AN EMPIRICAL ANALYSIS OF STOCHASTIC DOMINANCE
AND PORTFOLIO SELECTION IN THE STOCK MARKET:
EVIDENCE FROM NIGERIA

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Abstract

This study carried out an empirical test of stochastic dominance application on portfolio selection in the Nigerian stock market. December daily stock price of ten (10) listed insurance firms in the period 2014 to 2020 were selected and tested for stochastic dominance occurrence. The findings indicate that the selection of firm stock followed the Markowitz mean-variance and risk preference behavior of investors in the stock market. It also shows that two (2) firm stocks were first order stochastically dominant (FSD), four (4) stocks of firms were second order stochastically dominant while nine (9) stocks were third order stochastically dominant (TSD) in the period after the stock market meltdown in Nigeria. The study recommends that future researchers should empirically investigate portfolio dominance on a sector by sector basis. This will guide potential investors at selecting securities on the basis of mean-variance and utility function.

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Introduction

The application of stochastic dominance in portfolio selection cannot be overemphasized. Stochastic dominance is applicable in a decision under uncertainty
and in the choices of random variables with payoffs. Random variables are subject to variation in outcomes (payoffs). A rational agent such as a risk averse investor with an expected utility (gain), will prefer to select a random variable if it yields the expected satisfaction (maximized utility or gain) as against another random variable with negative expected utility (loss) within a utility function. Wolfstetter (1996) states that it is hard to find an agent utility function with a similar random variable outcome. One possible way to resolve this is to estimate if a random variable is a dominant, since it is often a choice preferred by all rational agents whose utility function shares general and common characteristics in portfolio selection.

In the choice and selection of portfolio, four sets of stochastic dominances are applicable. These are the first, second, third and higher than third order stochastic dominances. These sets of stochastic dominances in random variables choice and selection assist to indicate when and if one random variable ranks higher than the other through specifying a condition which the difference between their distributions function must satisfy. Wolfstetter (1996), avers that first order stochastic dominance is stochastically larger than the second order stochastic dominance. Conventionally, first order stochastic dominance (is) less volatile given that its utility function belongs to a defined asset class with incontrovertible particularity.

Stochastic dominance appears closely connected with the mean-variance approach developed by Harry Markowitz in 1952. Previously, economics and finance scholars have often thought that the mean-variance approach is the best way to measure risks in a comparative manner. In the passage of time, the mean-variance approach to risk analysis became less sophisticated. For instance, mean-variance probability serves the purpose of risk assessment if all probability distributions are normal distributions (Kinnunen, 2018). This presupposes that utility function often tends to get to a maximum to permit a rational agent’s asset (portfolio) selection. It is suggestive that the absolute level of risk aversion increases in relation with an increase in wealth and it eventually gets to infinity as utility reaches its peak.

In the view of Osamwonyi (2012), stochastic dominance is a preferred alternative to mean-variance approach in risk pricing and asset selection, and it is commonly used in decision towards comparing and ranking two stochastic distributions. Constructing stochastically dominating stock/portfolios is necessary, since a stochastically dominating portfolio naturally suggests higher returns without higher risk, lower risk without lower returns, or both higher returns and lower risk simultaneously (Kinnunen, 2018). In other words, a data set is always stochastically dominant over another in relation to the value of the outcomes (Wikipedia, 2018). For example, when comparing the relative value of two investment securities, say security A and security B, the one whose possible rate of return is more than the other asset at any level is presumed to be
stochastically dominant (Kinnunen, 2018).

