EXTREME RISK AND THE PERFORMANCE OF FIRMS LISTED IN THE NAIROBI SECURITIES EXCHANGE

BY

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DECLARATION

This project report is my original work and has not been presented for award of any degree in any university.

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This project report has been submitted for examination with my approval as the University Supervisor.

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DEDICATION

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ABSTRACT

The purpose of the study was to establish the relationship between extreme risk and the performance of firms listed at the Nairobi Securities Exchange. Extreme risk is a potential risk that is very unlikely to occur but that could have a significant impact on economic growth and assets returns, should it happen. During the period 2004 to 2015, Kenya experienced a spate of extreme events including the post-election violence which paralyzed operations at the NSE, effect of financial crisis experienced in Europe leading to mass exodus of foreign investors, several terrorism attacks among others. The study adopted a descriptive research design. The population comprised of the 62 firms listed at the NSE as at 31 December 2014. GEV and GDP distributions were used to model the extreme risk. The key finding of the study is that there is a positive and significant correlation between extreme risk and firm performance. However some counters, for instance Nation Media Group, are more prone to extreme risk than others. Such findings are critical to investors at the NSE since a carefully selected portfolio can minimize unsystematic risk. The study recommends further study as to why some counters are more adversely affected than others during the period of same extreme risk.

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LIST OF ACRONYMS

AOI	All Ordinaries Index
ARMA	Autoregressive moving average
ATS	Automated Trading System
AUD	Australian Dollar
CBK	Central Bank of Kenya
EMH	Efficient Market Hypothesis
EPS	Earning Per Share
EVT	Extreme Value Theory
GEV	Generalized Extreme Value
GDP	Gross Domestic Product
GPD	Generalized Pareto Distribution
MSM	Muscat Securities Market
NASI	NSE All Share Index
NSE	Nairobi Securities Exchange
PEV	Post Election Violence
POT	Peak Over Threshold
QFIIs	Qualified Foreign Institution Investors
ROA	Return on Asset
ROE	Return on Equity
RWH	Random Walk Hypothesis
S&P	Standard and Poor
TGARCH	Threshold Generalized Autoregressive Conditional Heteroscedasticity
TSE	Taiwan Stock Exchange
U.S.	United States
VaR	Value at Risk

CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

Risk is defined as the chance of an adverse event depending on the circumstances Hayes, Perry &Thompson, 1986). It arises out of uncertainty and is an inherent part of existence. It is the chance of something happening as a result of hazards or disasters which have an impact on communities and the environment (Love &Rachinsky, 2007). It is measured in terms of the likelihood of it happening and the consequences of it happening, even if attempts have been made to reduce the effect it has on communities (Bali, 2007). A risk is considered as extreme if the potential event's occurrence is very unlikely but if it occurs, it could have a significant impact on economic growth and asset returns (Castillo, 2008). The occurrence of such extreme risk events negatively affects the financial performance of firms (Mcneil, Frey &Embrechts 2005.

The study is anchored on three theories including the efficient market hypothesis which states that at any given time and in a liquid market, security prices fully reflect all available information (Fama, 1960).An efficient market is defined as a market in which securities' prices fully reflect all available information. The second theory is be the Random Walk Hypothesis (RWH)which states that stock market prices evolve according to a random walk and thus cannot be predicted and finally the chaos theory which studies complex, nonlinear, dynamic system that reconciles the essential unpredictability of industries with the emergence of distinctive patterns (Cartwright, 1991).

Risk is the probability or chance that the hazard poses. Thus, it can be minimized by preparing a suitable risk management strategy. Risk and uncertainty are part of all transactions in investment especially at a security market because of the many challenges posted by the operating environment (Coronado, 1996).The impact of a risk can be measured as the likelihood of a specific unwanted event and its unwanted consequences or loss.

The firms listed at the Nairobi Securities Exchange have faced several extreme risk events that have occurred in Kenya. First, the post-election violence which paralyzed

operations at the market (CMA, 2015). In addition, the violence reduced much of the gains that the market had registered leading to reduced activity especially in the primary market. The market again immediately faced the financial crisis experience in Europe leading to mass exodus of foreign investors. In the year 2013/2014, the market was faced with increased effects of terrorism activities. All these events among others have affected the performance of firms listed at the NSE (NSE, 2015).

