue that the value of a corporation's stock is determined by expectations regarding future earnings and by the rate at which those earnings are discounted on time. The technical school of taught on the other hand, opposes the fundamentalists' arguments, and postulate that stock price behaviour can be predicted by the use of financial or economic data. The behavioural school of finance holds different view from the above schools of thoughts and opined that market might fail to reflect economic fundamentals under three conditions, which are: The first behavioural condition is irrational behaviour. It holds that investors behave irrationally when they do not correctly process all the available information while forming their expectations of a company's future performance. The second is systematic patterns of behaviour, which hold that even if individual investors decided to buy or sell without consulting economic fundamentals, the impact on share prices would be limited. As in Inegbedion (2009), the third is limits to arbitrage in financial markets ascertain that when investors assume that a company's recent strong performance alone is an indication of future performance; they may start bidding for shares and drive up the price. Some investors might expect a company that surprises the market in one quarter to go on exceeding expectations. The macroeconomic approach attempts to examine the sensitivity of stock prices to changes in macroeconomic variables. The approach posits that stock prices are influenced by changes in money supply, interest rate, inflation and other macroeconomic indicators. According to Afego (2012), the random walk theory is a component of efficient market hypothesis. It states that current price of any security, fully reflects the information content of its historical sequences of price. It is built on the premises that investors react instantaneously to information advantage, they have thereby eliminating profit opportunities

The main premise in finance is that there is a connection between risk and return. Higher risk is assumed to lead to higher return on stocks with rationale pricing of stocks. Empirical study by Galati and Moessner (2010) concluded that despite the wealth of research on systemic risk and stock prices, there is still no consensus on the definition of systemic risk. Empirical validity of theories on factors that determine stock price is based on financial market of the developed countries with high degree of perfection while Nigeria financial market is emerging and characterized with high level of imperfection. From the above, this paper examined the effect of systemic risk on the stock prices of Nigeria firms.

LITERATURE REVIEW

Concept of Systemic Risk

Systematic risk, also known as un-diversifiable risk volatility or market risk, affects the overall market, not just a particular stock or industry. According to Pandey (2005) this type of risk is both unpredictable and impossible to completely avoid. It cannot be mitigated through diversification, only through hedging or by using the right asset allocation strategy. Systemic risk evolves along with the development of financial markets, regulations and collective behavior of market participants and it may be prompted by regulatory arbitrage. Systemic risk arises from: excessively risky activities of a single or a group of traders, an aggressive type of organizational culture (driven towards short-term profits), a collective failure of management in the bank (or across the financial system), which leads to inertia and the inability to respond to changed economic circumstances and high (over)exposure of banks to the same type of risk (symmetric shock) in the system as a whole. A systemic risk literature review by Galati and Moessner (2010) concludes that despite the wealth of research on the subject, there is still no consensus on the definition of systemic risk. As in the case of financial stability, there are many systemic risk definitions, but it remains difficult to operationalize them. Nevertheless, the operationalization would be most useful from the perspective of conducting macro-prudential supervision, aiming at systemic risk prevention. This narrative informs that, systemic risk can have a macro- or microeconomic dimension. Nier (2009) indicates that macro-systemic risk arises when the financial system becomes exposed to aggregate risk, resulting from, e.g. growth of correlated exposures. Micro-systemic risk arises when the failure of an individual institution has an adverse impact on the financial system as a whole (default of a SIFI).

Concept of Stock Prices

Stock price is the cost of purchasing a security on an exchange. It is affected by a number of things including volatility in the market, current economic conditions, and popularity of the company. According to Ronen and Yaari (2008), the invention of double entry book keeping in the 14th century led to company's valuation which is based upon ratios such as price per unit of earnings (from income statement), price per unit of net worth (from balance sheet) and price per unit of cash flow (cash flow statement). The next advance was to price individual price shares rather than the whole company. A price per dividend was the next advancement. Analysts find it appropriate to use discounted cash flow that is based on time value of money to estimate the intrinsic value of share rather than price per dividend of share prices.

Theoretical framework

The Capital Asset Pricing Model

The CAPM is a model for pricing an individual security or a portfolio. The CAPM model was developed independently by William Sharpe (1964) and Parallel work was performed by Lintner (1965) and Mossin (1966) these model marks the birth of asset pricing theory.

Derivation of the CAPM

The CAPM is a simple linear model that is expressed in terms of expected return and expected risk. The model states that the equilibrium returns on all risky assets are a function of their covariance with the market portfolio.

Under the assumptions of the CAPM, if a risk-free asset exists, every investor's optimal portfolio will be formed from a combination of the market portfolio and the risk-free asset. The precise combination of the market portfolio and the risk-free asset depends on the degree of investors risk aversion. Since investors can choose the combination of the market portfolio and the risk-free asset, then the equation of the relationship connecting a risk-free asset and a risky portfolio is:

$$E\,(Ri) = R\,f + \frac{E(Rm) - Rf}{\sigma 2m}\ \sigma im \qquad 1$$

Where;

E (Ri) : Expected return on i^{th} portfolio.

R f : Return on the risk free asset

E (Rm) : Expected return on market portfolio

σim : The covariance between asset *i* and the market portfolio

σ2 m: The variance of the market portfolio

Based on the equation (3) the original CAPM equation can be derived as follows:

$$E(Ri) = R\,f + [\ E(Rm) - R\,f]\ \beta i \qquad 2$$

Equation 4 is known as Capital Asset Pricing Model and it could be shown graphically as the security market line (SML) which means the SML fundamentally graphs the results from the capital asset pricing model (CAPM) formula. The *x*-axis represents the risk (beta), and the *y*-axis represents the expected return. The market risk premium is determined from the slope of the SML. The SML model states that stocks expected return is equal to the risk-free rate plus a risk premium obtained by the price of risk multiplied by the quantity of risk. In a well-functioning market nobody will hold a security that offers an expected risk premium of less than [E (Rm)-R f] i.