In the selection of financial assets on the basis of which one is stochastically dominant over the other, some assumptions and definitions are held constant. Contextually, to understand these assumptions, it is necessary to denote random variables alphabetically such as A and B. In this case, all the random variables are assumed to have uniform outcomes denoted as: $I = [x, x]$, $-\infty < x < + \infty$. From the foregoing, it therefore implies that all the expected value distribution are assumed to be finite. Given the expected value distribution, the rational decision maker has a preference ordering regarding all possible outcomes denoted by the Von Neumann-Morgenstern utility function as: $I = [x, x]$, $-\infty < x < + \infty$. The Von Neumann-Morgenstern utility function principally emphasizes two aspects, which is monotonicity, connoting more is better than less and concavity, suggesting risk aversion. The value $U_1$ denotes monotone increasing and concave by $U_2$. Therefore, $U = U_1$ if and only if the argument of $U$ is taken as good and $U = U_2$ if the decision maker is equally risk averse. The dominance of a random variable over another is premised on its outcome which is premised on the rational investors’ preference and utility satisfaction. The preference of investors over a random variable outcome is hinged on their attitude to risk. The common investors’ attitudes to risk include risk aversion, risk neutral and risk seeking. Investors are in a three brackets of risks with respect to gains/loss. Investors could be risk seeking over gain or risk averse over loss and risk indifferent.

Financial assets such as security A, for example may stochastically dominate security B if it has a lower risk and higher gain. Similarly, security B is said to stochastically dominate security A if it has higher risk and higher gain. The choice of either of these two assets is dependent on the utility preference of the investor under uncertainty. However, Lean, Wong and Wing-Sweung (2016) emphasized that investors’ risk choices may hold if returns are in the positive or negative domain of an empirical return distribution. In accentuation to this, Starmer (2002) earlier posited that stochastic dominance are meaningful for a range of non-expected utility theory of choice under unlikelihood. This is however canonical with the prospect theory of Kahnemann and Tversky (1979) and the experimental work of Thaler and Johnson (1990) in behavioural finance. According to Fong et al. (2004), the essential concerns of prospect theory are that persons assess gains and losses in relation to a reference point. This was later refuted in that prospect theory has little to say about the dynamics of choice under risk; that is, how people make decisions after a sequence of gambles. Thaler and Johnson (1990) in an experimental research work, stressed that people are risk averse over gains as well as risk seeking over losses.

While several studies such as Davidson and Duclos (2000); Fong, Lean and Wong (2004); Chan, Deperetti, Qiao and Wong (2012); Lean, Wong and Wing-Keung
(2016); Qiao, Wong and Clark (2016) and Kinnunen (2018) have been carried out in developed countries over the application of stochastic dominance in financial assets (portfolio) selection in the financial market, the same cannot be said of developing countries. These observed gaps, the specific objective of this study is to apply the stochastic dominance technique in portfolio selection in the Nigerian stock market. Apart from the introductory part, section two concerns the review of related literature while section three dwells on conclusion and recommendations.

**Literature Review**

**Conceptual Review**

Wolfstetter (1996) opines that stochastic dominance is an age-long issue whether one sees a random variable as more risky in relation to the other; irrespective of who selects it, provided such utility function is within the ambit of asset class with similar characteristics. Stochastic dominance allows agents such as investors in the stock market to make the preference of an expected utility between different probability distributions over possible outcomes under uncertainty. Osamwonyi (2012) avers that the application of stochastic dominance makes no clear proposition concerning the probability distribution of returns or the specific form of the utility function.

Lean et al. (2016) noted that testing for stochastic dominance permits researchers to simultaneously recognize the assets preferred by risk averters and risk seekers in both positive and negative return in a behavioural manner. It further enables the drawing of preferences for risk averters, risk seekers, prospect investors and Markowitz investors (Lean et al. 2016). Stochastic dominance is used in identifying conditions under which one risky outcome (for example, stock return) can be preferred to another risky asset (for example, bond return) (Osamwonyi, 2012).