1.1.1 Extreme Risk

Extreme Risk is a potential event that is very unlikely to occur but that could have a significant impact on economic growth and asset returns, should it happen (Barnett, 2001). A robust risk management approach should not stop at a particular and a holistic risk management framework but should include very unlikely, but potentially high impact, events since extreme risk matters (Bali, 2007). Extreme risks are categorized into three groups: financial, economic and 'other'. The Financial category of extreme risks concerned an inability to meet liabilities (Coronado, 1996). This could occur as a liquidity event, as a banking crisis, where an institution has insufficient cash or other liquid assets to meet a current demand for payment, even if the institution has more assets than liabilities (Hayes, Perry, and Thompson, 1986).Failure to make that payment could cascade rapidly through the financial system, with further institutions then unable, or unwilling due to a collapse in trust, to meet their own payment demands (Garrick, 1987). The alternative mechanism for a financial extreme risk is a solvency-driven crisis, such as an insurance crisis or sovereign default; where there are insufficient assets to meet the liabilities irrespective of how liquid the assets are (Coronado, 1996). This does not preclude the possibility that a solvency crisis could lead to a liquidity crisis or vice versa.

Economic extreme risks are less homogenous, ranging from a deflationary depression to hyperinflation and end of fiat money. These risks would have their genesis in imbalances, which create instability. Imbalances could be seen all around us - household debt relative to income, government such debt relative to GDP, government revenue relative to expenditures, imports relative to exports, foreign reserves and, perhaps, the size of the financial sector relative to the economy in certain countries (Garrick, 1987). While the correction of imbalances can occur smoothly there is plenty of potential for non-linear, and therefore painful, jumps,

including a currency crisis or resource scarcity (Coronado, 1996). 'Other' extreme risks related to environmental and political themes. Climate change, major war, Euro break-up, political crisis, infrastructure failure, protectionism and killer pandemic were included in this group.

1.1.2 Firm Performance

Parrenas (2005) defines performance measurement as a way of ensuring that resources available are used in the most efficient and effective way. Performance Measures are quantitative or qualitative ways to characterize and define performance. These outcomes vary along a continuum of categories such as: financial measures (ROA, ROI, Turnover, PBT); measures of output of goods and services such as number of units produced, number of clients attended to, number of errors in the process, customer satisfaction indexes or; measures of employee satisfaction such as time an employee puts into work - lateness, absence of an employee (Locke & Latham, 1990). The essence is to provide for the organization the maximum return on the capital employed in the business. This term is also used as a general measure of a firm's overall financial health over a given period of time, and can be used to compare similar firms across the same industry or to compare industries or sectors in aggregation.

There are many different ways to measure financial performance, but all measures should be taken in aggregation. Some of the indicators of financial performance are return on equity liquidity ratios, asset management ratios, profitability ratios, leverage ratios and market value ratios. Carreta and Farina (2010) argue that use of financial performance could still be justified on the grounds that it reflects what managers actually consider to be financial performance and, even if this is a mixture of various indicators like accounting profits, productivity, and cash flow. Financial performance is determined by the following indicators; profit or value added; sales, fees, budget; costs or expenditure and stock market indicators (in terms of share price) and autonomy.

1.1.3 Extreme Risk and Firm Performance

Negative relationship has been reported on the effects of extreme risks on firm performance. For instance, the earthquake that struck Japan in March 2011 reduced

the supply capacity of the economy, which worked in the direction of tightening the output gap. The general impact of the earthquake on performance of firm was negative though not direct as it worked through other variables (Nakamura, 2011). Efficient Market Hypothesis (EMH) assumes that market prices reflect all available information and expectation, and that any new information is properly incorporated into prices without any delay. Sharp fall of security prices during the turbulent times is a very unique opportunity for testing validity of EMH (Aktas & Oncu, 2006).

Unexpected events can create more stress in the market, and market participants may lose their ability to asses rationally the valuation implications of event (Aktas and Oncu, 2006). Kryzaowski, Switzer, and Jiang (1995) investigated the abnormal return, volatility, and residual risk premium behavior of portfolios during the Canadian stock market crash of 1987. One of their findings is that the performance of beta-sorted portfolios over various time intervals around the crash is inversely related to systematic risk. Maloney and Mulherein (2003) provided evidence on the speed and accuracy of price discovery by studying stock return and trading volume surrounding the crash of the space shuttle Challenger. They showed that price discovery occurred without large trading profits and much of price discovery occurred during a trading halt of the firm responsible for faulty component.

Risk in financial terms is usually defined as the probability that the actual return may differ from the expected return (Howells & Bain, 1999). In the financial system, there are at least three broad categories of risks, financial risk, business risk and operational risk. For the case of stock markets, the prices existing reflects all the publicly available information in a semi efficient market while in a strong form, the prices reflect all the available information both public and private (Hayes, Perry, &Thompson, 1986). Therefore, the happening of anticipated extreme risk may have negative effects of the performance of listed companies thereby bring about a drop in share prices.