If we think E (Rm) – Rf as the market price of risk for all efficient portfolios, than, it represents the extra return that can be gained by increasing the level of risk on an efficient portfolio by one unit. The quantity of risk is often called beta, and it is the contribution of asset *i* to the risk of the market portfolio. In other words, it is the correlation of the asset *i*'s return with the return on the market portfolio. If everyone holds the market portfolio, and if beta measures each security's contribution to the market portfolio risk, then it's no surprise that the risk premium demanded by investors is proportional beta. According to the CAPM the total risk of a security could be divided between systematic and unsystematic risk. The systematic risk is the portion of the security return variance that is explained by market movements such as fiscal changes, swings in exchange rates and interest rate movements. On the other hand, the unsystematic risk is the variability in return due to factors unique to the individual firm, such as R&D achievements and industrial relations problem. The relevant measure of the risk of an asset is its contribution to the systematic risk of an investor's portfolio defined by its beta rather than the inherent variance in the assets total return.

If the beta of an asset is larger (smaller) than 1, then the standard deviation of an asset changes more (less) than proportionately in reaction to changes in market conditions. Thus, an asset whose beta is greater (less) than 1 has a relatively greater (smaller) contribution to the risk of a portfolio. While beta does not measure risk in absolute terms, it is a crucial risk indicator, reflecting the extent to which the return on the single asset moves with the return on the market.

Assumptions of the CAPM

The CAPM rests on several assumptions. The most important are as follows:

All investors are rationally risk-averse individuals whose aim is to maximize the expected utility of their end of period wealth. Therefore, all investors operate on a common single-period planning horizon. All investors are price-takers; so that, no investor can influence the market price by the scale of his or her own transactions. Asset markets are frictionless and information is freely and simultaneously available to all investor. All investors have homogeneous expectations about asset returns, this mean that all investors arrive at similar assessments of the probability distribution of returns expected from traded securities. This says that investors will not be trying to beat the market by actively managing their portfolios Distributions of expected returns are normal. All securities are highly divisible, i.e. can be traded in small packages. All investors can lend or borrow unlimited amounts of funds at a rate of interest equal to the rate of risk-free securities. Investors pay no taxes on returns and there are no transaction costs entailed in trading securities, so expected return is only related to risk.

Let (σ_M, $\bar{r}_M$) denote the point corresponding to the market portfolio M. All portfolios chosen by a rational investor will have a point (σ, $\bar{r}$) that lies on the so-called capital market line

$$\bar{r} = rf + \frac{\bar{r}M - T_f}{\sigma_M}\sigma, \qquad 3$$

The efficient Portfolio

It tells us the expected return of any efficient portfolio, in terms of its standard deviation, and does so by use of the so-called price of risk.

$$\frac{\bar{r}M - rf}{\sigma M}, \qquad 4$$

The slope of the line, which represents the change in expected return r per one-unit change in standard deviationσ. If an individual asset i (or portfolio) is chosen that is not efficient, then we learn nothing about that asset. It would seem useful to know, for example, how $\bar{r}_i - r_f$, the expected excess rate of return is related to the market portfolio. The following formula involves just that, where $\sigma_{M,}$i denotes the covariance of the market portfolio with individual asset i:

Theorem (CAPM formula) for any asset i

$$\bar{r}_i - r_f \;\; = \beta_i \; (\bar{r}_M - r_f), \qquad 5$$

Where

$$\beta_i = \frac{\sigma M, i}{\sigma^2 M} \qquad 6$$

Is called the beta of asset i. This beta value serves as an important measure of risk for individual assets (portfolios) that is different from α_i^2; it measures the systematic risk part of risk.

More generally, for any portfolio p = ($\alpha_1 \dots \alpha_n$) of risky assets, its beta can be computed as a weighted average of individual asset betas:

$$\bar{r} - rf = \beta_p \; (\bar{r}M - rf) \qquad 7$$

Where

$$\beta_p = \frac{\sigma M_1 \; p}{\sigma^2 M} = \sum_{i=1}^{n} \alpha_i \beta_i \qquad 8$$

Before providing the above theorem, we point out a couple of its important consequences and explain the meaning of the beta. For a given asset i, σ^2_i tells us the risk associated with its own fluctuations about its mean rate of return, but not with respect to the market portfolio. For example if asset i is uncorrelated with M, then β_i= 0 (even presumably if σ^2_i is huge), and this tells us that there is no risk associated with this asset (and hence no high expected return) in the sense that the variance σ^2_i can be diversified away assets and form a portfolio with equal proportions thus dwindling the variance to 0 so it becomes like the risk-free asset with deterministic rate of return r_f, So, in effect, in the world of the market you are not rewarded (via a high expected rate of return) for taking on risk that can be diversified away. β_i as a measure of non diversifiable risk, the correlated-with-the-market part of risk that we can't reduce by diversifying. This kind of risk is sometimes called market or systematic risk. It is not true in general that higher beta value β_i implies higher variance σ^2_i, but of course a higher beta value does imply a higher expected rate of return: you are rewarded (via a high expected rate of return) for taking on risk that cannot be diversified away; everyone must face this kind of risk.