**First Degree Stochastic Dominance**

The most common types of stochastic dominance literature are first, second, third and higher order stochastic dominances (Fong et al. 2004). First order stochastic dominance is the most intuitive of the three criteria since it only assumes non-satiation (Fong et al. 2004). For instance, Let F and G be the cumulative distributions of two risky assets like shares and bonds, x be the uncertain return and U be a utility function (Kinnunen, 2018). Suppose all investors are non-satiated i.e. \( U'(x) \), then, all such investors will agree that security F is preferred to security G if \( F(x) \geq G(x) \) for all \( x \) random variables; thus, security F is said to dominate security G because the probability that returns \( x \) will be realized is always higher for security G than for security F (Kinnunen, 2018).
First-degree stochastic dominance (FSD) is a form of stochastic ordering. First order stochastic dominance is always a stochastically larger association, implying more is preferred to less by rational agents in decision making (Kinnunen, 2018). A random variable A is said to be first stochastically dominate (FSD) a random variable B, expressed as $A \geq_{FSD} B$ if $\Pr\{A > z\} \geq \Pr\{B > z\}$ for all $z$ returns; or is equivalent if $A(z) \geq B(z)$ for all $z$ returns. Equivalently, where $A(z) := 1 - A(F(z)$ and $B(z) := 1 - G(z))$. This equivalent equation makes it implicit that the dominant random variable is stochastically larger, thus expressing the degree of first order stochastic dominance. It further connotes that security B cannot first stochastically dominate security A if its expected value is lower. Tentatively, it means a random variable A is preferred to random variable B by all rational agents with monotone increasing utility function (satisfaction) if and only if $A \geq_{FSD} B$. However, the utility preference ranking is considered to be reversed if it is in a decreasing distribution order (Kinnunen, 2018).

**Second Order Stochastic Dominance**

This is concerned with stochastically more risky relationship and a preference order commonly embraced by all rational agents who prefer more to less and are risk averse (Kinnunen, 2018). A random variable X is said to second order stochastically dominate (SSD) another random variable Y, expressed as $X \geq_{SSD} Y$, if $\int \Pr\{X > x\} dx \geq \int \Pr\{Y > y\} dy$ for all k variables (Kinnunen, 2018). With further expression, this is equivalent to $\int F(x) dx \geq \int G(y) dy$ for all k variables. This presupposes that the prerequisite for second order stochastic dominance is first order stochastic dominance.

**Third Order Stochastic Dominance**

This order of stochastic dominance adds to risk aversion, the assumption of skewness preference (Kinnunen, 2018). Security F is said to dominate security G at the third order for all risk averse investors with $U''(x) = 0$ and $U'''(x) = 0$ if and only if security $F > G$ and $m > 0$ where $m$ denotes expected return. So, investors who prefer positive skewness will assign larger weight to upside potential and will hold a less diversified portfolio with large upside potential. Empirical evidence indicates that investors prefer more positively skewed returns distributions (e.g. Friend & Westerfield; 1980; Harvey & Siddique, 2000).

**Theoretical Framework**

This study is anchored on stochastic dominance theory of risk averters and risk seekers. It was Hadar and Russell (1969), Hanoch and Levy (1969), Rothschild and Stiglitz (1970, 1971) and Whitmore (1970) who laid the utility foundations of stochastic dominance analysis (Fong et al. 2004). According to Fong et al. (2004), stochastic
dominance theory opens up a general framework for ranking risky prospects which relies on utility theory. Stochastic dominance theory is connected with the prospect theory of Kahnemann and Tversky (1979) in psychological finance. In prospect theory, investors are risk seeking over gains and risk averse over losses (Fong, et al. 2004). Stochastic dominance theory holds the view that rational agents can maximize expected utility except if and only if the utility functions have peculiar characteristics (e.g. high risk for higher gain and lower risk for lower gain). Stochastic dominance theory is appealing because it requires little proposition concerning returns distribution and preferences. For instance, returns may demonstrate time series dependence and matches with any distribution pattern (Fong et al. 2004).

Relevance of Stochastic Dominance

Stochastic dominance in terms of relevance, helps to know the shape of investors’ utility functions based on preference rankings of securities (Lean et al. 2016). Osamwonyi (2012) emphasized that stochastic dominance is relevant in optimal portfolio selection and capital budgeting problems, where a number of alternatives is pre-specified and finite. It is used for problems where economic theory fails to present strong forecast concerning decision-maker preference and distribution of the choice alternatives (Osamwonyi, 2012). The author notes that stochastic dominance is relevant where large, high-quality data sets are available to limit the sampling error and enable application of non-parametric tools. Similarly, where the distribution of portfolio returns is unknown, stochastic dominance becomes a readily verifiable tool.

