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PROSPECT THEORY AND UTILITY THEORY: A COMPARISON AND APPLICATION IN THE NAIROBI SECURITIES EXCHANGE

MACHARIA FIONA NJERI

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ABBREVIATIONS USED

NSE – Nairobi Securities Exchange

PROSPECT THEORY AND UTILITY THEORY: COMPARISON AND APPLICATION IN THE NAIROBI SECURITIES EXCHANGE

1 INTRODUCTION

1.1 BACKGROUND

Traditionally, financial markets are assumed to be efficient and all investors are assumed to think rationally hence make rational decisions (Kalunda and Mbaluka, 2012).[1] Efficiency, according to Fama (1990)[2], in this case means that the prices of assets in a capital market fully reflect all information for future prices implying that the investors cannot systematically beat the market and that the asset prices themselves are rational. Furthermore, applying Bayesian statistics (martingales) that suggest that given the current information, the best estimate for the future price is the current price for a particular financial asset. This implies that the market only reflects utilitarian characteristics that include risk and the philosophy of usefulness (Lawrence l. Martin 1996) and fails to acknowledge value characteristics such as sentiment (Statman 1999)[3]. The value characteristics are reflected clearly in Behavioral finance (Statman 1999)[4].

Behavioral Finance is finance from a social science perspective; encompasses psychology and sociology and how they challenge rationality (Robert J. Shiller 2003)[5]. The foundations of behavioral finance as described by Ritter (2003)[6] are cognitive psychology and the limits to arbitrage. Ritter (2003) [7]defines cognitive psychology as how people think and how their biases can affect their decisions as investors and the limitations in arbitrage are collectively defined as mispricing in the market. Behavioral finance therefore seeks to investigate what happens in

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[1] Kalunda and Mbaluka, "Test of Endowment and Disposition Effects under Prospect Theory on Decision-Making Process of Individual Investors at the Nairobi Securities Exchange, Kenya."
[2] Fama, "Stock Returns, Expected Returns, and Real Activity."
[3] Statman, "Behavioral Finance versus Standard Finance."
[4] Shiller, "From Efficient Markets Theory to Behavioral Finance."
[5] Ritter, "Behavioral Finance."
[6] Ibid.
[7] Ibid.

markets in which agents display human limitations and complications in order to improve financial decision-making.

Traditional Markets are assumed to be utilitarian, that is, driven by the Expected Utility Theory (Ritter 2003)[8]. (David E. Bell, Howard Raiffa, Amos Tversky 1995) express that the investor under the Expected Utility Theory makes normative decisions – those that are rational. However, taking into consideration the cognitive biases portrayed by investors defined under Behavioral Finance, a theory, prospect theory, is applied where it is used to make descriptive decisions – those that do not demand perfect rationality- under uncertainty.

1.2 RESEARCH OBJECTIVES

1. To investigate why Prospect Theory is preferred to the Expected Utility Theory

2. To investigate the application decision making under Prospect Theory in the NSE Stock Exchange in Kenya

3. To identify the benefits of using Prospect Theory while investing in the NSE Stock Exchange

1.3 RESEARCH QUESTIONS

1. Why is Prospect Theory preferred to the Expected Utility Theory?

2. How can the assumptions of decision making under Prospect Theory be applied while investing in the NSE Stock Exchange in Kenya?

3. What are the benefits of using Prospect Theory while investing in the Stock Exchange?

1.4 PROBLEM STATEMENT

The rationality-based market equilibrium models in finance in general are weighted down by anomalies such that attempting to replicate these models directly without reinforcing the attributes of the social psychology that affects an investor's rationale is inaccurate. Harburgh (2003) affirms that these simplistic economic models are poor predictors of human behavior and that there is a need for more detailed studies of human behavior in the process of making investment decisions. This study involves the application of Behavioral Finance where investors are assumed to follow descriptive decision-making processes rather than normative decision-making processes - meaning

[8] Bell, Raiffa, and Tversky, *Decision Making: Descriptive, Normative, and Prescriptive Interactions*.

and that the investor is not just rational in their decision patterns, but is also susceptible to cognitive biases, is more loss averse and regret averse, has a defined risk attitude, has preferences and has imperfect self-control (Statman 1999).[9]These additional aspects that affect the investor's financial decisions form the investor's value characteristics. This paper aims at investigating how these value characteristics affect the decisions made by investors as they invest in the NSE Stock Exchange in Kenya.

1.5 JUSTIFICATION OF THE PROBLEM STATEMENT

This study aims at the application of the value characteristics of investors on equity investing. This therefore implies that the primary beneficiaries of the study will include the equity investors themselves – both individual and corporate investors. This is because they will have an understanding of their limitations as investors and how to minimize them in order to maximize their utility (in form of meeting objectives in terms of profit, weighting portfolios, meeting client objectives for those hired to invest). By understanding the behavioral aspects of other investor's decision patterns, the investor may also be able to take advantage of the other investor's limitations and maximize on their utility.

This study also aids firms who have their stocks listed on the NSE Stock Exchange by assisting them to understand what drives investors to invest in a stock at initiation, continue to hold the stock over time and eventually sell/liquidate stock, what kind of properties their investors hold and how this affects their behavior when the stock prices fluctuate in terms of risk profiles, value perception and information adjustment. This provides a framework for the company decisions in terms of advertising, building brand loyalty, building a reputation.

[9] Statman, "Behavioral Finance versus Standard Finance."