Portfolio of asset i and the market portfolio M; (α, 1-α), with α € [0, 1], the rate of return is thus $r(\alpha) = \alpha r_i + (1-\alpha) r_M$. Asset it is assumed not efficient; its point lies in the feasible region but not on the efficient frontier. Thus as α varies this portfolio's point traces out a smooth curve in the feasible (σ,r) region $\alpha \rightarrow (\sigma(\alpha), \bar{r}(\alpha))$ parameterized by α, where.

$$r(\alpha) = \alpha \bar{r}_i + (1-\alpha)\ \bar{r}_M \qquad 9$$

$$= \alpha(\bar{r}_i - \bar{r}_M) + \bar{r}_M, \qquad 10$$

$$\sigma(\alpha) = \sqrt{\alpha^2 \alpha^2{}_i + (1-\alpha)^{2^{\sigma^2}} M + 2\alpha(1-\alpha)\alpha, Mi.} \qquad 11$$

$$= \sqrt{\alpha^2(\alpha^2{}_i + \alpha^2 M - 2\alpha M, i.) + 2\alpha(\alpha M, i - \sigma^2 M) + \sigma^2 M} \qquad 12$$

When α = 0 (σ (0), $\bar{r}$ (0)) = (σM, $\bar{r}_M$) and when α = 1, (σ(0), $\bar{r}$ (0))= (σ_i, $\bar{r}_i$). Thus the curve touches the capital market line at the market point (σM, $\bar{r}_M$), but otherwise remains off the capital market line but (of course) within the feasible region where it also hits the point (σ_M, $\bar{r}_M$) and therefore when α = 0 the curve's derivative.

$$\frac{d\bar{r}(\alpha)}{d\sigma(\alpha)_{\alpha=0}} \qquad 13$$

is identical to the slope of the capital asset line at point M. The slope (the price of risk) of the line is given by (2). We thus conclude that when α = 0

$$\frac{d\bar{r}(\alpha)}{d\sigma(\alpha)} = \frac{\bar{T}M - T_f}{\alpha M} \qquad 14$$

The composition rule from calculus yields

$$\frac{d\bar{r}(\alpha)}{d\sigma(\alpha)} = \frac{d\bar{r}(\alpha)/d\alpha}{d\sigma(\alpha)/d\alpha} \qquad 15$$

Differentiating (3) and (4) and evaluating at α = 0 yields

$$\frac{d\bar{r}(\alpha)/d\alpha}{d\sigma(\alpha)/d\alpha} = \frac{\bar{T}_i - \bar{T}M}{(\alpha M, i - \alpha^2 M / \sigma M} \qquad 16$$

From (5) we deduce that $$\frac{\bar{T}_i - \bar{T}M}{(\alpha M, i - \alpha^2 M / \sigma M} = \frac{\bar{T}M - r_f}{\sigma M} \qquad 17$$

Solving for $\bar{r}_i$ then yields the CAPM formula for asset i, $\bar{r}_i - r_f = \beta_i\,(\bar{r}_M - rf)$, as was to be shown. For the more general portfolio result, observe that

$$r_p - r_f = -r_f + \sum_{i=1}^{n} \alpha_i \bar{r}_i \qquad 18$$

$$= \sum_{i=1}^{n} \alpha_i (\bar{r}_i - rf) \qquad 19$$

$$\sum_{i=1}^{n} \alpha_i \beta_i \ (r_i - r_f) \qquad 20$$

$\sum_{i=1}^{n} \alpha_i \beta_i \ (r_M - r_f)$ CAPM formula for single asset i 21

$$= (\bar{r}\ M - rf) \sum_{i=1}^{n} \alpha_i \beta_i \qquad 22$$

Note that when $\beta_p = 1$ then $\bar{r}_p = \bar{r}_M$; the expected rate of return is the same as for the market portfolio. When $\beta_p >$ 1, then $\bar{r}_p > \bar{r}_M$; when $\beta_p < 1$, then $\bar{r}_p < \bar{r}_M$.

Also note that if an asset i is negatively correlated with M, $\sigma_{M,i} < 0$, then $\beta_i < 0$ and $r_i < r_f$; the expected rate of return is less than the risk-free rate. Effectively, such a negatively correlated asset serves as insurance against a drop in the market returns, and might be viewed by some investors as having enough such advantages so as to make it worth the low return. Investing in gold is thought to be such an example.

Estimating the Market portfolio and betas

These estimates are computed using sample means, variances and covariance as follows:

N time points such as the end of each of the last 10 years k = 1, 2… N. r_{Ak} and $r_{S\&Pk}$ denote the k^{th} such sample values for rate of return yielding estimates.

$$\bar{r}A = \frac{1}{N} \sum_{k=1}^{N} rAk \qquad 23$$

$$\bar{r}_{S\&P} = \frac{1}{N} \sum_{k=1}^{N} r_{S\&Pk} \qquad 24$$

The variance $\sigma^2_{s\&p}$ is then estimated by

$$Y = \frac{1}{N} \sum_{k=1}^{N} (r_{S\&Pk} - \hat{\bar{r}}_{S\&P})\ (r_{S\&Pk} - \hat{\bar{T}}A). \qquad 25$$

The beta value is then estimated by taking the ratio X/Y.

More on Systematic risk

With the CAPM formula in mind, for a given asset i let us express r_i as

$$r_i = rf + \beta i(\bar{r}_M - {}_rf) + \in i, \quad 26$$

Where $\in_i = r_i - r_f - \beta_i(\bar{r}_M - rf)$, 27

a random variable, is the error term. Note how we replaced deterministic r_M with random r_M in the CAPM to do this. Our objective is to determine some properties of the error term.