Challenges Associated with Stochastic Dominance Application

Stochastic dominance has two sides of a coin, the useful side in terms of portfolio selection and its reverse side which concerns the peculiar challenges in using it given the underlying assumptions. First, non-discrimination-low crossing is a major issue connected with stochastic dominance in applying empirical data (Osamwonyi, 2012). In the view of Osamwonyi (2012), first degree stochastic dominance, for instance, requires the dominant distribution to always have an expected minimum than the dominated distribution; and where this distribution indicates a large improvement under all the observations, except the lowest one, stochastic dominance will fail to hold in any form. Most of the time, simple crossing algorithms are employed to assess it in a pairwise method. Where these algorithms could fail to deal with cases involving infinity of asset preference by a rational investor. Post (2003), however, posits that there is a challenge associated with the determination of the level of investor risk-averseness directly with the stochastic dominance technique.
Classical Assumptions in Stochastic Dominance Application

Risk averseness of an investor is assumed within the stochastic dominance framework. In other words, stochastic dominance holds the proposition that individual investors always fall into the class of risk averter and may include continuously risk-averse individuals. Stochastic dominance holds the assumption that an individual can possess a risk aversion parameter that is so large that the utility of the small variation at the lowest observation is extraordinarily important (Osamwonyi, 2012). However, overcoming the peculiar teething issue associated with stochastic dominance assumptions require placing bounds on the risk aversion parameter through constraining numerical designs (Osamwonyi, 2012).

Empirical Review

Fong, et al. (2004) investigated stochastic dominance and behavior towards risk with respect to the market for internet stocks during the period 1988 to 2000. They used the stochastic dominance test developed by Davidson and Duclous (2000) to identify dominant types of risk preference in the internet bull and bear markets. According to the authors, the choice of DD test was predicated on the fact (that) unlike most traditional stochastic dominance tests, the DD test takes the viewpoint of risk averse decision makers. The study leaned on the utility theory of gambling and behavioural finance. The findings of the research show that first, risk averters and risk seekers have unique differences concerning preference for internet versus “old economy” stocks. They apportioned the difference in preference for internet stocks over “old economy” stocks to the bull market period where internet stocks were observed to stochastically dominate old economy stocks for risk seekers but not for risk averters. The result further indicates that in the bear market, risk averters demonstrated an increased preference for old economy stocks, while risk takers showed a decreased choice for internet stocks. The authors concluded that the results are contrary with prospect theory which often points to the fact that investors tend to demonstrate reverse S-shaped utility functions. From the research outcome of Kundu (2010), internet stocks are stocks investors purchased through online trading in a technologically driven stock market environment.

Due to the information technology evolvement, the on-line approach has helped individual investors to have better control on their stock investments (Looney and Chatterjee, 2002). With the proliferation of the internet, more banks and stock brokerage firms are offering on-line stock trading and financial services for investors for a gain. Through that, investors can now gain access to various kinds of information on financial planning such as real-time stock prices and portfolio management (Wong, 2000). However, internet stock is different from non-internet stock. Non-internet stocks are stocks which are traded without the influence of technology. While internet stocks
are common to the old economy, non-internet stocks are found in the new economy. Old economy refers to old ways of trading of stocks. It mainly relies on traditional methods of doing business and trading in stocks rather than leveraging new cutting-edge technology as common to the new economy which favours the use of technology in the trading of stocks.

Lean, Wong and Wing-Keung (2016) applied stochastic dominance (SD) to test the dominance relationships between the futures and spot markets in Hong Kong. They also assess the choices for the risk averters, risk seekers, prospect investors and Markowitz investors (mean-variance investors) within the spot and futures markets. The study finding indicates that for the risk averters, spot dominates futures while for the risk seekers, futures dominate spot. This is clearly suggestive that the risk averters like to purchase indexed stocks, while risk lovers are attracted to long index futures because of the intention to maximize their expected utilities, but not necessary their wealth. They concluded that the prospect investors go for spot in the positive domain and prefer futures in the negative domain while the Markowitz investors like spot in the negative domain and prefer futures in the positive domain as well.

