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**PROSPECT THEORY: EVIDENCE OF OVERREACTION IN INVESTOR DECISION
MAKING AT THE NAIROBI STOCK EXCHANGE.**

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Declaration of Authorship

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ABBREVIATIONS

EMH – Efficient Market Hypothesis

MPT- Modern Portfolio Theory

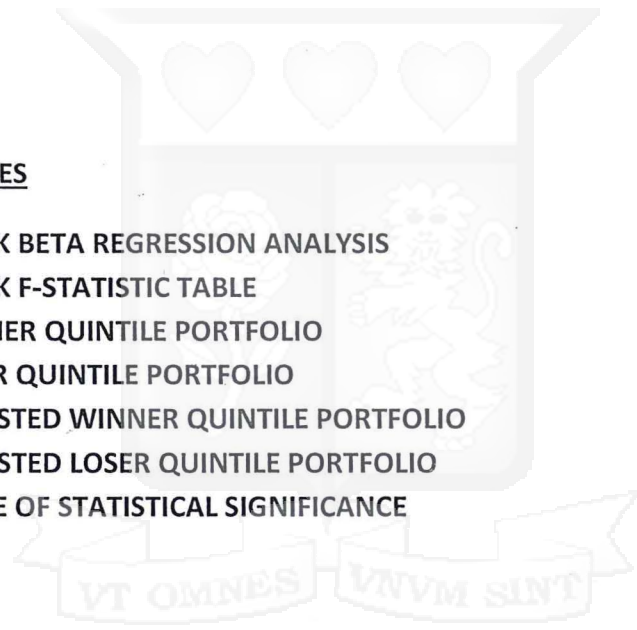
CAPM- Capital Asset Pricing Model

APT- Arbitrage Pricing Model

NSE- Nairobi Securities Exchange

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ABSTRACT

Overreaction is a common investor problem that heavily occurs due to irrationality on the part of the investor. According to Kahneman and Tversky, investors tend to be risk seeking in losses and risk averse in gains, a realization that led to the genesis of the Prospect Theory. Moreover, studies have identified that the Efficient Market Hypothesis is not a perfect tool in determining investor reaction. Therefore this study purposed to analyze the existence of overreaction in the Nairobi Securities Exchange through use of a model Swallow (1998) that analyzes stock abnormal returns, checks for their persistency and also examines if they are driven by overreaction. According to the findings, the market was deemed to be in the weak form of efficiency hence abnormal returns being experienced were persistent. Further, overreaction was observed in losses and not in gains, hence affirming the findings of the Prospect Theory. Overall, in comparison to the Portuguese market, similar findings were obtained hence leading to the conclusion that behavioral biases do play a role in investor decision making and it is imperative for investors to be well educated before investing and to take up effective hedging strategies to mitigate against the negative effects of stock losses.

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1. CHAPTER ONE

1.1. BACKGROUND TO THE STUDY

Behavioral finance is a field that is being explored to help in determining the impact of investor biases, preferences and opinions have on their investment patterns. Sewell(2007) defines behavioral finance as the study of the influence of psychology on the behavior of financial practitioners and the subsequent effect on markets. In addition to that, Shefrin(2000) defines behavioral finance as a rapidly growing area that deals with the influence of psychology on the behavior of financial practitioners and the subsequent effect on markets. Thus, behavioral finance can be defined as a field of finance that proposes explanation of stock market anomalies using identified psychological biases rather than dismissing them as “chance results consistent with the market efficiency hypothesis” Fama(1998)

Traditional finance, according to Fama & Eugene(1965) puts forward two main paradigms:

Market agents are perfectly rational: any new available information is interpreted correctly and uniformly

Markets are efficient: EMH states all relevant information is reflected in prices instantaneously and completely. If the hypothesis holds, prices are right and there is no investment strategy which can earn excess risk-adjusted average returns consistently.

However, as time has passed, we have seen traditional finance not being able to explain some situations that have occurred and keep recurring e.g. underperformance of Initial Public Offerings despite corporate announcement, The US Stock Market Crash that lasted a few hours after President Donald Trump was declared the winner of the 2016 US General Elections, why prices tend to go up in January despite strong monetary and fiscal policies among other factors.

Kahneman & Tversky(1979)studied the behavior of investors and came up with the Prospect Theory that shows the trends investors take behaviorally e.g. being loss averse. This theory is the cornerstone of behavioral finance. Moreover, he was able to identify some psychological biases that plagued investors e.g. Representativeness, Framing, Mental Accounting, Disposition, Hindsight, Endowment, Loss Aversion, Regret Aversion, Availability among others. This study shall seek to utilize the Prospect Theory to test for representativeness, overconfidence and regret aversion presence in investor decision making at the Nairobi Stock Exchange, Kenya.

1.2. Problem Statement

Standard finance has been heavily relied on to understand the financial markets' mechanism. However, it is not a perfect tool. Statman(1999) found that today's standard finance is so weighed down by anomalies to a point rebasing financial theory on behavioral patterns is necessary. Heuristics are more commonly used to solve challenges in decision making processes. Harbaugh(2003) shows that simple economic models are often poor predictors of human behavior hence the need to study human behavior interactions in decision making process is paramount. Clare(1995) studied the London Stock Exchange over a period of 36 months and was able to establish some overreaction; due to a small firm size effect. A similar study had been undertaken in Kenya in the previous decade. However, this had not been tested in Kenya over the current decade given the economic changes that have occurred in the country e.g. since inception of the new constitution in 2010. Therefore, this study sought to establish whether investors at the Nairobi Securities Exchange overreact to information coming in and this was evaluated using secondary data and a model from Swallow(1998) that is based on the overreaction hypothesis.

1.2. Research Objectives

The objective of this study was to achieve the following:

1. To test whether abnormal returns in the Nairobi Securities Exchange (NSE) were persistent in line with the weak form of market efficiency (EMH).
2. To determine whether overreaction was the main driver of the abnormal returns in the NSE.