2 LITERATURE REVIEW

2.1 THEORETICAL LITERATURE

2.1.1 THE THEORY OF DECISION-MAKING

The kind of decision the investor makes can either be prescriptive, normative or descriptive. (Simon B. 2009[10]) describes both prescriptive theory and descriptive theory as complicated and difficult to apply. Prescriptive theory assumes that the investor makes a decision based on perfect estimations in perfect accuracy and in complete rationality. It describes how unboundedly rational human beings make decisions. It is a way in which a practical decision is made (David E. Bell, Howard Raiffa, Amos Tversky 1995[11]). Descriptive decision theory is a sum total of the following decisions: how people accumulate evidence, learn, adapt their behavior, decompose complex problems, integrate solutions, perceive uncertainties and how difference in types of thought patterns varies from one decision maker to another (David E. Bell, Howard Raiffa, Amos Tversky 1995 [12]). It is summarized as how and why people act the way they do. Normative, on the other hand is coined 'the mathematician's' theory is where a super-intelligent, idealized, rational thinks and acts. It does not involve the cognitive concerns of real people. According to Simpson A. (1957)[13], normative decision theory is the basis of 'bounded rationality' which he defined as:

> 'The capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behavior in the real world -- or even for a reasonable approximation to such objective rationality.'

2.1.2 EXPECTED UTILITY THEORY

Utility is the satisfaction that a person makes from making a decision. The measurement of utility thus includes the following three processes: (Alchian A. 1953)[14]

- Purpose of measurement of the utility
- Process by which one measures utility

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[10] Board, *Preferences and Utility*.
[11] Bell, Raiffa, and Tversky, *Decision Making: Descriptive, Normative, and Prescriptive Interactions*.
[12] Ibid.
[13] Simon, "Rational Decision Making in Business Organizations."
[14] Alchian, "The Meaning of Utility Measurement."

❖ Uniqueness of the values wrapped in the purpose and process of measurement

According to the expected utility theorem and Markowitz (1952) [15]the investor is rational and therefore follows normative decision making processes. Markowitz (1952) [16]suggests that decisions that an investor makes are based on the total wealth (w) at the time of investment and a one dimensional utility function. The axioms of The Expected Utility Theory (Simon B. 2009[17]) are inclusive of the following: comparability, transitivity, weak axiom of revealed preference and certainty equivalence. Transitivity is implied by asymmetry and negative transitivity, and it seems like a reasonable criterion of coherence for an individual's preferences. (Simon Grant and Timothy Van Zandt 2007). [18]

2.1.3 PROSPECT THEORY

According to the critics of the Expected Utility Theory, Kahneman and Tversky (1979) [19] Prospect Theory analysis takes precedence. Prospect theory has its roots in Behavioral Finance; a field that is focused on the application of psychological and economic assumptionsto investigate what happens in markets in which agents display human limitations and complications for the improvement of financial decision-making (Kalunda and Mbaluka 2012[20]). Unlike the Markowitz (1952) model of utility as a measure of the total wealth that an investor has, Kahneman and Tversky (1979) defines utility as not a smoothly increasing function of the level of consumption or wealth but in terms of increase and decrease of wealth relative to a reference level. Kahneman and Tversky (1979) plotted a graph of utility against different outcomes over time; the main features being a kink at the origin, a concave graph of gains and a steeper convex graph for losses. This implies that the value function embodies the concept of loss aversion. In a paper published later, Kahneman and Tversky (1984) define loss aversion as the disutility of giving up an object is greater that the utility associated with acquiring it. Thaler (1980) tops up the loss aversion concept and states that:

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[15] Markowitz, "Portfolio Selection."
[16] Ibid.
[17] Board, *Preferences and Utility*.
[18] Grant and Van Zandt, "Expected Utility Theory."
[19] Kahneman and Tversky, "Prospect Theory: An Analysis of Decision under Risk."
[20] Kalunda and Mbaluka, "Test of Endowment and Disposition Effects under Prospect Theory on Decision-Making Process of Individual Investors at the Nairobi Securities Exchange, Kenya."

"the fact that people often demand much more to give up an object than they would be willing to pay to acquire it"

Kahneman and Tversky (1979) [21]describes the empirical phenomenon of making losses, even small ones, is particularly painful. As discussed earlier, decisions are of three types, normative, descriptive and prescriptive decisions (Simon Grant and Timothy Van Zandt 2007). [22] Kahneman and Tversky (1979)[23] argue convincingly that normative decision approaches are doomed to failure, because people routinely make choices that are simply impossible to justify on normative grounds, in that they violate dominance and invariance. Unlike the linear value functions generated from the Expected Utility Theory, the value function of this theory is consistent with the way people perceive attributes such as brightness, loudness or temperature relative to earlier levels (Kalunda and Mbaluka 2012).[24] The interpretation of the value function allows concluding that losses hurt more than gains satisfy, implying that decision makers will be risk averse when choosing between gains and risk seeking when choosing between losses. Prospect theory, according to Ritter (2003) focuses on changes in wealth, whereas expected utility theory focuses on the level of wealth. Gains and losses are measured relative to a reference point.

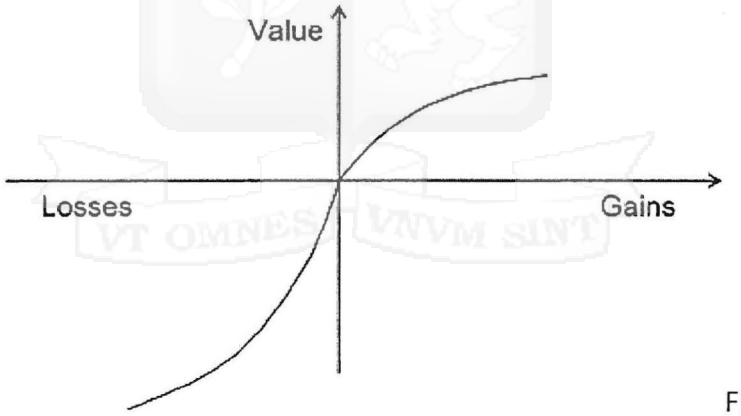

Figure 1.1

[21] Kahneman and Tversky, "Prospect Theory: An Analysis of Decision under Risk."
[22] Grant and Van Zandt, "Expected Utility Theory."
[23] Ritter, "Behavioral Finance."
[24] Kalunda and Mbaluka, "Test of Endowment and Disposition Effects under Prospect Theory on Decision-Making Process of Individual Investors at the Nairobi Securities Exchange, Kenya."