Chan, et al. (2012) used stochastic dominance and likelihood ratio tests to investigate the efficiency of the UK covered warrants market. The finding indicates there exists no dominance between covered warrants and the underlying shares. Qiao et al. (2016) apply stochastic dominance tests to examine investors’ preferences with respect to the Taiwan stock index and its corresponding index futures. They found that spot prices dominate futures for risk averters, whereas futures dominate spot for risk seekers. Lean, Wong and Zhang (2015) research reveals that risk-averse investors prefer the spot index, whereas risk seekers are attracted to the futures index to maximize expected utility, though not their expected wealth for the entire period or for the sub-period before the 2008 global financial crisis.

Kinnunen (2018) undertook a study measuring the performance of a stochastic dominance-based portfolio selection model in Nordic stock market using eight years of daily return data of OMX Nordic 40 index and its constituents. The portfolio selection model was used in a stochastic dominance-based model developed by Kopa and Post (2015). The empirical finding shows that returns are higher with lower risk for the optimized portfolios compared to the index.

Methodology

This study uses the descriptive research design. The study population consist of the listed insurance firms in the Nigerian insurance sector as at 31st December, 2020. There are a total number of fifty-three (53) listed insurance firms in the Nigerian insurance
sector (NSE Fact book report, 2020). A sample size of 10 listed insurance firm were selected using the simple random sampling technique. The average of the daily share price of December 2014 to December, 2020 of each of the listed insurance firms was used in the data analysis. The stock return was calculated for 10 firm stock price with the formula:

\[ r_i = \frac{p_{ti} - p_{t+1}}{p_{t-1}}; \text{ } t = 1,2,\ldots10; \text{ } i = \text{ for individual firm, } t= \text{ is the period.} \]

The periods were chosen in order to determine how the listed insurance firms were stochastically dominant in terms of share price returns and variance after the global stock market meltdown of 2007/2008. The selected listed insurance firms were Niger insurance PLC, NEM insurance PLC, OASIS insurance PLC, Guinea insurance PLC, Crusader insurance PLC, Cornerstone insurance PLC, UNIC insurance PLC, Universal insurance PLC and LASACO insurance PLC. First order stochastic dominance (FSD), second order stochastic dominance (SSD) and third order stochastic dominance (TSD) were employed to estimate dominance of the securities using descriptive statistics of mean-risk and skewness parameters respectively through application of E-views 8.0 version.

**Stochastic Dominance Modelling**

\[ A \leq FSD^B \text{ IF } Pr\{A < z\} \leq Pr\{B < z\} \text{ for all } z \text{ returns} \]

\[ X \geq SSD^Y, if \int Pr\{X > x\}dx \geq \int Pr\{Y > y\}dy \text{ for all } k \text{ variables} \]

\[ U'(x) < 0, U^n(x) = 0 \text{ and } U^m(x) = 0 \text{ if and only if security } F > G \text{ and } m > 0 \]

Equation (1) presupposes that no rational agent (investor) will prefer a random variable A with lower returns and higher risk to random variable B of higher returns with lower risk in a utility function (Elton & Gruber, 2002). In checking for dominance of the firm stock over another, the Markowitz mean-variance process was followed. For the first order stochastic dominance to apply, stock A is said to FSD over stock B if its mean (expected return) is > the mean (expected value) of stock B. For the second order stochastic dominance, stock A is said to SSD over stock B if the standard deviation (risk) of stock A is < standard deviation (risk) of stock B. Applying the third order stochastic dominance, stock B is TSD if it has a positive skewness and mean >0; conversely, stock B is not TSD if it has a negative skewness and the mean is <0 (Harvey & Siddique, 2000).
Empirical Analysis