1.1.4 Nairobi Securities Exchange

The Nairobi Securities Exchange was constituted as a voluntary association of stock brokers registered under the societies Act in 1954 and in 1991 the Nairobi Stock Exchange was incorporated under the companies Act of Kenya as a company limited by guarantee and without a share capital (Kibuthu, 2005). Subsequent

development of the market has seen an increase in the number of stockbrokers, introduction of investment banks, establishment of custodial institutions and credit rating agencies and the number of listed companies have increased over time. Securities traded include, equities, bonds and preference shares (NSE, 2014).

In 1996, the largest share issue in the history of NSE, the privatization of Kenya Airways, came to the market. In May 2006, NSE formed a demutualization committee to spearhead the process of demutualization. In September 2006 live trading on the automated trading systems of the Nairobi Securities Exchange was implemented. In July 2007 NSE reviewed the Index and announced the companies that would constitute the NSE Share Index. The review of the NSE 20-share index was aimed at ensuring it is a true barometer of the market. In 2008, the NSE All Share Index (NASI) was introduced as an alternative index (NSE, 2012). Its measure is an overall indicator of market performance. The Index incorporates all the traded shares of the day. Its attention is therefore on the overall market capitalization rather than the price movements of select counters. The Nairobi Securities Exchange marked the first day of automated trading in government bonds through the Automated Trading System (ATS) in November 2009. The automated trading in government bonds marked a significant step in the efforts by the NSE and CBK towards creating depth in the capital markets by providing the necessary liquidity (NSE, 2014).

In July 2011, the Nairobi Stock Exchange Limited changed its name to the Nairobi Securities Exchange Limited. The change of name reflected the strategic plan of the Nairobi Securities Exchange to evolve into a full service securities exchange which supports trading, clearing and settlement of equities, debt, derivatives and other associated instruments. In September 2011 the Nairobi Securities Exchange converted from a company limited by guarantee to a company limited by shares and adopted a new Memorandum and Articles of Association reflecting the change. In October 2011, the Broker Back Office commenced operations. The system has the capability to facilitate internet trading which improved the integrity of the Exchange trading systems and facilitates greater access to our securities market (NSE, 2014).

1.2 Research Problem

The occurrence of extreme risk events, such as hurricanes and earthquakes, and geo-political events, such as civil unrest financial crisis, elections, terrorism activities

among others affect operations and financial performance of companies. The occurrences of these events signal potential shift in national policy or uncertainty in society development thereby bringing about market-wide valuation influence (Niederhoffer, Gibbs & Bullock, 1970).

Kenya as a country has faced several extreme risk events which may have affected the performance of share prices at the Nairobi Securities exchange. For instance, the country was affected by the financial crisis that occurred in the U.S. in the period 2007 to 2009, at the same period, the country suffered from Post Election Violence (PEV) (Irungu, 2012) and in the year 2014 and 2015, the country has suffered from terrorism activities including the attacks on Westgate and Garrisa University. All these events communicate something to investors and thus inform their investment decisions.

A number of studies have been conducted on extreme risk events and performance of institutions. For instance, Chen, Bin and Chen (2005) studied the impacts of political events on foreign institutional investors and stock returns using emerging market evidence from Taiwan. It was established that price reactions to most of the political events were rather insignificant, implying those events be largely uninformative with only a few exceptions. The abnormal return behaviors were also frequently comparable between firms with small and large foreign institutional ownerships. Irungu (2012) did a study on the informational content of general election results announcement at the Nairobi Securities Exchange and established that general election results carried a lot of information which affected the performance of shares trading at the NSE. Lusinde (2012) reviewed volatility in stock returns of NSE listed companies around general elections in Kenya. The findings revealed that volatility in stock returns of Kenyan listed companies' increases around general elections within which period investors are sensitive to the developing political landscape which then influences their decisions on whether to invest at the NSE or not.

From the above brief literature review it can be seen that few studies if any have been conducted on the relationship between extreme risk and the performance of firms listed at the Nairobi Securities Exchange in Kenya. This study therefore seeks to fill this research gap by answering one research question: How does an extreme risk affect the performance of firms listed at the Nairobi Securities Exchange?

1.3 Research Objective

The objective of the study is to establish the relationship between the extreme risk and the performance of firms listed at the Nairobi Securities Exchange in Kenya.

1.4 Value of the Study

The finding of the study would help the policy makers in the Ministry of National Treasury and the Central Bank of Kenya in developing policies related to regulation of capital market to ensure that they play their role effectively in financial intermediation. This would contribute in formulation of policies necessary to ensure a strong and stable capital market.