It is immediate form the CAPM formula that $E(\in i) = 0$. Moreover Cov $(\in_i, r_M) = 0$ as is seen by direct computation and the definition of β_i:

$$\text{Cov}(\epsilon i, r_M) = \text{cov}(r_i - r_f - \beta_i(\bar{r}_M - \bar{r}_f), r_M) \quad 28$$

$$= \text{cov}(r_i - \beta_i(\bar{r}_M - r_f), r_M) \quad 29$$

$$= \text{cov}(\bar{r}_i, r_M) - \beta_i \text{cov}(r\overline{M} - r_f, r_M) \quad 30$$

$$= \text{cov}(\bar{r}_i, r_M) - \beta_i \text{cov}(r_M, r_M) \quad 31$$

$$= \sigma M, i - \frac{\sigma M, i}{\sigma^2 M} \sigma^2 M \quad 32$$

$$= \sigma M, i - \sigma_{M,i} \quad 33$$

$$= 0 \quad 34$$

So the error term has mean 0 and is uncorrelated with the market portfolio. It then follows by taking the variance of both sides of (6) that

$$\sigma^2_i = \beta^2_i \sigma^2_M + \text{var}(\in_i) \quad 35$$

We conclude that the variance of asset i can be broken into two orthogonal components. The first, $\beta^2_i \sigma^2_M$, is called the systematic risk and represents that part of the risk (of investing in asset i) associated with the market as a whole. The other part, var $(\in_i)$, is called the nonsystematic risk. Nonsystematic risk can be reduced (essentially eliminated) by diversification, but the systematic risk, when $\beta^2_i > 0$, cannot be diversified away. Solving for σ in terms of $\bar{r}$ in the capital market line yields the inverse line for efficient portfolios.

$$\sigma = \frac{\bar{r} - rf}{\bar{r}M - rf} \sigma_M \quad 36$$

Using the CAPM formula $\bar{r}_p - \bar{r}_f = \beta_p(\bar{r}M - rf)$ and plugging into this inverse line formula, we conclude that for any efficient portfolio p, $\sigma_p = \beta_p \alpha_M$; there is only systematic risk for efficient portfolios, no nonsystematic risk. This makes perfect sense: clearly M has only systematic risk since $\beta_M = 1$.it is known that all efficient portfolios are a mixture of M and the risk-free asset (e.g., they all have points on the capital market line). Since the risk-free asset is deterministic it does not contribute to either the variance or the beta of the portfolio, only M does; so all of the risk is contained in M which is just pointed out is pure systematic risk.

Arbitrage Pricing Theory

The Arbitrage Pricing Theory (APT) is another model of asset pricing based on the idea that equilibrium market prices should be perfect, in such a way that prices will move to eliminate buying and selling without risks (arbitrage opportunities). The basis of this theory is the analysis of how investors construct efficient portfolios and offers a new approach to explaining the asset prices and also states that the return on any risky asset is a linear combination of various macroeconomic factors that are not explained by this theory. It is probably safe to assume that both the CAPM and APJ will continue to exist and will be used to price capital assets.

Assumptions of the APT

Asset markets are perfectly competitive and frictionless; all investors have homogeneous expectations that returns are generated randomly according to a k-factor model. Investors have monotonically increasing concave utility functions; the number of assets existing in the capital market from which portfolios are formed is much larger than the number of factors. There are no arbitrage opportunities.

Pricing assets

Consider an asset with price $P = X_0$ at time t=0, payoff (random) $Q - X_1$ and expected payoff $\overline{Q} = E(X_1)$ at time t=1. Then by definition $\bar{r} = (E(X_1) - X_0)/X_0 = \overline{Q} - P)/P.$ Solving for P yields

$$P = \overline{Q}/(1+\bar{r}), \qquad 37$$

Which expresses the price as the discounted payoff (present value) if using $\bar{r}$ as the discount rate. But since $\bar{r}$ =rf + $\beta(\bar{r}_M - r_f)$ from the CAPM formula, we conclude that

$$P = \frac{\overline{Q}}{1 + r_f + \beta\,(\bar{r}M - r_f)}(\text{Pr}icing\ version\ of\ CAPM\ \ formula) \qquad 38$$

We can re-express this formular by using r = (Q – P)/P = (Q/P) – 1, then computing

$$\text{Con}(r,rM) = \text{Cov}((Q/P) - 1, r_M \qquad 39$$

$$= \text{Cov}((Q/P), r_M \qquad 40$$

$$= \frac{1}{P} Cov\,(Q, rM\,)\,/\,\sigma^2 M \qquad 41$$

Obtaining

$$\beta = \frac{1}{P} Cov\,(Q, rM\,)\,/\,\sigma^2 M \qquad 41$$

Plugging into the pricing version of CAPM formula yields

$$P = \frac{\overline{Q}}{1 + r_f + \frac{1}{P}(Cov\,(Q, rM\,)/\sigma^2 M)\ (\bar{r}_M - rf\,)}. \qquad 42$$

Solving for P yields

$$P = \frac{\overline{Q}\ \dfrac{(Cov\,(Q, rM\,)/\sigma^2 M)\ (\bar{r}_M - rf\,)}{\sigma^2{}_M}}{1 + r_f}. \qquad 43$$

This equation is interesting, since it expresses the price as the present value of an "adjusted" expected payoff. If the asset is uncorrelated with the market, then the price is exactly $\overline{Q}/(1+rf)$,

$$\frac{(Cov\,(Q, rM)\;(\bar{r}_M - rf\,)}{\sigma^2{}_M} \qquad 44$$

Yields a lower price if the asset is positively correlated with the market and a higher price if the asset is negatively correlated with the market

Empirical Review

Izova, Bollerslev, Osterrieder, Tauchen (2011) investigated the relationship between risk and return using, Fractional Cointegration based on daily data for the S&P 500 and the VIX volatility index. Their series were divided into different components. The findings indicated that the relationship between volatility and the volatility-risk reward is strongly direct and positive. They also found that fractionally cointegrated VAR. in addition they find that corresponding the qualitative conceptions from that same theoretical and their study represent variance risk premium estimated as the long-run equilibrium relationship within the fractionally co integrated system results in non-trivial return predictability over longer inter-daily and monthly return horizons.