This section of the study concerns the application of the stated method for portfolio selection in the stock market. The selection of the portfolio is premised on the Markowitz and then followed by first order stochastic dominance, second order stochastic dominance and third order stochastic dominance approaches respectively using the criteria stated in the methodology segment of the study.

| S/N | Company                        | Mean | Standard Deviation | Risk Preference Behaviour |
|-----|--------------------------------|------|--------------------|---------------------------|
| 1.  | Niger Insurance PLC            | 9.39 | 4.72               | Risk seeking              |
| 2.  | NEM Insurance PLC              | 11.32| 10.73              | Risk seeking              |
| 3.  | OASIS Insurance PLC            | 6.31 | 4.51               | Risk seeking              |
| 4.  | Great Nigeria Insurance PLC    | 9.79 | 6.05               | Risk seeking              |
| 5.  | Guinea Insurance PLC           | 14.93| 13.70              | Risk averse               |
| 6.  | Crusader Insurance PLC         | 29.60| 42.15              | Risk averse               |
| 7.  | Cornerstone Insurance PLC      | 48.62| 23.19              | Risk averse               |
| 8.  | UNIC Insurance PLC             | 23.64| 33.62              | Risk seeking              |
| 9.  | Universal Insurance PLC        | 13.88| 5.54               | Risk Averse               |
| 10. | LASACO Insurance PLC           | 4.33 | 2.65               | Risk Averse               |

Source: Data Collected from the Nigerian Stock Market and Computed with E-view 8.0

Table 1 shows the selection of the security (stocks) using the Markowitz mean-variance criterion. It can be observed that the selection of the portfolio is a function of the risk appetite and preference behavior of different investors in the stock market. Investors who prefer higher risks for higher expected returns would select the securities of Niger Insurance PLC, NEM insurance PLC, OASIS insurance PLC, Great Nigeria insurance PLC and UNIC insurance PLC for inclusion in the portfolio selection. While investors who like higher expected return (mean) for a lower risk will select the stocks of Guinea insurance PLC, Crusader Insurance PLC, Cornerstone Insurance PLC, Universal insurance PLC and LASACO insurance PLC respectively. This selection of the securities enables the investor to maintain efficient frontier curve, promoting portfolio risk diversification in a systematic pattern in the stock market.
In the passage of time, mean and variance approach to risk analysis became less sophisticated in that it fails to indicate condition upon which one financial asset could dominate another (Kinnunen, 2018). Osamwonyi (2012) posits that stochastic dominance is a preferred alternative to mean-variance approach to risk pricing and asset selection, commonly used in decision making to compare and rank two stochastic distributions. Stochastic dominance is the utility preference for one asset over another with minimal knowledge of the decision maker’s utility function (Kinnunen, 2018). Following the drawback associated with Markowitz mean-variance approach to securities selection, the first, second and third order stochastic dominances are applied to select the securities into a basket of portfolio.