Simon Grant and Timothy Van Zandt (2007) [25]Suggests that each decision by a rational investor is static and independent of any past decisions with regards to the past and the other decisions in the future. The paper continues to site that the decision maker, Anna, has a bunch of choices together in a choice set and from it, she uses a choice rule to make a decision. The choice set is a non-zero set, which implies that the investor has to make a decision. The choice rule gives rise to the investor's preferences or the choice rule is derived from the investor's preferences.

The decisions made are a combination of considerations made from all information available in the market and due to the uncertainties of outcome, a compensation for any risks associated with the decision is added in form of a risk premium. Research on judgment and decision making under uncertainty, especially by Daniel Kahneman and Amos Tversky (1974), [26]has shown that such mental illusions should be considered the rule rather than the exception. Systematic, predictable differences between normative models of behavior and actual behavior occur because of what Simpson A. (1957) [27]called 'bounded rationality':

The critics of the expected utility theory suggest that merely assigning a probability weighting to a utility is too simplistic of an approach to risk (Rabin and Thaler 2001).[28]

2.1.4 LOSS AVERSION

This describes a scenario where more utility is lost when losing an amount of money than the utility that is gained when obtaining the same amount of money in regards to the initial wealth w. Tversky and Kahneman (1992)[29] suggest that in the domain of money the people value a loss roughly twice a same size of gain. This asymmetry in the valuation is called loss aversion.

Theoretical papers such as Ang. Bekaert and Liu (2004)[30] , Barberis Huang and Thaler (2006)[31], Berkelaar, Kouwenberg and Post (2004)[32], Gomes (2005)[33], and Polkovnichenko (2005)[34] further explain loss aversion as a frame for events as either gains or losses relative to a reference point. In

[25] Tversky and Kahneman, "The Framing of Decisions and the Psychology of Choice."
[26] Ibid.
[27] Rabin and Thaler, "Anomalies: Risk Aversion."
[28] Ibid.
[29] Tversky and Kahneman, "Advances in Prospect Theory: Cumulative Representation of Uncertainty."
[30] Berkelaar, Kouwenberg, and Post, "Optimal Portfolio Choice under Loss Aversion," 2004.
[31] Barberis, Huang, and Thaler, "Individual Preferences, Monetary Gambles, and Stock."
[32] Berkelaar, Kouwenberg, and Post, "Optimal Portfolio Choice under Loss Aversion," 2004.
[33] Gomes, "Portfolio Choice and Trading Volume with Loss-Averse Investors."
[34] Kaustia, "What Causes the Disposition Effect? An Empirical Evaluation."

equity trading for example, if an individual investor is risk-averse over gains, an individual, for example should sell a stock that is trading at a gain anchored to the purchase price; and the individual is risk seeking over losses they should be inclined to hold on a stock that is trading at a loss (Kahneman and Tversky 1979)[35]. Huddart, Lang, and Yetman (2009)[36] find that trading volume and return patterns change as recent highs are approached for seasoned issues, and Kaustia (2004) [37] finds that trading volume behavior changes as IPOs reach new maxima and minima. Barberis and Thaler (2003) [38]argue that the extent of loss aversion will influence the frequency with which investors evaluate their portfolio. Active investors or active investment managers; those that evaluate their portfolio frequently are more loss averse. Consequently, they will allocate less of their wealth in equities. They call the combination of loss aversion and frequent evaluations myopic loss aversion.

2.2 EMPIRICAL FRAMEWORK

To investigate the actual presence of cognitive biases, some studies have introduced questionnaires to random individuals with an intention of understanding the decision making process that eventually generates the final decision. These studies that include Rabin and Thaler 2001)[39] and Kalunda and Mbaluka (2012) [40]use qualitative data that is in form of questionnaires in order to obtain first hand data from respondents. Amongst them, Rabin and Thaler (2001) [41]presents a questionnaire to respondents containing one of the most common questions asked to the respondents that involves a gamble between gaining some certain amount above the initial wealth w now with certainty or a possibility of gaining a further increased gain onto the initial wealth at a later date or a possibility of losing a certain amount below the initial wealth w. The empirical findings of this questionnaire were as follows:

(1) Gains are treated differently than losses; except for very small probabilities, risk seeking is observed for losses while risk aversion is observed for gains.

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[35] Gomes et al., "A New Distribution System Reconfiguration Approach Using Optimal Power Flow Technique and Sensitivity Analysis for Loss Reduction."
[36] Grinblatt and Han, "Prospect Theory, Mental Accounting, and Momentum."
[37] Barberis, Huang, and Thaler, "Individual Preferences, Monetary Gambles, and Stock."
[38] Rabin and Thaler, "Anomalies: Risk Aversion."
[39] Kalunda and Mbaluka, "Test of Endowment and Disposition Effects under Prospect Theory on Decision-Making Process of Individual Investors at the Nairobi Securities Exchange, Kenya."
[40] Rabin and Thaler, "Anomalies: Risk Aversion."
[41] Ibid.