Pollet, Kräussl, Jegadeesh (2010) investigated the risk and returns of PE investments and LPEs using the market Prices of FOFs that invests in unlisted private equity funds. Their findings indicate that the market expects for PE to earn abnormal return is approximately 0.5 percent and for LPEs is approximately close to zero after fees. Private equity fund returns are negatively related to the credit expand and positively related to Gross Domestic Product growth. In addition they find that both listed and unlisted PE has betas near to one.

Chudhary, Chudhary (2010) examined the relationship between stock returns and systematic risk based on capital asset pricing model (CAPM) in the Bombay Stock Exchange. The sample search is 287 top companies of Bombay (BSE) Stock Exchange that the data were collected over thirteen years period from January1996 to December 2009. Their findings (about intercept and slop of CAPM equation states that intercept should be equal from zero and slop should be excess returns) rely on negate hypotheses of capital asset pricing model and offer evidence against the CAPM. In addition, this paper investigated whether the CAPM adequately captures all -important determinants of returns including the residual variance of stocks. The results represent that residual risk has no effect on the expected returns of portfolios.

McCurdy and Morgan (2011) investigated equilibrium model for the inter-temporal evolution of the basis in foreign currency markets. The weights are specified in a hedged by the prices of futures and spot contracts position and by Internal and external interest rates. Evaluating this hedged position using inter temporal asset pricing model, leads to a testable equilibrium model of the futures basis. Systematic risk will be commensurate to the conditional covariance of the basis with a generalized discount factor. Empirical implementation uses a conditional (CAPM) in which both the quantity and the price of covariance risk are free to vary over time. However, for this application, the estimated inter-temporal risk is insignificantly different from zero the risk in the futures market offsets that in the spot, providing an effective hedge.

Aduda *et al. (*2012) found out that, macro-economic factors such as stock market liquidity, institutional quality, income per capita, domestic savings and bank development are important determinants of stock market development in the Nairobi Stock Exchange. There is no relationship between stock market development and macroeconomic stability - inflation and private capital flows. The results also show that Institutional quality represented by law and order and bureaucratic quality, democratic accountability and corruption index are important determinants of stock market development because they enhance the viability of external finance. They concluded that there is a relationship between stock market developments and stock market liquidity, institutional quality, income per capita, domestic savings and bank development.

Methodology

This study used the ex post Facto Research Design. This is because the study attempts to explore the cause nature that affects relationships, where causes already exist and cannot be manipulated. The choice of model for this research is the Ordinary Least Squares because it provides satisfactory results for estimates of structural parameters. This method involves decision on whether the parameters are statistically significant and theoretically meaningful. It also verifies the validity of estimates and whether they actually represent economic theory. However, due to conventional reasons, we used E-view statistical package in the analysis for a reliable result. The researcher used only the secondary source of data due to the nature of information. The data were generated from the publications by from CBN statistical bulletin of various years, and stock exchange fact-book. In an attempt to examine the impact of exchange rate on profitability of manufacturing firms in Nigeria (1990-2017); the research adopted multiple regression analysis in order to test the three objectives. Thus

SP = f (PR, LIQR, INTR, EXR) 45

SP = $\alpha_0 + \alpha_1 PR + \alpha_2 LIQR + \alpha_3 INTR + \alpha_4 EXR + \mu$ 46

Where:

SP = Stock Prices

PR = price risk proxy by volatility of real inflation

LIQR = liquidity risk proxy by volatility of money supply

INTR = interest rate risk proxy by volatility of real interest rate

EXR = exchange rate risk proxy by volatility of naira exchange rate per US dollar

μ = Error Term

Therefore, a priori expectation ($\alpha_{1>}\alpha_{2>}\alpha_{3,>}\ \alpha_{4,}$>0) 47

Stationarity (Unit Root) Tests

The study investigates the stationarity properties of the time series data using the Augmented Dickey Fuller (ADF) test. According to Nelson and Plosser (1982), Chowdhury (1994) there exist a unit root in most macroeconomic time series. Non stationary time series will have a time varying mean or a time- varying variance or both. If a time series is non stationary, we can study its behaviour only for the time period under consideration, and cannot generalize it to other time periods, and hence remain of little practical value if we intend to forecast (Gujarati, 2003). It should be noted that a time series is a set of observations on the values that a variable takes at different times (daily, weekly, monthly, quarterly, annually, etc). Stationary test therefore checks for the stationarity of the variables used in the models. If stationary at level, then it is integrated of order zero which is 1(0). Thus, test for stationarity is also called test for integration. It is also called unit root test. Stationarity denotes the non existence of unit root.

$$\Delta y_t = \beta_1 + \beta_2 + \delta y_{t-1} + \alpha i \sum_{i-1}^{m} \Delta y_{t-1} + Et \qquad 48$$

Where:

Δy_t = change time t

Δy_{t-1} = the lagged value of the dependent variables

Σ_t = White noise error term

If in the above δ =0, then we conclude that there is a unit root. Otherwise there is no unit root, meaning that it is stationary. The choice of lag will be determined by Akaike information criteria.