1.3. Research Questions

This study sought to answer the following questions:

1. Were there persistent abnormal returns in the NSE consistent with the weak form of market efficiency (EMH)?
2. Was overreaction the main driver of the abnormal returns in the NSE?

1.4. Justification of the study

This study shall be useful to market participants as it will provide insight on the prevalence of these behavioral biases to help enhance effective decision making. It will also be useful to companies as it will provide insight on the impact of the biases on investment decisions which will help companies know where to invest, how to invest under a more informed framework. Moreover, it will be useful to industry analysts as it will enable them incorporate the influence of such biases at analyzing trends in industries where investment decisions weigh heavily.

2. CHAPTER TWO

2.1. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1.1. Introduction

Finance is defined as the study of the management of investments, and large amount of money especially by large companies and by governments. Investments can be in e.g. stocks, real estate etc. According to Fama & Eugene(1965) within traditional finance there are two key paradigms:

Market agents are perfectly rational- any new available information is interpreted correctly and uniformly.

Markets are efficient- EMH states all relevant information is reflected in prices instantaneously and completely. If the hypothesis holds, prices are right and there is no investment strategy which can earn excess risk-adjusted average returns consistently

Subrahmanyam(2007) classifies the central paradigms of finance as: Portfolio allocation based on expected risk and return, Risk based asset pricing model e.g. Capital Asset Pricing Model (CAPM), Pricing of contingent claims and Modigliani- miller theory and its augmentation by theory of agency

Traditional finance has been applicable since the advent of investment. However, it has failed to explain issues such as the following:

The January Effect- an anomaly in the financial market where the prices of a security increase in the month of January without fundamental reasons. Rozeff(1976)

The Winner's Curse- where the winning bid in an auction tends to exceed intrinsic value of the item purchased mainly due to incomplete information and emotions leading bidders to overestimating the item's value. Thaler(1988)

2.1.2. Efficient Market Hypothesis

An efficient market is defined as a market where there are large number of rational, profit-maximizing individuals actively competing with each other to predict future market values of individual securities and where important current information is almost freely available to all participants. Fama & Eugene(1965)

Fama goes on to say that it would be impossible for a trading system based on currently available information to have excess returns consistently.

Theoretical foundation of EMH is based on three key arguments:

Investors are rational and value securities rationally. Moreover, in case some investors are irrational, their trades are random and cancel each other out without affecting prices; furthermore, rational arbitrageurs eliminate the influence of irrational investors on the market

Shleifer(2000) points out two main categories that strengthen EMH. These are: any fresh news about a security should be reflected in its price promptly and prices should not move as long as there is no new info about the company since it must be exactly equal to the value of the security

Fama & Eugene(1965) distinguishes between three forms of EMH. First and foremost there is the weak form in which all past market prices, returns and other information are fully incorporated in prices which renders technical analysis useless. Secondly, there is the semi strong form in which it is impossible for investors to earn superior returns using publicly available information hence rendering fundamental analysis useless. Moreover, there is the strong form in which all information is reflected hence you cannot make superior returns from insider information.

Seyhun(1998) notes that, however, there has been evidence that insiders did in fact earn abnormal returns even when trading legally. In support of weak form of efficiency, Fama & Eugene(1965) found that stock prices follow a random walk pattern. Semi strong form was tested by event studies and this was facilitated by Fama(1969).

EMH, however was heavily challenged. Grossman(1980) argued that it was impossible for efficient markets to exist since information has a cost associated with it and prices will not perfectly reflect available information since if it did, there would be no incentive for investors to spend money to obtain it. Moreover, Kahneman(1998) showed that people deviated from the standard decision making model in key fundamental areas e.g. on areas based on varying risk appetite levels.

Shiller(1984) and Summers(1986) provided empirical evidence to show that returns were predictable to some extent which contradicted the existing market model assumption of constant expected returns.

2.1.3. Foundations of behavioral finance

Sewell (2007) defines behavioral finance as the study of the influence of psychology on the behavior of financial practitioners and the subsequent effect on markets.

Shefrin (2000) defines behavioral finance as a rapidly growing area that deals with the influence of psychology on the behavior of financial practitioners and the subsequent effect on markets. Thus, behavioral finance can be defined as a field of finance that proposes explanation of stock

market anomalies using identified psychological biases rather than dismissing them as “chance results consistent with the market efficiency hypothesis” Fama(1998)

Fama(1996)and others have shown that the basic facts about the aggregate stock market, the cross section average returns and individual trading behavior are not easily understood in the Traditional Finance and Modern Portfolio Theory framework. Kishore(2004) explains that behavioral finance emerged due to a relaxation of the two doctrines of traditional paradigm:

Agents fail to update their beliefs correctly

There is a systematic deviation from the normative process in making investment choices.

2.1.4. Prospect Theory

The Prospect Theory originated from the works of Daniel Kahneman and Amos Tversky and is the cornerstone of behavioral finance. It argues that when choosing between gambles, people compute the gains and losses for each one and select the one with the highest prospective utility. It mainly focuses on the significance of investment losses as most investors are loss averse hence investment losses must be compensated through the opportunity for higher returns. It draws from the expected utility theory by also having the characteristic of declining marginal utility of gains.

Utility is the main function for this rather than wealth. In the prospect utility function graph, we can see that it is concave in gains and convex in losses representing risk aversion in gains and risk seeking in losses. Investors typically feel losses more than gains. The loss area reflects the declining marginal damage of the losses. This is because prospect utility proponents would risk their investment for a break even opportunity rather than face a definite loss.

If markets were efficient, as per Fama’s theory, all investment returns would have normal distribution and the application of the mean standard deviation criterion would still be justified for prospect theory investors. However, in reality the efficient market hypothesis is not valid so very few investments have returns with normal distributions.