(2) Outcomes received with certainty are over-weighted relative to uncertain outcomes.

(3) The structure of the problem may affect choices.

This study, in reference to loss aversion and Prospect theory in general concludes similarly. However, the study by Rabin and Thaler (2001) [42]final empirical conclusions of the paper is not investing in the stock exchange, particularly in the NSE. This is solved by the application of the conclusions made by Kalunda and Mbaluka (2012)[43] that are based on decisions made with regards to the NSE.

2.3 DISCUSSION OF WORKS

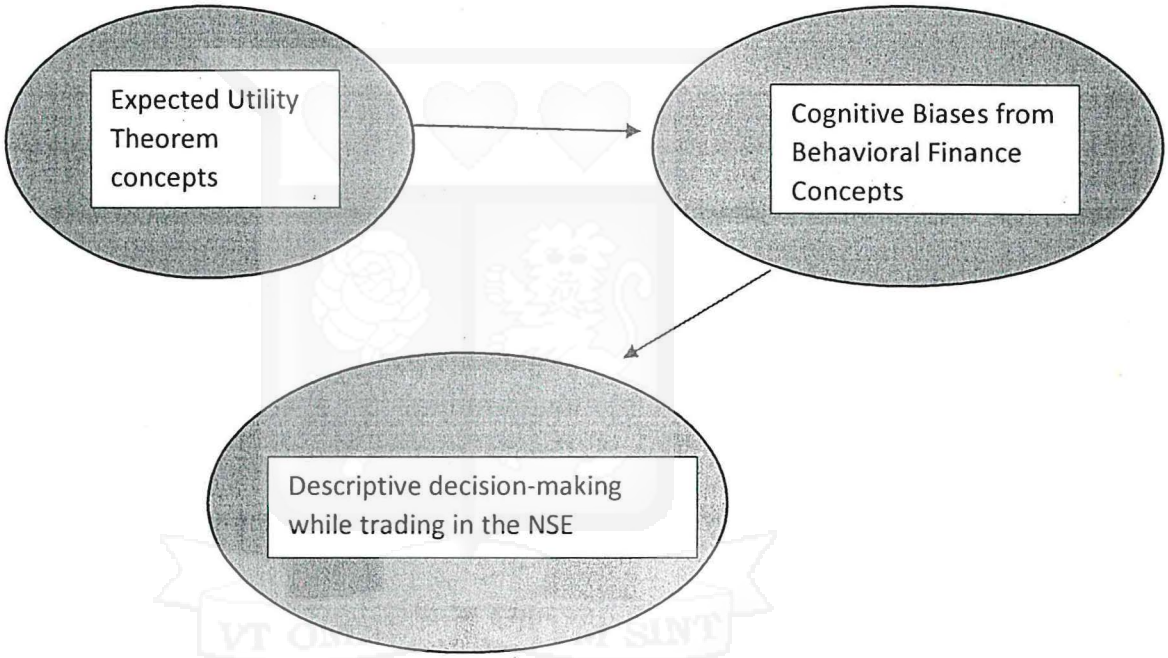
This study focuses primarily on the concepts of investments discussed by Markowitz (1952)[44] and Kahneman and Tversky (1979)[45]. Its application of these concepts especially to the Stock Exchange, the NSE is driven form the findings of a Kenyan paper, Kalunda and Mbaluka (2012)[46] offers a better quality of conclusions since the study presents a set of decisions based financially and primarily on the Kenyan index. The second paper that this study uses is the Rabin and Thaler (2001) [47]study.

In comparison, Kalunda and Mbaluka (2012)[48] illustrates the decision problem presented to respondents in form of a questionnaire as similar to that of Rabin and Thaler (2001)[49], where the individual is presented with a gain and in the second scenario, the individual is presented with a possibility of loss; a gamble but both scenarios were identical in terms of their final wealth. It further goes on to describe that a fully rational decision maker would treat the two decision problems as identical because they were identical when formulated in terms of states of wealth. The inconsistencies found in the choice of investment are presented as signs of loss aversion, a

[42] Kalunda and Mbaluka, "Test of Endowment and Disposition Effects under Prospect Theory on Decision-Making Process of Individual Investors at the Nairobi Securities Exchange, Kenya."
[43] Markowitz, "Portfolio Selection."
[44] Tversky and Kahneman, "Advances in Prospect Theory: Cumulative Representation of Uncertainty."
[45] Kalunda and Mbaluka, "Test of Endowment and Disposition Effects under Prospect Theory on Decision-Making Process of Individual Investors at the Nairobi Securities Exchange, Kenya."
[46] Rabin and Thaler, "Anomalies: Risk Aversion."
[47] Kalunda and Mbaluka, "Test of Endowment and Disposition Effects under Prospect Theory on Decision-Making Process of Individual Investors at the Nairobi Securities Exchange, Kenya."
[48] Rabin and Thaler, "Anomalies: Risk Aversion."
[49] Ibid.

concept that this study also explains. The paper also however differs from this study since it tests for Framing Effect, a concept of Behavioral Finance that decisions made by investors are affected by the way they scenario is presented to them (Ritter 2003). This study also draws conclusions with attention to gender, specifying how many respondents were either female or male while the paper by Rabin and Thaler (2001) [50]treats the individual investor without knowledge of their gender. In this way, this study and Rabin and Thaler (2001)[51] are similar.

2.4 CONCEPTUAL FRAMEWORK



[50] Ibid.

[51] Kahneman and Tversky, "Prospect Theory: An Analysis of Decision under Risk."