Decision Rule

t-ADF (absolute value) > t-ADF (critical value) : Reject Ho (otherwise accept H1)

Note that each variable will have its own ADF test value. If the variables are stationary at level, then they are integrated of order zero i.e 1(0). Note that the appropriate degree of freedom is used. If the variables are stationary at level, it means that even in the short run they move together. The unit root problem earlier mentioned can be explained using the model:

$Y= Yt\text{-}1 + \mu I$ 49

Where; Yt is the variable in question; μi is stochastic error term. Equation (a) is termed first order regression because we regress the value Y at time "t" on its value at time (t- 1). If the coefficient of Yt-i is equal to 1, then we have a unit root problem (non stationary situation). This means that if the regression.

$Y= Yt\text{-}1 + \mu I$ 50

Where Y and I are found to be equal to 1 then the variable Yt has a unit root (random work in time series econometrics).

If a time series has a unit root, the first difference of such time series are usually stationary. Therefore to salve the problem, take the first difference of the time series. The first difference operation is shown in the following model:

$\Delta Y=(L\text{-}1)Yt\text{-}1\mu I$ 51

$\delta Yt\text{-}1 + \mu I$ 52

(Note: δ =1-1= 0; where L =1; $\Delta Yt = Yt - Yt\text{-}i$) 53

Integrated Of Order 1 or I (I)

Given that the original (random walk) series is differenced once and the differenced series becomes stationary, then the original series is said to be integrated of order I or I (1).

Integrated of Order 2 or I (2)

Given that the original series is differenced twice before it becomes stationary (the first difference of the first difference), then the original series is integrated of order 2 or 1(2).

Therefore, given a time series has to be differenced Q times before becoming stationary it said to be integrated of order Q or I (q). Hence, non stationary time series are those that are integrated of order 1 or greater.

The null hypothesis for the unit root is: Ho: a = 1;

The alternative hypothesis is Hi: a < 1.

We shall test the stationarity of our data using the ADF test.

Co-integration Test (The Johansen Test)

It has already been warned that the regression of a non stationary time series on another non stationary time series may lead to a spurious regression. The important contribution of the concept of unit root and co-integration is to find out if the regression residual are stationary. Thus, a test for co-integration enables us to avoid spurious regression situation. If the residuals from the regression are 1(1) or 2(2), i.e. stationary, then variables are said to be co-integrated and hence interrelated with each other in the long run. This approach is based on conducting unit root test on residual obtained from the estimated regression equation. If the residual is found to be stationary at level, we conclude that the variables are co-integrated and as such as long-run relationship exists among them.

$$TA_t = w_O + \sum_{i=1}^{i} \vartheta_t TA_{t-i} + \sum_{i=1}^{j} \varpi_i TA_{jt-i} + \mu_{1t} \quad 54$$

Granger Causality Test

One of the objectives of this study is to investigate the causality between the independent and the dependent variables. Granger causality test according Granger (1969) is used to examine direction of causality between two variables. Causality means the impact of one variable on another, in other-words; causality is when an independent variable causes changes in a dependent variable. The rationale for conducting this test is that it enables the researcher to know whether the independent variables can actually cause the variations in the dependent variable. Thus, Granger causality test helps in adequate specification of model. In Granger causality test, the null hypothesis is: no causality between two variables. The null hypotheses is rejected if the probability of F* statistic given in the Granger causality result is less than 0.05.

The pair-wise granger causality test is mathematically expressed as:

$$Y_t \pi_o + \sum_{i=1}^{n} x_1^{\,y} \; Y_{t-1} \sum_{i=1}^{n} \pi_1^{\,x} \, x_{t-1} + u_1 \quad 55$$

and

$$\mathrm{x_t dp_o} + \sum_{\mathrm{i=1}}^{\mathrm{n}} \mathrm{dp_1^y \; Yt - 1} \sum_{\mathrm{i=1}}^{\mathrm{n}} \mathrm{dp1^x x_{y-1} + V_1} \quad 56$$

Where xt and yt are the variables to be tested white ut and vt are the white noise disturbance terms. The null hypothesis $\pi_1^y = dp_1^y = 0$, for all I's is tested against the alternative hypothesis $\pi_1^x \neq 0$ and $dp_1^y \neq 0.$ if the co-efficient of π_1^x are statistically significant but that of $dp1y$ are not, then x causes y. If the reverse is true then y causes x. however, where both co-efficient of π_1^x and dp_1^y are significant then causality is bi – directional.

Vector Error Correction (VEC) Technique

The presence of co-integrating relationship forms the basis of the use of Vector Error Correction Model. E-views econometric software used for data analysis, implement vector Auto-regression (VAR) - based co-integration tests using the methodology developed by Johansen (1991, 1995). The non-standard critical values are taken from Osterward Lenun (1992).