When it comes to investment in stocks, the natural reference point is the purchase price of the stock and is one of the reference points used by an investor. Maximum stock prices in recent return history are found to affect investors trading decisions. In principle, this bias, known as framing, can be broad or narrow. It can be broad in the sense that it affects the investor’s entire wealth function or narrow in the sense that it affects one of the mental accounts that the investor has. Vast majority of empirical studies, therefore, assume a degree of rationality in investment hence implicitly assume narrow framing.

Hence, the loss aversion under prospect theory is key to an optimal portfolio. In order to study it more, we need to replace the efficient market line in the mean standard deviation model with a behavioral efficient frontier based on the prospect theory. The behavioral efficient frontier was developed in a paper by Enrico De Giorgi, Thorsten Hens and Janos Mayer in 2011. It depicts the prospect theory using a risk- return diagram and offers various hedging strategies based on the investor's risk profile.

If we compare prospect theory portfolios with the Markowitz portfolios we see that they have a lower portion of equities and hedge funds while weighting capital protection products more heavily. Equities and hedge funds are not largely represented in the prospect portfolios because of their potential huge losses.

A major element of the prospect theory is the weighting function. The value of each outcome is multiplied by a decision weight. Decision weights measure the impact of events on the desirability of an investment. They are not probabilities and typically do not add up to unity. Kahneman & Tversky(1979) call this property subcertainty

Swallow(1998) identified heuristics and behavioral biases e.g. representativeness, regret aversion, overconfidence, hindsight, availability bias among other biases as some of the key factors that lead to overreaction among investors. We shall seek to evaluate the two to gain some insight on them and how they can contribute to overreaction and irrationality in investor decision making.

2.2. Empirical Evidence

Rozeff & Zamani(1998) carried out a study on overreaction and insider trading to provide evidence on whether market prices reflect investor overreaction. Cash flow and book value data from the annual compustat industrial tape is used over the years 1978 to 1991. The cash flow for year t is divided by the market value of equity at the end of May in year $t+1$. Market value of equity is the product of the number of shares outstanding and the end-of-may stock price, both of which are obtained from the Centre for Research on Security Prices (CRSP) Monthly NYSE-AMEX files. After obtaining a ratio of cash flow to market value of equity each year for each company, the companies are sorted into deciles each year by the CF/P ratio and assigned a value of one to ten. Stocks ranked one have the lowest CF/P ratios and are called the growth stocks. Stocks ranked ten have the highest CF/P ratios and are called the value stocks. Returns of each stock in periods prior to May of year $t+1$ are found. Periods of 12 month and 36 month are examined. The proportion of buy transactions in the insider trades is positively related to the ratio of cash flow to price (as well as book value to price) and negatively related to prior stock return. Outside investors, thus, overvalue growth stocks and undervalue value stocks. Insider transactions are consistent with a well-informed contrarian approach to stock investing. Insider buying climbs as stocks change from growth to value categories. Insider buying is also greater after low stock returns and lower after high stock returns. These findings

are consistent with a version of overreaction which says that prices of value stocks tend to lie below fundamental values, and prices of growth stocks tend to lie above fundamental value.

In a study of market efficiency, DeBondt & Thaler(1985) investigated whether such behavior affects stock prices. They used monthly return data for New York Stock Exchange (NYSE) common stocks, as compiled by the Center for Research in Security Prices (CRSP) of the University of Chicago, for the period between January 1926 and December 1982. An equally weighted arithmetic average rate of return on all CRSP listed securities serve as the market index. The results are consistent with the overreaction hypothesis. Loser portfolios of 35 stocks Outperform the market by, on average, 19.6%, 36 months after portfolio formation. Winner portfolios, on the other hand, earn about 5% less than the market, so that the difference in cumulative average residual between the extreme portfolios equals 24.6%. The findings have other notable aspects. First, the overreaction effect is asymmetric; it is much larger for losers than for winners. Secondly, most of the excess returns are realized in January. Finally the overreaction phenomenon mostly occurs during the second and third year of the test period.

Zarowin(1989) tested whether the stock market overreacts to extreme earnings by examining firms' stock returns over the 36 months subsequent to extreme earning years. Portfolios of firms that are characterized by extreme (good versus bad) current period earnings performance are formed and to compare the subsequent stock returns of the poorest earners versus the best earners. CRSP monthly return file and the Compustat Annual Industrial file is the data base for this study. Each year from 1971 to 1981 all firms meeting the following data requirements are included in the sample for that year: availability of the six consecutive prior years and the current year of earnings before extraordinary items and discontinued operations; December 31 fiscal year end and availability of price per share and number of shares outstanding on the CRSP monthly file at year end. To examine whether the stock market overreacts to extreme earnings news, the excess returns of the two extreme earnings portfolios over the 36 months subsequent to the extreme earnings year are compared. Results presented fail to support the overreaction to earnings hypothesis. Although the poorest earnings performers outperform the best earnings performers by a statistically significant 16.6% over the 36 months subsequent to the extreme earnings year, he argues that this result is due primarily to differences in size between the two groups. Poor earners tend to be smaller firms than good earners. When poor earners are matched with good earners of equal size there is little difference in return behavior. When poor (or good) earners of disparate sizes are compared, small firms outperform large firms, and smaller winners outperform larger losers. Thus the statistically significant differences between the returns of extreme prior period performers appear to be the result not of investor overreaction to earnings but of the size effect. This is in contrast with DeBondt(1987) who maintained, "The winner loser effect is not primarily a size effect".

Clare (1995) carried out a study on "The overreaction hypothesis and the UK stock market".