3 METHODOLOGY

The methodology part of this paper is aimed at outlining the process and methods to which analysis will be carried out. This includes the research design, population and sample that the study focuses on, the data source, methodological approach and data analysis methods

3.1 RESEARCH DESIGN

This is the overall strategy that will bring the components of this study together in a manner that best addresses the research problem.

In this case, the study is descriptive in nature since the study seeks to come up with a fact from a set of assumptions and variables. Its major purpose is to define the state of affairs in the present times. It is from this definition that the study seeks to define the decisions made by investors in the Stock Exchange are descriptive rather than normative, that is, that the investor is not just rational in their decision patterns, but is also susceptible to cognitive biases and more susceptible to the assumptions of loss aversion that Prospect Theory presents.

3.1.1 POPULATION AND SAMPLING

3.1.1.1 POPULATION

The population of this study is the share prices for Safaricom Stock; one of the 67 listed companies in the exchange. The prices chosen for consideration begin the 9th of June 2008 and onwards for 280 business days in the year that followed the commencement of the trades. The study groups the prices into 40 day cohorts to generate 7 cohorts.

The purpose of choosing this particular time frame is the fact that the Safaricom IPO and the shares began trading on this day. The cohorts are divided into 7, 40-day cohorts because the highest fluctuations are experienced in the first 40 days and they stabilize for the remaining 240 days. This implies that the market is driven by investors' behavior and expectations as well as the trends of investors' decision making patterns.

3.1.1.2 SAMPLING

The study took on a quasi-experiment which by definition is a study that is used to estimate the causal impact of a variable on a target population without random assignment. This study takes on this approach since its aim is to demonstrate that cognitive biases cause certain investors to invest

in certain stocks, the effect of this behavior and the benefits of using these assumptions in their investment decisions.

3.1.2 DATA SOURCE

The data used in this study is both Primary and Secondary Data.

The secondary data is obtained from the NSE and the prices for the Safaricom Stock over a period of 10 years. The stock prices considered are as of 9th June 2008; for 280 days thereafter. The prices are assumed to represent a perfect market price in that the prices cannot be manipulated and the participants are assumed to be well-informed. It is from these prices and their fluctuations within the defined period that the study generates evidence of the biases that Behavioral Finance concept illustrates.

The Primary data used is from a questionnaire that is specifically structured to show evidence of a maximization of utility as well as an adjustment to the assumptions of Prospect Theory- loss aversion.

The advantage of using both the secondary data and primary data is that the secondary data from the Safaricom stock provides the analysis in the past while the questionnaire shows evidence of the same trends in current time. Primary data is also used to ease the assumption on the Perfect market since the data collected overlooks this assumption. It is in its place, clean and directly obtained from a human sample, making it most reliable for showing cognitive bias.

3.2 METHODOLOGICAL APPROACH

3.2.1 DATA ANALYSIS

3.2.1.1 BASIC PROSPECT THEORY MODEL

The linear model from Kahneman and Tversky (1979)[52], Unlike Markowitz (1952), describes the investor's decision as being based on the changes of wealth as opposed to total wealth independently. Assuming that the individual has an initial wealth w will value a prospect (x, p; y, q) as

[52] Markowitz, "Portfolio Selection."

$$E(U) = U(W) + pU(w \pm x)$$

Where $U\ (W)$ = the satisfaction an investor gets from investing

$U(w \pm x)$ = the satisfaction of gains/losses of investment X

p = the probability of change in wealth from additional investments

This implies that the total satisfaction of an individual is the sum of current utility from investing the initial wealth and the utility change from a change in wealth; measured by x with a probability of p.

The sample of investors are assumed to be rational investors and they aim to maximize their utility and any further investment is made with an aim at making profits rather than losses. The initial investment is assumed to have been in the Safaricom Stock upon trading commencement on 9th June 2008 and the additional investment is in any of the other 66 stocks listed in the NSE. The basis of the assumption that all investors are rational is based on the Markowitz (1952) assumption. The additional investment is based on the loss aversion assumption that suggests that the investor will invest into a stock that stands to make him/her the most gains.

The study also assumes that the utility of any given investor is an increase in the price of a specified stock within the NSE. This is because retention of the stock over a day's period earns the investor the change in price that day. The returns are therefore the total gains the same investor obtains in the period for which they retain the stock.

3.2.1.2 TIME SERIES ANALYSIS

This study considers prices of the Safaricom stock from the NSE with a specific analysis of a period of 280 business days; commencing 9th of June 2008. The prices are the closing stock prices for each of the 280 business days. From this, the time series model is applied to the deterministic data points to examine the trends in data as well as to select which summary statistics to apply for the analysis; amongst which are mean, variance, standard deviation and correlation coefficient. The graph also determines the cohort that the study will consider and the reason for the time frame each cohort is divided into. This is dependent on the fluctuations and their degree as well as the time the prices take to stabilize. The time that the price of the Safaricom Stock is unstable is the

time that the investors' decision making processes show patterns: seasonal patterns and cyclic patterns. A template example of the plot would be:

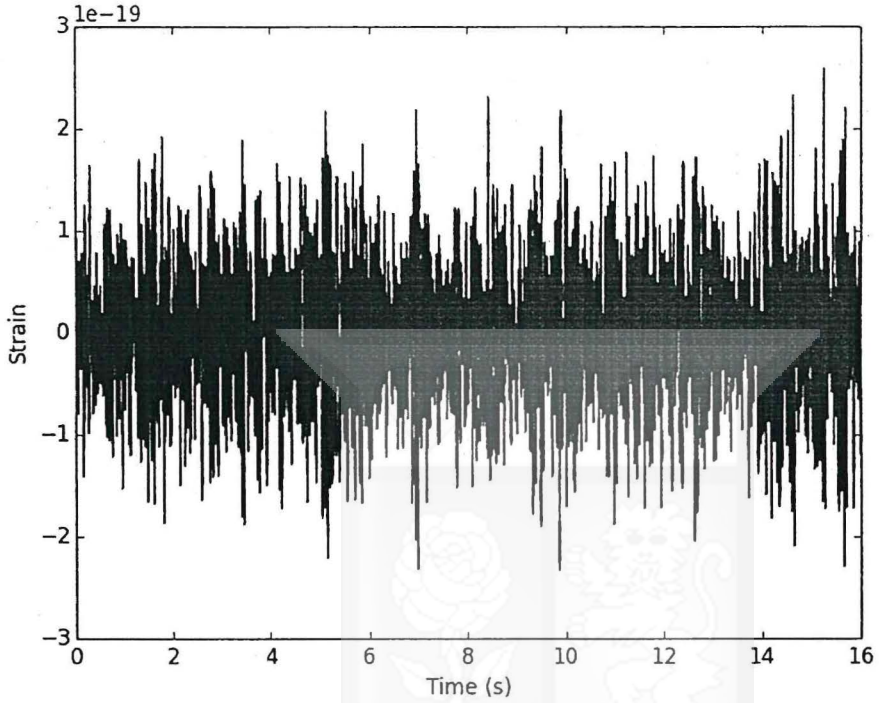


Figure 1.2

Where the time would be in days along the X axis and the closing price for each day for a particular stock on the Y axis.

3.2.1.3 SIMPLE ANOVA TEST

Let the Correlation Co-efficient between cohorts be noted by $\rho_{x,y}$ and let the correlation coefficients be for all cohorts; 1-7

$$\rho_{1,2}, \rho_{2,3} \cdots \rho_{6,7}$$

Let the null hypothesis in this case be that the correlation co-efficient between any two cohorts be equal be 0. This means that the cohorts exist independently; they do not have any relation to each other. In addition, let the alternative hypothesis be that the correlation co-efficient between any two cohorts is not equal to 0.

$$H_0: \rho_{x,y} = 0$$

$$H_a: \rho_{x,y} \neq 0$$

The test assigns a certain significance value to the data. This study assigns the Safaricom Stock data on closing prices a significance of 0.05. The study also uses the Anova test due to the following advantage:

- ✓ The test is used for data that is not normally skewed and can therefore be easily applied to the volatile Safaricom stock prices.

3.2.1.4 SOFTWARE USE

Several software can be used to analyze data so as to it to give the desire output in terms of time series generation and the ease of generating the summary statistics using the formulae built into the software or from codes that can generate the same. This include Microsoft Excel, R Software and Minitab.

3.2.1.5 SOFTWARE SELECTION

This study adopts the use of Ms. Excel for the analysis of secondary data since it is the standard software used for financial forecasting, budgeting and data entry. Other advantages include:

1. It easily accommodates large amounts of data that can quickly and easily be organized and presented in charts

2. Ease of data entry and formatting

3. Excel can be used for analysis and decision making.

4. Calculations are easily done in excel especially since it does not require complex coding for the execution of specific calculations as would be required in Minitab and R software

5. Excel sheets can easily be transferred to word documents in case documentation is necessary of the manipulations or analysis of the data, especially since this study is draws theoretical conclusions from numerical data.

6. Excel has built in formulae that have definitions for the components that make computations easy and very accurate.

7. Ms. Excel also has a help option that assists in understanding the formulae inputs as well as the outputs and how to interpret them.

However, the software's short-comings include:

1. Entering data into excel manually can be very time consuming and tedious especially in the event that the data is large, especially for data that has daily entries such as that of the daily stock prices from the NSE

2. Excel has no means what so ever of automatically checking for human error in the event that the user makes a mistake, Excel will overlook it and execute as per the will of the user. This mistake could greatly distort the data or the computations/manipulations/analysis that stem from it.

4 DATA ANALYSIS AND RESEARCH FINDINGS

4.1 INTRODUCTION

In this chapter the results of the data are presented. Data was collected in relation to the research questions; the study seeks to investigate the application of Prospect theory assumptions while investing in the NSE and to show the benefits of application of the same by investors seeking to invest in future. The study was successful in this investigation and the findings demonstrated in this chapter indicate the same.

The study took on a quasi-experiment where its aim was to demonstrate the cause of certain investors to invest in certain stocks and the effect of this behavior and thereafter, accessed the benefits of expressing these assumptions in their decisions. Therefore to test whether investment decisions exhibited loss aversion while trading shares at the Nairobi Securities Exchange (NSE), this study accessed a select group of 11 investors in the NSE. The investors were required to fill in a semi-structured, 10-question questionnaire that was sent on WhatsApp, e-mail and text message from 10th November to 20th November 2017. The questionnaire consisted open-ended and closed- ended questions with an aim of providing more accuracy by mimicking an interview, where the respondent has more room to express themselves fully. The questions in the questionnaire were aimed to test whether investors have made losses in the past in a certain stock, whether they have proceeded to hold onto the stock or discarded it after the losses and if given a chance to reinvest in any stock in the NSE to-date, which stock they would choose and why.
The study also accessed the prices of a stock within the companies listed in the NSE, Safaricom. The choice of the stock was based on the fact that 50% of the respondents had the stock in their portfolio or suggested that they would purchase the stock given the opportunity to do so at the time of the study; exhibiting a bias to it.