RESULTS AND DISCUSSION OF FINDINGS

Table i: Presentation of Level Series Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PR	3.143241	0.360824	2.396983	0.0054
LIQR	0.673035	0.590774	1.139242	0.0074
INTR	-1.829224	1.626006	-1.124980	0.2733
EXR	-1.649833	1.549582	-1.064696	0.2991
C	51.64218	34.57035	1.493829	0.1501
R-squared	0.786098	Durbin-Watson stat		2.365587
Adjusted R-squared	0.545763	Prob(F-statistic)		0.024421
F-statistic	3.993920			

Table ii: Diagnostic Test

	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
PR	0.130194	1.017090	1.012920
LIQR	0.349014	1.527845	1.115794
INTR	2.643896	1.069012	1.044450
EXR	2.401204	1.876702	1.145503
C	1195.109	2.453434	NA

Table iii: Test of Unit Root

SP		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.352753	0.0002
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

PR		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.890783	0.0001
Test critical values:	1% level	-3.737853	

	5% level	-2.991878	
	10% level	-2.635542	

LIQR		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.618607	0.0011
Test critical values:	1% level	-3.711457	
	5% level	-2.981038	
	10% level	-2.629906	

INTR		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.354402	0.0000
Test critical values:	1% level	-3.752946	
	5% level	-2.998064	
	10% level	-2.638752	

EXR		t-Statistic	Prob*
Augmented Dickey-Fuller test statistic		-5.698327	0.0001
Test critical values:	1% level	-3.724070	
	5% level	-2.986225	
	10% level	-2.632604	

Table iv: Cointegration Test

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.801051	91.90307	69.81889	0.0003
At most 1 *	0.636167	56.37951	47.85613	0.0065
At most 2 *	0.562561	34.13619	29.79707	0.0149
At most 3 *	0.449156	15.94619	15.49471	0.0427
At most 4	0.120607	2.827520	3.841466	0.0927

Table v: Normalized Cointgration Test

SR	PR	LIQR	INTR	EXR
1.000000	-23.33280	83.09287	-112.8707	69.60283
	(7.29967)	(13.4946)	(26.0309)	(21.3629)

Table vi: Error Correction Model

Error Correction:	D(SR)	D(PR)	D(LIQR)	D(INTR)
CointEq1	-0.173825	-0.295014	0.062647	0.017755
	(0.29462)	(0.07001)	(0.06632)	(0.03444)
	[-0.59000]	[-4.21361]	[0.94463]	[0.51547]
C	-1.097063	5.909431	0.655582	0.372893
	(31.7356)	(7.54180)	(7.14369)	(3.71020)
	[-0.03457]	[0.78356]	[0.09177]	[0.10050]
R-squared	0.707868	0.943769	0.754404	0.690037
Adj. R-squared	0.415736	0.887539	0.508807	0.380075
Sum sq. resids	192439.3	10867.99	9750.913	2630.227
S.E. equation	138.7225	32.96663	31.22645	16.21798
F-statistic	2.423110	16.78393	3.071722	2.226195
Log likelihood	-125.5894	-95.41278	-94.27394	-80.51589
Akaike AIC	13.00851	10.13455	10.02609	8.715799
Schwarz SC	13.55564	10.68168	10.57322	9.262930
Mean dependent	-0.854762	3.900476	-3.780952	0.021429
S.D. dependent	181.4857	98.30452	44.55503	20.59809
Determinant resid covariance (dof adj.)		1.24E+12		
Determinant resid covariance		6.39E+10		
Log likelihood		-380.4368		
Akaike information criterion		41.18445		
Schwarz criterion		43.77089		

Table vii: **Estimated Error Correction Model**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-21.91316	28.11665	-0.779366	0.4558

D(SP(-1))	-0.707197	0.372778	-1.897099	0.0903
D(PP(-1))	-0.487469	0.428622	-1.137295	0.2848
D(PP(-2))	-0.771063	0.450238	-1.712567	0.1209
D(PP(-3))	-0.762335	0.425431	-1.791909	0.1067
D(LIQR(-1))	-1.732736	1.024718	-1.690939	0.1251
D(LIQR(-2))	-2.767740	1.051625	-2.631871	0.0273
D(LIQR(-3))	-0.633063	0.635972	-0.995426	0.3455
D(INTR)	-2.412426	1.761922	-1.369202	0.2041
D(EXR)	1.044424	4.496768	0.232261	0.8215
ECM(-1)	-0.410690	0.393671	-1.043230	0.3241
R-squared	0.816098	Mean dependent var		0.848000
Adjusted R-squared	0.611763	S.D. dependent var		186.0282
S.E. of regression	115.9117	Akaike info criterion		12.64503
Sum squared resid	120919.6	Schwarz criterion		13.19268
Log likelihood	-115.4503	Hannan-Quinn criter.		12.75193
F-statistic	3.993920	Durbin-Watson stat		2.365587
Prob(F-statistic)	0.024421			

Table viii: Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
PR does not Granger Cause SP	22	1.61549	0.2279
SP does not Granger Cause PR		0.48833	0.6220
LIQR does not Granger Cause SP	25	2.99209	0.0430
SP does not Granger Cause LIQR		0.37445	0.6924
INTR does not Granger Cause SP	25	1.02109	0.3782
SP does not Granger Cause INTR		0.91251	0.4176
EXR does not Granger Cause SP	25	0.35297	0.7069
SP does not Granger Cause EXR		1.52981	0.2409

Source: extract from E-view 9.0

Analysis and Discussion of Findings

From table i, the value of the intercept which is 51.64218 shows that stock prices of quoted firms in Nigeria will experience 51.64218 unit increases when all other variables are held constant. The coefficient of price risk is 0.143241. This shows that price risk is positively related to stock prices of quoted firms in Nigeria that a unit increases in price risk is followed by an increase in stock prices in Nigeria. The coefficient of liquidity risk is -0.673035. This shows that liquidity risk is positively related to stock prices of quoted firms in Nigeria, that a unit increase in liquidity risk is followed by an increase in stock prices traded on the floor of Nigeria stock exchange.