UK data is used from 1955 to 1990 drawn from a random sample of up to 1,000 stocks in any one year. Portfolios of stocks are formed on the basis of prior period performance. The portfolios are formed using stock return data taken from the London Business School LSPD tapes. The data base consists of the end month dividend adjusted returns on all those stocks

listed on the London Stock Exchange since January 1955. Stocks are ordered into portfolios according to their performance relative to the performance of the market over three separate periods: one, two and three years. Then the market adjusted return for any month is calculated. Regression analysis on means of the winner and loser portfolio returns is done. A t-test is carried out on the significance level. It is found that losers outperform previous winners over a two-year period by a statistically significant 1.7% per annum. On further investigation it is found that such overreaction may in fact be a manifestation of the small firm effect.

2.3. Key Research Gaps

Clare(1995) evaluated stock data at the London Stock Exchange since January 1955 to 1990. She analyzed portfolios based on short run performance. However, she was not able to perform an analysis on portfolios in the long run. Moreover, she identified that overreaction could have been caused by manifestation of the small firm effect. She did not endeavor to test how the small firm effect was singled out as a key factor that led to overreaction; hence leaving uncertainty towards its implication on the rationale of an investor when making decisions.

Zarowin(1989) was able to expound on the effect of firm size and investor size on the various reactions of investors. He was able to identify stocks from small sized firms that were poor performers and compare their excess returns with those of similar firms and also larger firms that were better performers. Hence, he was able to find that the winner loser phenomenon was influenced to a certain degree by size of the firms. However, he was not able to identify to what degree firm size generally impacted the overreaction witnessed in investor decision making and whether firm size was significant in leading to overreaction among investors.

DeBondt & Thaler(1985) conducted a study where they found that the overreaction hypothesis was asymmetric in nature and that most overreaction was witnessed by losers compared to winners. This supports the Prospect Theory which shows that investors are risk averse in gains and risk seeking in losses. In his study he was able to find that the overreaction occurred within a period of 36 months of portfolio formation. However, he did not test the reaction of winners and losers over a longer period e.g. 5 year period which is the recommended base minimum of study since recent times hence running the risk of having skewed information due to a short range period. Moreover, he formed portfolios from as far back as 1925 yet his study was conducted in 1985. He therefore, ran the risk of having obsolete information due to changes in trends and prevailing economic conditions over the span of time hence increasing potential of inaccuracy of results.

Rozeff & Zamani (1998) examined the reaction of outside investors and investors who trade in stocks. He was able to find that outside investors undervalued value stocks while they overvalued growth stocks. Moreover, he found that insider trading gradually went up as stocks turned from value stocks to growth stocks. These findings are consistent with a version of overreaction which says that prices of value stocks tend to lie below fundamental values, and prices of growth stocks tend to lie above fundamental values. He conducted this study over

periods of 12 months and 36 months. Hence, he did not test this version of overreaction over a longer period of time e.g. a 5 year period which is the recommended base minimum of study since recent times. Hence, this study ran the risk of having highly skewed information due to having a short time frame.

2.4. Link between studies

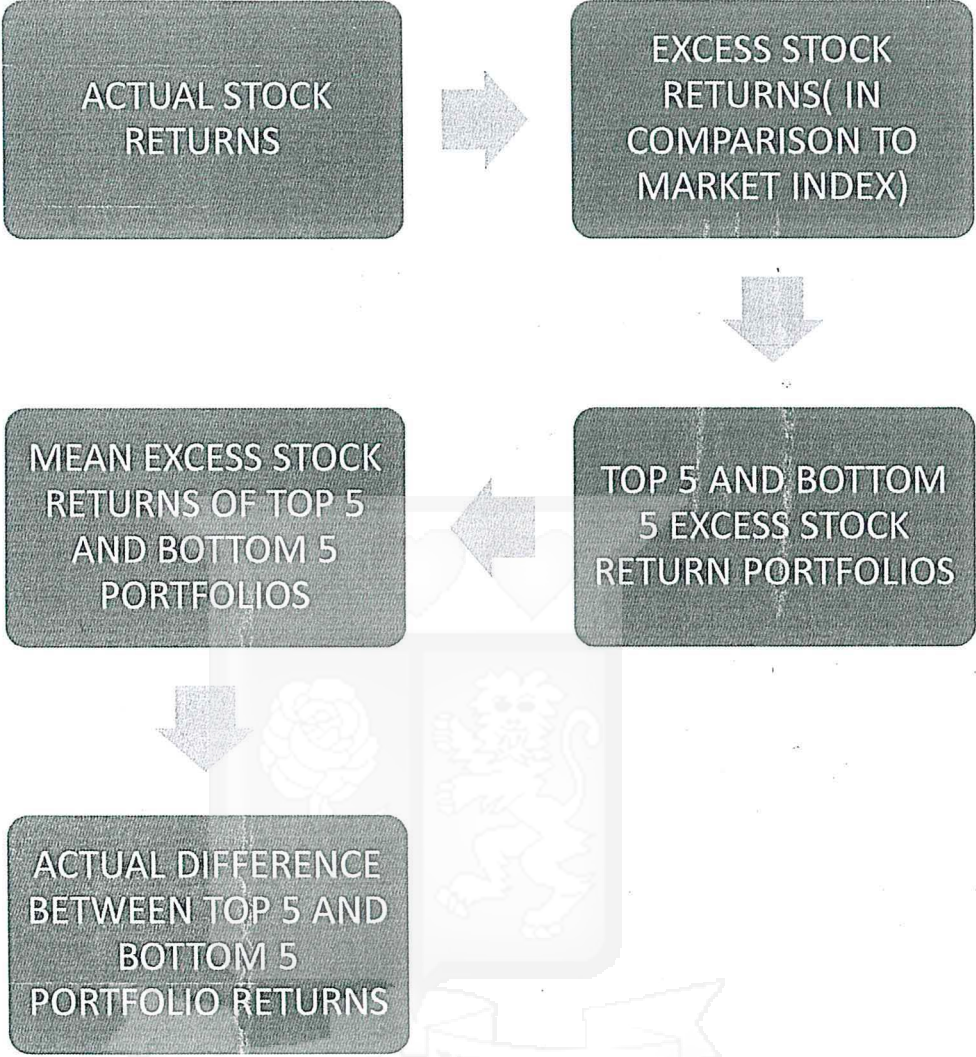
This research attempted to use the Prospect Theory to test the presence of overreaction in Kenyan investors in the Nairobi Stock Exchange basing this on the overreaction hypothesis in a similar pattern to Clare (1995) who conducted a similar study at the London Stock Exchange but that hadn't been tested before in Kenya in the current decade (beginning 2010 onwards) in order to determine its significance on investor behavior at the Nairobi Stock Exchange.