4.2 DATA ANALYSIS PROCEDURE

Data was obtained from 11 respondents and the response was 100%, with 72.7% Male and 18.2% Female and 9.1% preferring not to say. Out of the 11 respondents, more than 50% of them had received an education level above the Diploma stage, showing a satisfactory level of competency that is required for an investor to make rational decisions. The study was also confined to respondents that were aged 18-40 years of age. The digital questionnaire circulated amongst the

students of Strathmore University and employees of the financial sector in Kenya. It was purposely refrained from circulating among Stock Brokers since they were assumed to be trading with an objective to make profit or to outperform the market, hence negating any cognitive biases that the non-professional investor has. The study also failed to consider stock brokers because they are third party participants; where the first party is the NSE and the second, the investor. The study revealed that 100% of the investors had invested in the NSE for less than 5 years.

Atypically, the study did not consider the time period that transactions had been made within the past 5 years because it is assumed that the investors had all invested once in the period and had held on to the stocks for the period up to the date the study was carried out. The questionnaire did however offer the investor the opportunity to hypothetically invest in the NSE as at the date of the study and to state their reasons for doing so.

The study also undertook a quantitative analysis on the Safaricom Stock. This was as a result of the responses from the questionnaire. The study looked at the stock from the day it started trading on 9th of June 2008 and analyzed and the shifts in the prices over 280 business days in the year that followed the commencement of the trades. The study grouped the prices into 40-day cohorts. This was based on the conclusions made from a bar graph that was plotted for the 7 cohorts chosen.

4.3 DISCUSSION OF FINDINGS

The study revealed that aside from the rationality that investors, they are influenced by their own bounded rationality as explained by Kahneman and Tversky. This is constant for individuals over time. It is from this that a cross-section was established where the study generated the behavior of investors in the past as well as the current investors; in real time.

The first cross-section generated the following graph and summary statistics:

Summary Statistics	1	2	3	4	5	6	7
Mean	6.93	5.35	3.87	3.45	2.95	2.86	3.14
Variance	0.396872	0.119674	0.186381	0.024674	0.042976	0.010253	0.109503
Standard Deviation	0.629978	0.345939	0.431719	0.157079	0.207306	0.101257	0.330912
Correlation Coeffecient	0.798337	0.294327	0.159736	-0.58484	0.598247	-0.44216	

Table 1.1

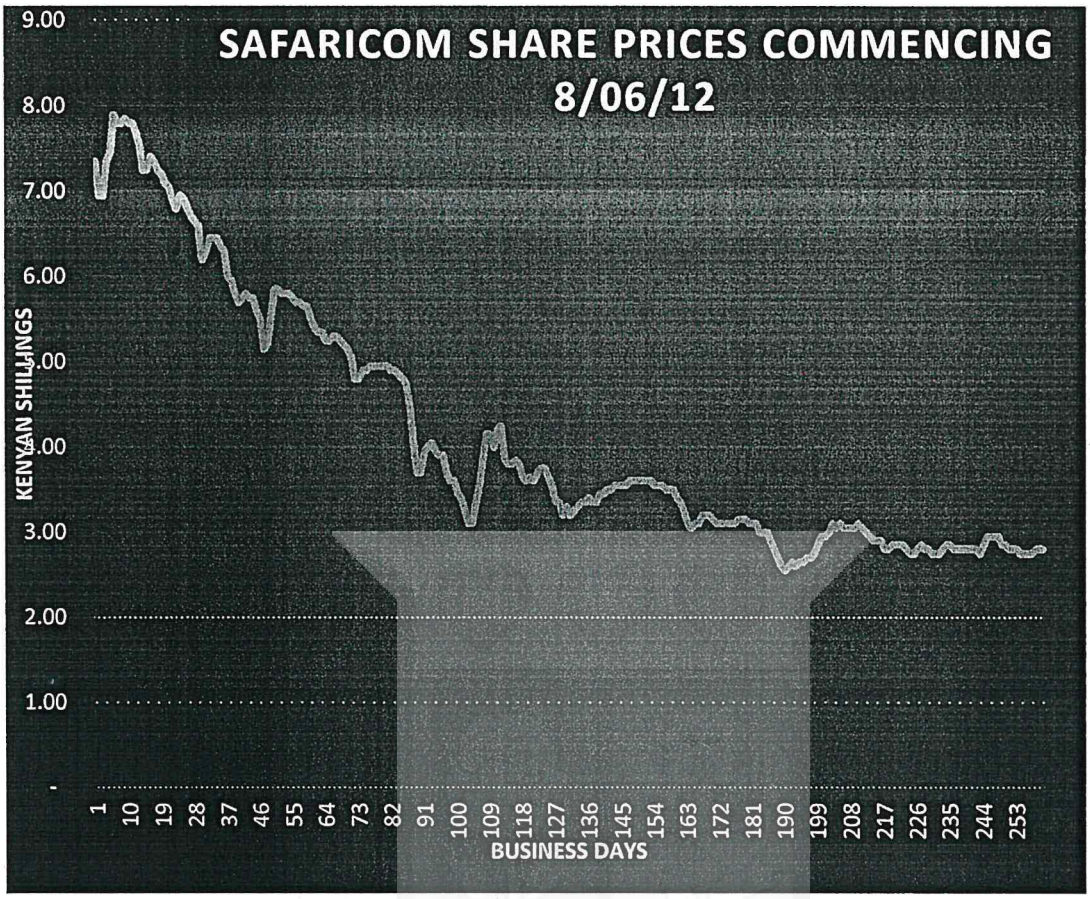


Figure 1.3

According to the table, the first cohort has the highest mean price of the seven cohorts. This is explained under the Law of Supply and Demand, the price was highest because of the high demand of the Stock shortly after it became a publicly traded stock. The cognitive biases in this case are assumed to transverse time and generations of investors therefore the demand in this case is caused by the wrong perception of investors of high value based on popularity.