Furthermore, the value of interest rate risk shows a negative relationship with stock prices of quoted firms in Nigeria with a value of -1.829224 this implies a unit increase in stock prices in Nigeria is been followed by an increase in interest rate risk in Nigeria. The OLS result indicates that price fluctuation has a positive relationship with stock prices again the p-value shows that the coefficient is statistical significant. Therefore, we reject the null hypothesis and conclude that price fluctuation has significant impact on stock prices in Nigeria within the year under-review. The coefficient of exchange rate risk shows that exchange has negative and insignificant effect on stock prices within the period covered in the study. The probability value is greater than the critical level of 0.05 at 5% level of significant, we accept null hypothesis that exchange rate risk have no significant effect on stock prices.

f- test: If the f-calculated is greater than the f-tabulated (f-cal > f-tab) reject the null hypothesis (H0) that the overall estimate is not significant and conclude that he overall estimate is statistically significant. From the result, f-calculated (3.993920) is greater than the f-tabulated (1.94), that is, f-cal > f-tab. Hence we reject the null hypothesis (H0) that the overall estimate has a good fit which implies that our independent variables are simultaneously significant.

Goodness of Fit Test (R^2): The (R^2) shows the amount of the variation in the dependent variables (stock price) that are explainable by the explanatory variable. The (R^2) which measures the overall goodness of fit of the entire regression shows the value of 0.786098= 78.6% approximately 80%. This indicates that the independent variables accounts for about 80% of the variation in the dependent variable.

Durbin Watson Statistics: The computed DW is 2.365587, at 5% level of significance with three explanatory variables and observations, the tabulated DW for dI and du are 1.16 and 1.64 respectively. The value of DW is greater than the lower limit. Therefore, we conclude the there is evidence of positive first order serial correlation.

The Augmented Dickey-Fuller (ADF) was employed to test for the existence of unit roots in the data using trend and intercept. The test results were presented in table ii. The result shows that none of the variables; was stationary at levels using Augmented Dicey Fuller test. This is because their critical values were greater than ADF test statistics in absolute value at 5 percent level of significance. However, all the variables considered became stationary after first difference since their ADF test statistics were greater than their critical values in absolute value. The results show that the series are integrated of the same order; I (1) with the application of both ADF test. Therefore, the variables are fit to be used for the analytical purpose for which they were gathered

Johansen co-integration test determines whether there exist long-term relationship occurs in variables or not. The test envisages that there can be just one relationship between variables in long term. In most cases, it two variables that are I (1) are linearly combined, the combination will also be I(1). More generally, if variables with differing orders of integration are combined, then the combination will have an order of integration equal to the largest. The model with lag 1 was chosen with the linear deterministic test assumption and the result is presented in table iii.

Under the Johansen Co-integration test, Co-integration is said to exist if the values of computed Eigen values are significantly different from zero or if the trace statistics is greater than the critical value at 5 percent level of significance, the results of the co-integration in table iii above indicated 3 cointegrating equation, the critical value at 5 percent level of significance in only of the hypothesized equations. Similarly, the computed Eigen value is significantly different from zero in one of the hypothesized equations. Hence, 3 of the hypothesized equations satisfy this condition and therefore the null hypothesis of 3 co-integration equations among the variables is accepted in at least all equation. Therefore there is long run relationship between the variables used for the analysis in Nigeria within the period under study 1990-2017.

Normalized cointegration test presented in table IV found that price risk and interest rate risk have negative long run effect on stock price while liquidity risk and exchange rate risk have positive run effect on stock prices traded on Nigeria stock exchange. Table v and table vi presented the error correction model of the variables. Evidence from the result shows the large explained variation (table iv) while the coefficient of error correction model prove that adjustment speed of 41 percent. The causality results prove that the variables have no causal relationship except bi-directional relationship from liquidity to stock prices. The positive findings of the study confirm the findings of Izova, Bollerslev, Osterrieder, Tauchen (2011) that the relationship between volatility and the volatility-risk reward is strongly direct and positive. The findings of Pollet, Kräussl, Jegadeesh (2010) that the market expects for PE to earn abnormal return is approximately 0.5 percent and for LPEs is approximately close zero after fees and the findings of Aduda *et al. (*2012) that macro-economic factors such as stock market liquidity, institutional quality, income per capita, domestic savings and bank development are important determinants of stock market development in the Nairobi Stock Exchange.

CONCLUSION AND RECOMMENDATIONS

This paper applied multiple regression analysis to study the effects of systematic risk on stock prices in Nigeria. The analysis covered firms listed in the NSE from 1990 to 2017. By means of multiple regressions analysis of stock price to sensitivity of the price changes, liquidity changes, interest rate and exchange risk. From the findings of the study, we conclude that price risk and liquidity risk have positive effect on stock prices while interest rate risk and exchange rate risk have negative effect in stock prices. From the regression summary, we conclude that systemic risk significantly affects stock prices in Nigeria. We make the following recommendations:

1. The management of the capital market should ensure that the operating environment is risk minimum to ensure appreciable stock prices by developing strategies and policies aim at managing the systematic risk in the operating environment and engage a regular environmental impact assessment on systemic risk, to avert its negative effect on stock prices.
2. Liquidity risk can be properly managed by formulating optimal liquidity strategy, therefore the study recommends the need for management to ensure optimum liquidity that balance cash inflow and cash outflow and policies should be formulated to manage the systematic risk within the operating environment to enhance good stable stock price.
3. Exchange rate risk can be managed by formulating policies that will leverage the firms the challenges of depreciating Naira exchange rate. Therefore the study recommend that the macroeconomic factors that results in depreciating Naira exchange rate should be well managed and financial policies should be formulated by the regulators of the Nigerian capital market to manage equity price risk of the manufacturing firms.

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