The details of each of the 90 pairwise comparisons of the first order stochastic dominance (FSD), second order stochastic dominance (SSD) and third order stochastic dominance (TSD) are indicated in Table 2. Table 2 results shows that among the ten firm stocks, only Crusader insurance PLC and Cornerstone insurance PLC stocks were first order stochastically dominant in the period after the stock market meltdown in Nigeria. The finding affirms the assertion of Meyer, Li and Lawrence (2005) that first order stochastic dominance is empirically hard to observe because of its low discriminating power in making choices compared to higher degrees of stochastic dominance. In table 2, column 2, it can be observed that out of the 10 firms which comprise the 90 pairwise comparison, only four (4) stocks of firms, namely, LASACO insurance Plc, Universal insurance Plc, OASIS insurance Plc and Niger insurance Plc were second order stochastically dominant in the stock market in the period after the stock market meltdown in Nigeria. This is an improvement on the first order stochastic dominant (FSD) strength. In column 3, nine (9), namely, Niger insurance Plc, NEM insurance Plc, Great Nigeria insurance Plc, OASIS insurance Plc, Guinea insurance Plc, Cornerstone insurance Plc, UNIC insurance Plc, Universal insurance Plc and LASACO insurance out of the ten (10) stocks were observed to be third order stochastically dominant (TSD), leaving only one security non-dominating in the period after the stock market meltdown in Nigeria. The overall stochastic dominance results are quite intriguing! While the result explicitly demonstrates the dominating strength of the stocks in stochastic order form, it does not convincingly portray the risk preference attitudinal disposition of investors unlike the Markowitz mean-variance criterion demonstrated in table 1. This overtly is in tandem with the viewpoint of Post (2003) that there is the challenge of determination of the level of investor risk-averseness directly with the stochastic dominance application.
| S/N | Comparison                        | FSD  | SSD  | TSD  |
|-----|-----------------------------------|------|------|------|
| 1.  | Niger Insurance PLC vs. NEM       | Neither | Apply | Apply |
|     | Insurance PLC                     |      |      |      |
| 2.  | OASIS Insurance PLC               | Apply | Neither | Apply |
| 3.  | Great Nigeria Insurance PLC        | Neither | Apply | Apply |
| 4.  | Guinea Insurance PLC              | Neither | Apply | Apply |
| 5.  | Crusader Insurance PLC            | Neither | Apply | Apply |
| 6.  | Cornerstone Insurance PLC          | Neither | Apply | Apply |
| 7.  | UNIC Insurance PLC                | Neither | Apply | Apply |
| 8.  | Universal Insurance PLC           | Neither | Apply | Neither |
| 9.  | LASACO Insurance PLC              | Apply | Neither | Apply |
| 10. | NEM Insurance PLC vs. Niger        | Apply | Neither | Neither |
|     | Insurance PLC                     |      |      |      |
| 11. | OASIS Insurance PLC               | Apply | Neither | Apply |
| 12. | Great Nigeria Insurance PLC        | Apply | Neither | Apply |
| 13. | Guinea Insurance PLC              | Neither | Apply | Apply |
| 14. | Crusader Insurance PLC            | Neither | Apply | Apply |
| 15. | Cornerstone Insurance PLC          | Neither | Apply | Apply |
| 16. | UNIC Insurance PLC                | Neither | Apply | Apply |
| 17. | Universal Insurance PLC           | Neither | Neither | Neither |
| 18. | LASACO Insurance PLC              | Apply | Neither | Apply |
| 19. | OASIS Insurance PLC vs. Niger      | Neither | Apply | Neither |
|     | Insurance PLC                     |      |      |      |
| 20. | NEM Insurance PLC                 | Neither | Apply | Apply |
| 21. | Great Nigeria Insurance PLC        | Neither | Apply | Apply |
| 22. | Guinea Insurance PLC              | Neither | Apply | Apply |
| 23. | Crusader Insurance PLC            | Neither | Apply | Apply |
| 24. | Cornerstone Insurance PLC          | Neither | Apply | Apply |
| 25. | UNIC Insurance PLC                | Neither | Apply | Apply |
| 26. | Universal Insurance PLC           | Neither | Apply | Neither |
| 27. | LASACO Insurance PLC              | Apply | Neither | Apply |
| 28. | Great Nig. Ins. PLC vs. Niger      | Apply | Neither | Neither |
| 29. | NEM Insurance PLC                 | Apply | Apply | Apply |
| 30. | OASIS Insurance PLC               | Apply | Neither | Apply |
|   |   | Guinea Insurance PLC | Neither | Apply | Apply |
|---|---|----------------------|---------|------|------|
| 31 |   | Crusader Insurance PLC | Neither | Apply | Apply |
| 32 |   | Cornerstone Insurance PLC | Neither | Apply | Apply |
| 33 |   | UNIC Insurance PLC | Neither | Apply | Apply |
| 34 |   | Universal Insurance PLC | Neither | Neither | Neither |
| 35 |   | LASACO Insurance PLC | Apply | Neither | Apply |
| 36 |   | Guinea Insurance PLC vs. Niger Insurance PLC | Apply | Neither | Apply |
| 37 |   | NEM Insurance PLC | Apply | Neither | Neither |
| 38 |   | OASIS Insurance PLC | Apply | Neither | Apply |
| 39 |   | Great Nig. Insurance PLC | Apply | Neither | Apply |
| 40 |   | Crusader Insurance PLC | Neither | Apply | Apply |
| 41 |   | Cornerstone Insurance PLC | Neither | Apply | Apply |
| 42 |   | UNIC Insurance PLC | Neither | Apply | Apply |
| 43 |   | Universal Insurance PLC | Neither | Neither | Neither |
| 44 |   | LASACO Insurance PLC | Apply | Neither | Apply |
| 45 |   | Crusader Ins. PLC vs. Niger Insurance PLC | Apply | Neither | Neither |
| 46 |   | NEM Insurance PLC | Apply | Neither | Apply |
| 47 |   | OASIS Insurance PLC | Apply | Neither | Apply |
| 48 |   | Guinea Insurance PLC | Apply | Neither | Apply |
| 49 |   | Great Nig. Insurance PLC | Apply | Neither | Apply |
| 50 |   | Cornerstone Insurance PLC | Neither | Neither | Apply |
| 51 |   | UNIC Insurance PLC | Apply | Neither | Apply |
| 52 |   | Universal Insurance PLC | Apply | Neither | Neither |
| 53 |   | LASACO Insurance PLC | Apply | Neither | Apply |
| 54 |   | Cornerstone Ins. PLC vs. Niger Insurance PLC | Apply | Neither | Neither |
| 55 |   | NEM Insurance PLC | Apply | Neither | Apply |
| 56 |   | OASIS Insurance PLC | Apply | Neither | Apply |
| 57 |   | Guinea Insurance PLC | Apply | Neither | Apply |
| 58 |   | Crusader Insurance PLC | Apply | Apply | Apply |
| 59 |   | Great Nig. Insurance PLC | Apply | Neither | Apply |
| 60 |   | UNIC Insurance PLC | Apply | Apply | Apply |
| 61 |   | Universal Insurance PLC | Apply | Neither | Neither |
| 62 |   | LASACO Insurance PLC | Apply | Neither | Apply |
Conclusion and Recommendations