The table also indicated that the variance is highest in the first cohort as compared to the 6 other cohorts. This indicates that the volatility of the price of the Safaricom Stock is highest in the initial stage of trade commencement. The study concluded that this was caused by the new investors whose movements are best analyzed since the market has not stabilized. According to the graph, the price fluctuated most at Cohort 1.

This is seen in the perception that the Safaricom Stock is the highest valued stock and therefore offers the highest returns. This was concluded from Question 10, where most of the investors would reinvest in the Safaricom Stock based on the fact that it is popular because of the perception that people have of it as high-valued stock.

According to the table, the coefficient of correlation for Cohorts 1, 2 and 3 are positive and the ones for 4, 5, 6 and 7 are negative. This implies that regardless of the fluctuations of the price of the stock, it generally moves in opposite directions within the period stated. The changes in the movements is due to stabilization of the market which can be viewed from Cohort 2 going onwards.

In order to determine the significance of the Correlation Co-efficient, a hypothesis test was performed. The null hypothesis was that the Correlation co-efficient was equal to 0 while the alternative hypothesis was that the correlation co-efficient was not equal to 0. An anova test was carried out and the following was what was obtained:

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	565.91277	6	94.318795	741.55633	0.05	2.131028
Within Groups	35.61329268	280	0.12719033			
Total	601.5260627	286				

Table 1.2

The p-value assigned is the level of significance which is this case 0.05. The F crit value is lower than that of the F value implying that we reject the null hypothesis therefore the linear relationship represented by the correlation co-efficient in the sample data is significant and can be used to represent the linear relationship of the population.

5 SUMMARY, CONCLUSIONSAND RECOMMENDATIONS

5.1 INTRODUCTION

The following is what this chapter considers: a summary of the research findings, conclusions, recommendations and the limitations of the study.

5.2 SUMMARY

The objective of this study was to first investigate the superiority of the Prospect Theory assumptions over the expected utility principles, to show evidence of the same in investors as they invest in stocks listed in the NSE and the benefits of investing under the same superior principles. First, the superiority of applying Prospect theory in investing was proven in the Literature Review of this study; where descriptive decision making was universally accepted to be superior to normative and prescriptive decision making.

The investors were therefore all assumed to make irrational decisions when it came to their initial investments. This was shown in the analysis of the Safaricom stock for 280 business days, an equivalent of a year (inclusions of public holidays, weekdays and weekends) commencing the 9th of June 2008. This period was selected for analysis because it was the earliest stage that the company began being publicly traded. The most significant bit of this study is the first cohort of the 7, 40-day cohorts; when the prices show the highest levels of variance. This is assumed to be the representation of the irrationality in the investors' decision making patterns. The first cohort has the highest measure of risk; the standard deviation standing at 0.6800. The movements in price in the first cohort represented the non-mean-reverting phase while the price changes in the subsequent stages represented the mean-reverting phase. The state of 'non-mean-reversion' is what this study concluded to be the evidence of loss aversion and the cognitive biases associated with it.

This was further portrayed through loss aversion characteristics noted from changes in wealth. This reaction was seen from the primary data collected from the questionnaire distributed to the 11 respondents that the study analyzed. All the respondents had previously invested in the NSE and when they were asked if they had an opportunity to discard the loss making stock, they responded yes and in place of the loss making stock, they would invest in a stock that they would make profits from. The study also found an unusual bias for the Safaricom stock amongst the

respondents. Despite having other higher-return-generating stock, the respondents opted to invest in the stock. The reasons for this was largely due to a wrong perception that the stock has the highest value.

5.3 RECOMMENDATIONS

The study therefore concluded that, from empirical evidence, the secondary data and the primary data collected from a sample of respondents that the Prospect Theory assumptions are superior to the assumptions of Expected Utility Theory because cognitive biases do exist in investors that invest in the NSE. It is therefore recommended that any investors actively overcome their own bias behavior so as to maximize satiety from the investment in the stocks in the NSE.

5.4 LIMITATIONS OF THE STUDY

The study portrays the following major limitations:

- ✓ The assumption that the Safaricom price movements in the period after 9th June 2008 are representations of weaknesses in the rationality of human thinking
- ✓ The price considered is the closing price yet the prices for stock fluctuate throughout the day
- ✓ The study also considers a sample of 11 respondents in a pool of over 500,000 investors

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APPENDIX 1:QUESTIONNAIRE

1. Are you male or female? _____

2. What is the highest level of education you have received?

   a) Primary School _____

   b) Secondary School _____

   c) Diploma/Certificate _____

   d) College _____

   e) University Degree _____

   f) Masters _____

   g) PHD _____

3. Do you hold investments in the Nairobi Securities Exchange?

_____

4. How long have you been an active investor in the Nairobi Securities Exchange? _____

5. What are the top 3 securities in your portfolio?

_____

_____

_____

6. What led to the decision to invest in this/these particular stock? (a minimum of 1 response and a maximum of 3 responses required)

_____

_____

_____

7. In the time that you have held on to the stock, have you made any losses in terms of the decline in the security price? _____(with regard to any of the stocks listed above)

8. Assume that the security had not declined made losses, would you have let it remain in your portfolio? YES/NO _____

9. If given an option to revisit your initial decision to invest in the Nairobi Securities Exchange, which security will you opt for currently? (This is based on the current 67 companies listed on the Securities Exchange) _____

10. What is the reason for your answer in (7) above?

a) Highest Value

b) Advice from a friend/family member

c) New merger/acquisition that may increase its value

d) Popularity