Most of the studies involved utilized mainly primary data in delivering their results. However, this research utilized mainly secondary data obtained from the monthly stock patterns in the Nairobi Stock Exchange and changes in stock prices were evaluated based on the occurrence of abnormal returns, basing it on an autoregressive model Swallow(1998). Evaluation occurred based on activity of portfolios formed from stock of select companies whose activity was monitored and an analysis conducted based on the findings.

The study provided insight on the presence of overreaction among Kenyan investors at the Nairobi Stock exchange through model analysis and demonstrated possible irrationality based on the overreaction hypothesis.

2.5. Conceptual Framework





ACTUAL STOCK
RETURNS

EXCESS STOCK
RETURNS(IN
COMPARISON TO
MARKET INDEX)

MEAN EXCESS STOCK
RETURNS OF TOP 5
AND BOTTOM 5
PORTFOLIOS

TOP 5 AND BOTTOM
5 EXCESS STOCK
RETURN PORTFOLIOS

ACTUAL DIFFERENCE
BETWEEN TOP 5 AND
BOTTOM 5
PORTFOLIO RETURNS

VT OMNES VNVM SINT

3. CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

3.1. Nature of the study

This research adopted a longitudinal survey design. Sekaran (1992) defines a longitudinal study as a correlation based research study that involves repeated observations of the same items over long periods of time. Since the given study was largely descriptive, sample statistics were used to make generalization about population parameters.

3.2. Population

Portfolios were formed using stock return data taken from Nairobi Securities Exchange. An equally weighted arithmetic average rate of return on all NSE listed securities was served as the market index. The portfolios were formed from all listed companies at the Nairobi Securities Exchange, with particular consideration of the listing date or period- provided it was listed in the NSE as at January 2012- when the study was commenced, and is still listed up to and including January 2016- when the study was ended.

3.3. Data Collection

Secondary data was used and this was adopted from the NSE List of companies. The companies were listed from January 2012 to January 2016. The study analyzed the stock prices over a period of 5 years on a monthly basis in order to establish monthly returns for the stocks. This data was obtained from the Nairobi Securities Exchange website where stock price data is recorded. This information was useful at calculating the betas of the stocks hence calculating their expected returns and the difference between the actual and expected return gave the abnormal return.

3.4. Data Analysis

Tools of Analysis

The data was analyzed using Microsoft Excel 2010 and was used to generate the excess returns of the stocks, rank the stocks based on their excess returns, group the stocks into quintile portfolios based on their ranks: Top 5 and Bottom 5 portfolios and analyze their mean returns in order to generate a difference portfolio.

Techniques of Analysis

In order to analyze the data, autoregressive methods were used, which borrowed heavily from econometric methods i.e. Ordinary Least Squares method. Also, technical analysis, consistent with the Weak Form of EMH was used as an analysis technique to check for any historical relationship between the prices of and returns of stocks in the NSE.

3.4.1. Model Specification

To effectively determine the consistency of the abnormal returns, the study used tests of market efficiency consistent with the Efficient Market Hypothesis to test on their significance or otherwise. Stocks listed on the NSE 20 were evaluated and their monthly returns analyzed. Moreover, the comparison between stock returns and abnormal returns was used as a founding basis to study overreaction through use of the overreaction hypothesis where mean reversion is used as a precursor to overreaction- stocks with the highest positive returns under mean reversion record the most negative abnormal returns while stocks with the lowest positive returns record the most positive abnormal returns. Abnormal return was obtained as the difference between the stock's actual return and its expected return. The stock expected return was obtained through the formula:

$$E[Rs] = Rf + B[Rm - Rf]$$

Where $E[Rs]$ = Expected Stock Return

Rf = Risk Free Rate

B = Beta

Rm = Market Return

The returns were thus obtained for each and every stock over the 5 year period. Thereafter, the 91 day T-Bill rate was obtained as it was ideally useful to provide the risk free rate. The 91-day T Bill rate was converted using the same formula as the stock return and this became the risk free rate to be used in the analyses.

The proxy for the market was selected as the NSE-20 index and the returns of the NSE-20 index were obtained in a similar manner to the stock and risk free returns.

Therefore, I ended up with three sets of returns- stock returns, risk free returns and market returns. From then, I obtained the excess stock returns and the excess market returns.

The excess market return was obtained from the difference between the market return and the risk free return. The excess market return comprises the market premium which is the compensatory figure for risk e.g. market risk and was calculated over the 5 year period.

The excess stock return was obtained from the difference between the stock return and the risk free return. The excess stock return comprises the premium which is the compensatory figure for both systematic risk that affects the stock and idiosyncratic risk. The excess stock returns were obtained for each of the 47 stocks over the 5 year period.

3.4.2. Estimation of stock beta

The stock beta is the measure of sensitivity of the stock to the market. It is obtained through the following:

$$B = (Rs - Rf) / (Rm - Rf)$$

Where B = beta

R_s = Stock Return

R_m = Market Return

R_f = Risk free Return

3.4.3. Estimation of stock expected returns

The stock betas obtained were used to calculate the stock expected returns based on the following formula:

$$E[R_s] = R_f + B(R_m - R_f)$$

Where:

$E[R_s]$ = Expected Stock Return

R_f = Risk free rate

B = Beta coefficient

R_m = Return of the market

This formula was applied for the 47 stocks and the stocks' expected returns were obtained. The betas underwent tests of significance to determine their suitability and their accuracy at effectively estimating stock expected returns.