The study examined stochastic dominance technique in portfolio selection in the Nigerian stock market. The literature reviewed revealed that stochastic dominance remained a potent tool to selecting random variables which rank higher than another.
through specifying a condition which the difference between their selections must satisfy. Ten (10) listed insurance firm stocks were selected and tested for stochastic dominance. Findings indicate that the selection of firm stock followed the Markowitz mean-variance and risk preference behavior of investors in the stock market. The result of the stochastic dominance technique shows that two (2) firm stocks were first order stochastically dominant (FSD), four (4) stocks of firms were second order stochastically dominant while nine (9) stocks were third order stochastically dominant (TSD) in the period after the stock market meltdown in Nigeria. The study concludes that while stochastic dominance is good in determining the dominance of an asset over another, it does not succinctly portray investors’ risk preference behavior unlike the Markowitz mean-variance approach.

This study has contributed to knowledge in several ways. For instance, previous studies have always relied on the use of the capital asset pricing model (CAPM) and arbitrage pricing theory (APT) in the choice and selection of portfolio in the stock market. This study is the first to employ the stochastic dominance approach in portfolio selection on the empirical fronts in the emerging market of Nigeria.

The study therefore suggests that future researchers need to concentrate their attention on empirically investigating portfolio dominance on a sector by sector basis as this will guide potential investors to selecting securities on the basis of mean-variance and utility function. Similarly, further research work should be undertaken to determine the dominance of firms on the basis of portfolio selection, corporate governance mechanisms and firm characteristics using stochastic dominance software with a view to contributing to knowledge. This has the potency of guiding financial analysts and stock brokers in the context of fundamental analysis, when suggesting investment ideas to potential and existing investors in the stock market.

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