3.4.4. Calculation of abnormal returns

The abnormal returns were then calculated as the difference between the stocks' actual returns and the stocks' expected returns.

The significance of these abnormal returns was evaluated through regression against the excess market return to try and determine if the abnormal returns were within a trend of excess returns hence not significant or were above the trend of excess returns experienced by the market hence significant. For this, various coefficients were used to try and explain the relationship between the two variables.

3.5. Tests for Overreaction

In order to evaluate overreaction, a principle of mean reversion was invoked. According to the overreaction hypothesis, mean reversion is experienced in the height of overreaction. This implies that stocks experiencing positive returns will in turn record negative excess returns and stocks experiencing negative or less positive returns will in turn record greater positive excess return. This implies that the average cumulative abnormal return is positive in the wake of overreaction hence one can beat the market through the use of an arbitrage portfolio.

3.5.1. Formation of the winner, loser and arbitrage portfolios

The various stocks in the NSE were analyzed and their monthly returns were ranked in descending order. The first five stocks formed the winner portfolio and the last five stocks formed the loser portfolio. The average return of the highest return stocks comprised the winner portfolio's return, while the average return of the lowest return stocks comprised the loser portfolio's return. The arbitrage portfolio return comprised the difference between the winner portfolio's return and the loser's portfolio return.

3.5.2. Cumulative abnormal return analysis

The abnormal returns of the winner portfolio's stocks and the loser portfolio's stocks were obtained over the five year test period. These were then averaged monthly and each month's abnormal return was obtained, before being averaged for each entire portfolio. These were then termed as the Average Cumulative Abnormal Returns (ACAR) for both the winner and the loser portfolio.

CAR for each stock

$$CAR_{i,j} = \text{sum} (R_s - R_m)$$

$$CAR_{p,z,t} = \text{sum}[(1/n) * \text{sum} (R_s - R_m)]$$

Where $CAR_{i,j}$ = Stock Cumulative Abnormal Return

$CAR_{p,z,t}$ = Portfolio Cumulative Abnormal Return

N = number of stocks

R_s = Return of stock

R_m = Return of market

ACAR for portfolios

$$ACAR_p = [\text{sum} (CAR_{i,j})] / 60$$

Where $ACAR_p$ = Portfolio Average Cumulative Abnormal Return

The cumulative abnormal return for each stock was ranked side by side and the portfolios' returns were compared to the portfolios' abnormal returns.

The null hypothesis for this test states that the $ACAR_p = 0$. This implies that the cumulative abnormal return of the portfolio is equal to zero for a set of actual returns hence there is no mean reversion –which is experienced when a stock records positive returns and negative

abnormal returns, or vice versa hence there is no overreaction. Hence, one cannot make arbitrage returns from the arbitrage portfolio.

The alternative hypothesis for this test states that the ACARp is not equal to zero. This implies that the cumulative abnormal return of the portfolio is greater than or less than zero for a set of actual returns hence there is mean reversion as the stock returns offset the cumulative abnormal return hence there is overreaction. Hence, one can make arbitrage returns from the arbitrage portfolio.

To assess the statistical significance of the Average Cumulative Abnormal Return for the stock, the T-statistic is defined as:

$$T_{p,t} = [ACAR_{p,t}] / [Sp / \sqrt{60}]$$

Where Sp is the variance for the mean market adjusted return $[R_m - R_s]$ assuming time series independence of monthly mean returns. $AR_{p,t}$ denotes individual stock market adjusted return and $mean(AR_{p,t})$ denotes mean market adjusted return for all stocks

$$Sp = \sqrt{[(\sum(AR_{p,t} - mean(AR_{p,t}))^2) / (T - 1)] * \sqrt{T}}$$

To assess the statistical significance of the Average Cumulative Abnormal Return for the arbitrage portfolio, the T- statistic is defined as:

$$T = (ACAR_{i,t} - ACAR_{w,t}) / \sqrt{[2St]^2 / N}$$

Where $ACAR_{i,t}$ = loser portfolio average cumulative abnormal return

$ACAR_{w,t}$ = winner portfolio average cumulative abnormal return

$St = Sp$ = variance for the mean market adjusted return

N = test period

This methodology was what was useful in the data analysis that was carried out on the stocks in order to test the aforementioned research questions.

CHAPTER FOUR: DATA ANALYSIS

4.1. Analysis Findings

In order to obtain stock betas, linear regression was conducted on each excess stock return against the excess market returns. A series of betas for the stocks with the largest variances in peak returns was obtained as follows:

STOCK BETA REGRESSION ANALYSIS

STOCK	ALPHA	BETA
ARM	-0.018314301	0.741014718
BAMBURI CEMENT	0.027970812	0.136960984
BARCLAYS BANK	0.032622567	0.186824414
BOC KENYA	0.010613801	0.880486305
BRITAM	0.031188606	0.886146127
BAT	0.043061636	0.210330202
CAR & GENERAL	0.03065698	0.168622366
CARBACID	-0.064916914	0.780993404
CENTUM	0.022493087	0.890338755

Upon analysis, the monthly returns were obtained. Forty seven regressions were carried out to obtain each stock's beta coefficient, which was then used to calculate the stock expected return. The difference between the actual stock return and the stock expected return yielded the abnormal return for each stock. F-statistic tests for these stocks yielded a F-statistic of **6.125546**. **33 out of 47 stocks** had F-values **greater than 6.125546**.

For the 33 stocks, we reject the null hypothesis hence abnormal returns are consistent. **For the remaining 14 stocks**, we accept the null hypothesis that abnormal returns are inconsistent. Therefore, it is imperative for us to consider that the market is in the weak form of Efficient Market Hypothesis hence it has consistent abnormal returns for a large majority of its listed stocks. Below are the results of the stocks that had the largest variances in their peak returns and the states in which they were considered:

STOCK F- STATISTIC TABLE

STOCK	F- STATISTIC	STATE
ARM	13.37265	REJECT NULL HYPOTHESIS
BAMBURI CEMENT	0.963689	ACCEPT NULL HYPOTHESIS
BARCLAYS BANK	2.033059	ACCEPT NULL HYPOTHESIS

BOC KENYA	152.5752	REJECT NULL HYPOTHESIS
BRITAM	41.02877	REJECT NULL HYPOTHESIS
BAT	0.865922	ACCEPT NULL HYPOTHESIS
CAR AND GENERAL	18.45633	REJECT NULL HYPOTHESIS

The stocks that recorded the highest average return for the five year period were the following:

WINNER QUINTILE PORTFOLIO

<i>Kenya Orchids Ltd</i>	4.81%
<i>Safaricom Ltd</i>	3.37%
<i>Unga Ltd</i>	2.65%
<i>Centum Investments</i>	2.37%
<i>BAT</i>	2.18%

These stocks formed the winner quintile portfolio for this particular study. The winner portfolio had a mean average return of **3.08%**. The stocks that recorded the lowest average return for the five year period were the following:

LOSER QUINTILE PORTFOLIO

<i>Carbacid</i>	-3.02%
<i>Mumias Sugar</i>	-2.67%
<i>ARM</i>	-2.40%
<i>Transcentury Ltd</i>	-1.66%
<i>Kenya Airways Ltd</i>	-1.66%

These stocks formed the loser quintile portfolio for this particular study. The loser portfolio had a mean average return of **-2.28%**. Moreover, the analysis of the abnormal returns was also calculated on these ten stocks. The stocks that comprised having the highest cumulative abnormal returns among the ten stocks were the following:

ADJUSTED WINNER QUINTILE PORTFOLIO

<i>Kenya Orchids Ltd</i>	11.77%
<i>Transcentury Ltd</i>	8.58%
<i>Safaricom Ltd</i>	7.92%
<i>BAT</i>	4.53%
<i>Centum Investment</i>	3.29%

Out of the stocks, four out of five stocks with the highest returns recorded the highest cumulative abnormal return. The Average Cumulative Abnormal Return (ACAR) for these stocks was **7.22%**. **80%** of the stocks in the winner portfolio formed the portfolio of stocks that recorded the highest Average Cumulative Abnormal Return (ACAR). The stocks that comprised having the lowest cumulative abnormal returns among the ten stocks were the following:

ADJUSTED LOSER QUINTILE PORTFOLIO

<i>Carbacid</i>	<i>-5.65%</i>
<i>Kenya Airways Ltd</i>	<i>-2.05%</i>
<i>Unga Ltd</i>	<i>-1.98%</i>
<i>ARM</i>	<i>-1.01%</i>
<i>Mumias Sugar Ltd</i>	<i>-0.04%</i>

Out of the stocks, four out of five stocks with the lowest returns recorded the lowest cumulative abnormal return. The Average Cumulative Abnormal Return (ACAR) for these stocks was **-2.15%**. **80%** of the stocks in the loser portfolio formed the portfolio of stocks that recorded the lowest Average Cumulative Abnormal Return (ACAR).

The arbitrage portfolio return, formed on the difference between the mean average return of the winner portfolio and the mean average return of the loser portfolio was found to be **5.36%**. This would be the return an investor would make should there be any form of mean reversion, an indication of overreaction. The weighted return that the arbitrage portfolio would be required to make in order to take advantage of any mispricing due to other factors other than overreaction i.e. in absence of mean reversion hence no overreaction, would be **9.36%**. This is arrived at as the difference between the Average Cumulative Abnormal Return of the adjusted winner portfolio and the Average Cumulative Abnormal Return of the adjusted loser portfolio.

Tests of significance were carried out on the Average Cumulative Abnormal Returns and yielded the following outcomes:

TABLE OF STATISTICAL SIGNIFICANCE

<i>S-p</i>	<i>0.26890775</i>	
<i>T-stat Lower Quintile ACAR</i>	<i>-0.618161602</i>	<i>ACCEPT NULL HYPOTHESIS</i>
<i>T-stat Upper Quintile ACAR</i>	<i>2.079166096</i>	<i>REJECT NULL HYPOTHESIS</i>
<i>T-stat Value</i>	<i>-0.685300268</i>	

From analysis, it was observed that the loser quintile portfolio recorded less negative abnormal returns in comparison to its average return hence mean reversion was observed. As a result the null hypothesis of the study was acceptable that there was some degree of overreaction occurring in the lower quintile as shown through its T-statistic.

On the other hand, the winner quintile portfolio recorded greater positive abnormal returns in comparison to its average return hence mean reversion was not observed within this portfolio. As a result, it was prudent to reject the null hypothesis of the study as there was insufficient evidence to support any form of overreaction as shown through its T-statistic.

As a result, it would be possible for an investor holding the arbitrage portfolio (**5.36%**) to make arbitrage returns provided that the benchmark was the loser quintile portfolio (**-2.15%**).

However, it would be impossible for an investor holding an arbitrage portfolio (5.36%) to make arbitrage returns provided that the benchmark was the winner quintile portfolio (7.22%).



ADJUSTED LOSER QUINTILE PORTFOLIO

<i>Carbacid</i>	<i>-5.65%</i>
<i>Kenya Airways Ltd</i>	<i>-2.05%</i>
<i>Unga Ltd</i>	<i>-1.98%</i>
<i>ARM</i>	<i>-1.01%</i>
<i>Mumias Sugar Ltd</i>	<i>-0.04%</i>

Out of the stocks, four out of five stocks with the lowest returns recorded the lowest cumulative abnormal return. The Average Cumulative Abnormal Return (ACAR) for these stocks was **-2.15%**. **80%** of the stocks in the loser portfolio formed the portfolio of stocks that recorded the lowest Average Cumulative Abnormal Return (ACAR).

The arbitrage portfolio return, formed on the difference between the mean average return of the winner portfolio and the mean average return of the loser portfolio was found to be **5.36%**. This would be the return an investor would make should there be any form of mean reversion, an indication of overreaction. The weighted return that the arbitrage portfolio would be required to make in order to take advantage of any mispricing due to other factors other than overreaction i.e. in absence of mean reversion hence no overreaction, would be **9.36%**. This is arrived at as the difference between the Average Cumulative Abnormal Return of the adjusted winner portfolio and the Average Cumulative Abnormal Return of the adjusted loser portfolio.

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As a result, it would be possible for an investor holding the arbitrage portfolio (**5.36%**) to make arbitrage returns provided that the benchmark was the loser quintile portfolio (**-2.15%**).

However, it would be impossible for an investor holding an arbitrage portfolio (5.36%) to make arbitrage returns provided that the benchmark was the winner quintile portfolio (7.22%).





CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

5.1. Discussions

The findings of this study were consistent with Soares (2005), who studied overreaction and underreaction in the Portuguese Stock Exchange. In both studies, the markets were strongly subject to behavioral biases that affected the rationale of investor decisions. Hence, behavioral elements e.g. behavioral biases like loss aversion played an important role in several of the investments experienced in the NSE between January 2012 and January 2016. Moreover, both exchanges experienced overreaction in times of losses, and this was consistent with the prospect theory findings that investors are risk averse in times of gains and risk seeking in the event of losses. . Hence, overreaction was being experienced in the loser quintile portfolio of the Kenyan study as investors were taking up greater risk to minimize their losses, while no

overreaction was experienced in the winner quintile portfolio as investors were risk averse in order to safeguard their gains from potential loss, a characteristic known as loss aversion.

In addition, abnormal returns were persistent in both markets. However, in that study, Soares (2005), observed underreaction in the case of gains, whereas the Kenyan market experienced fairly normal reactions in the case of gains. Through analysis, it has been observed that a large majority of the listed stocks in the Nairobi Stock Exchange (33 out of 47 stocks) experienced persistent abnormal returns hence it was affirmative that the market was in the weak form of efficiency. Hence, one could take advantage of the stock market through use of technical analysis as the stock price majorly reflected information from the past in order to make consistent abnormal returns.

Also, the Portuguese market seemed to be more efficient as compared to the Kenyan market as the market was in the semi-strong form of efficiency as compared to the Kenyan market which was in the weak form of efficiency. Furthermore, the impact of legislation was much stronger in the Portuguese economy as compared to the Kenyan economy as the government actively stepped in to incentivise investors to moderate the reactions in the case of underreaction in the gains whereas in the Kenyan economy government impact was minimal.

5.2. Conclusions

The study aimed to answer the following two questions. The first question was whether the abnormal returns experienced in the Nairobi Stock Exchange were persistent to affirm that the market was in the weak form of efficiency. Hence through analysis, it was proved that the abnormal returns were persistent hence the market was in its weak form of efficiency.

The second question, which was the focal point of this study, was whether investor overreaction was a driver in the consistent abnormal returns experienced in the NSE. Through analysis, the Prospect Theory came into play as we were able to observe some degree overreaction in the loser quintile portfolio, which particularly had negative returns (losses) and no overreaction in the winner quintile portfolio, which particularly had positive returns (gains). This outcome was strongly consistent with the Prospect Theory which outlines that investors are convex (risk seeking) in losses and concave (risk averse) in gains.

Moreover, it was concluded that the efficiency of the market had a significant part to play in the degree of overreaction experienced in the NSE between January 2012 and January 2016. With the market being in its weak form of efficiency, it implied that the stock prices majorly reflected historical information, and hence there was ability to make greater returns through use of technical analysis. As a result, abnormal returns were consistently made over the test period and were significant.

All in all, this study highlighted the importance of behavioral elements in investor decision making and the impact of a weakly efficient market in overemphasizing behavioral biases e.g. overreaction and loss aversion.

5.2. Recommendations

The improvement of the efficiency of the stock market is paramount towards minimizing the potential impact of behavioral elements on investment decisions made at the NSE. Stock prices should be able to come in in a random fashion and incorporate all available information. In this manner, the abnormal returns will not be consistent and trading can occur in a random fashion, hence this will cause investors to think in a rational manner in order to make positive returns from trading in the stock market. Therefore, the Nairobi Stock Exchange could benefit from system enhancements to enable stock prices incorporate and reflect all available information to the best ability possible thus improving market efficiency.

Investor education is also of keen importance in order to improve their capacity to think and act rationally, rather than overreacting in the case of losses and being loss averse in the case of gains. Hence, they will have adequate knowledge to select value stocks or growth stocks based on their investment strategy, time horizon and risk tolerance. This in turn will minimize overreaction as investors will invest in portfolios that meet their unique investor characteristics and risk profiles.

The utilization of hedging strategies can also be useful at curbing overreaction among investors as this can minimize the negative returns (losses) experienced hence minimize overreaction tendencies by offsetting the effects of transaction risk that is experienced in the losses, hence reducing the amount of additional risk that investors would take up to offset the transaction risk experienced in the losses. These strategies could include use of forwards, futures, swaps and money market hedging strategies in order to minimize the losses experienced.

Finally, government involvement could play an important role in minimizing overreaction. From providing conducive trading conditions through political stability to regulation e.g. progressive capital gains taxes on abnormal returns and tax reliefs on losses, the government can play an important role in stabilizing the economy hence minimizing potential of overreaction among investors.

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