The findings of this study is also important to managers at the Capital Markets Authority and the Nairobi Security Exchange in the management of information from extreme events as they will be more informed on the effects of such events of share performance of listed firms.

The scholars and academicians would immensely benefit particularly those interested in carrying out studies on event studies and how they influence share price performance. The study also suggests areas for further studies where future scholars and researchers can further knowledge on besides acting as a source of reference.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of the related literature on the extreme risk and the performance of firms listed at the Nairobi Securities Exchange in Kenya. The chapter is organized as follows: Section 2.2 dwells on theoretical literature on measures of extremes; section 2.3 focuses on empirical literature on various studies on extreme risk and firm performance; section 2.4 gives a summary on the chapter.

2.2 Theoretical Literature

This section reviews the theories that guided this study. Specifically, it reviews theories explaining stock market performance and how it can vary. The section specifically reviews four theories including efficient market hypothesis, the random walk hypothesis and chaos theory. These theories were deemed relevant because of their explanations concerning the variables in this study.

2.2.1 Efficient Market Hypothesis

The efficient market hypothesis states that at any given time and in a liquid market, security prices fully reflect all available information (Fama, 1960). The theory was developed independently by Samuelson and Fama in the 1960s. An efficient market is defined as a market in which securities' prices fully reflect all available information. This implies that when news about the value of a security hits the market, its price should react and incorporate this news quickly and correctly, and the price should neither under reacts nor overreacts to particular news announcements.

The theory of semi-strong form efficiency asserts that all publicly available information is fully reflected in security prices. It is impossible for technical or fundamental analysts to beat the market by exploiting public information. This theory also provides the basic theoretical background in this study. The main purpose of this study is to examine how the markets react to presidential elections (Fama, 1970). This theory is appropriate for this study on extreme risk and performance of financial institutions listed at the Nairobi Securities Exchange because the occurrence of an

extreme risk event communicates some information to the market about future expectations of the business environment. It is this information that investors react to thus affecting the demand and supply of shares and the existing market price of shares.

2.2.2 The Random Walk Hypothesis

The Random Walk Hypothesis (RWH) a financial theory which states that stock market prices evolve according to a random walk and thus cannot be predicted. The importance of the EMH stems primarily from its sharp empirical implications many of which have been tested over the years. Much of the EMH literature before Lerol (1973) and Lucas (1978) revolved around the random walk hypothesis (RWH) and the martingale model, two statistical descriptions of unforecastable price changes that were initially taken to be implications of the EMH (Fama&Blume, 1966). One of the first tests of the RWH was developed by Cowles and Jones (1937), who compared the frequency of sequences and reversals in historical stock returns, where the former are pairs of consecutive returns with the same sign, and the latter are pairs of consecutive returns with opposite signs.

French and Roll (1986) document a related phenomenon: stock return variances over weekends and exchange holidays are considerably lower than return variances over the same number of days when markets are open. This difference suggests that the very act of trading creates volatility, which may well be a symptom of Black's (1988) noise traders.

2.2.3 Chaos Theory

Chaos theory was developed by Lorenz (1963) who was studying the dynamics of turbulent flow in fluids. A chaotic system is one in which a tiny change in initial conditions can lead to a large change in results. It is the study of complex, nonlinear, dynamic system that reconciles the essential unpredictability of industries with the emergence of distinctive patterns (Cartwright, 1991). It is an interrelation between efficient market hypothesis and the random walk theory. This theory is congruous with the postmodern paradigm, which questions deterministic positivism as it acknowledges the complexity and diversity of experience. It argues that firms interact with each other and with other actors in their environment, such as consumers, labor,

the government, and financial institutions who affect the way that an organization operates. Therefore the happenings in the operating environment will greatly influence the performance of the organization (Konrad, 2011).

Chaos theory is a branch of mathematics that, despite its name, attempts to make order out of seemingly random events. Market chaologists have marshaled an array of formulas and computer models but have been criticized for not being able to explain their ideas in practical terms or to demonstrate how to apply these ideas. Fractals are the main mathematical tool of chaos theory (Konrad, 2011).Periods with high uncertainty may be caused not only by the system dynamics, but also by some specific events, such as natural disasters, earthquakes or floods and computers. Most chaotic systems are chaotic because they contain positive feedback (Cartwright, 1991). Positive feedback tends to amplify trends over time, while negative feedback tends to reduce trends over time. Complex systems such as climate and the financial markets have both positive and negative feedback (Konrad, 2011).

2.3 Determinants of Firm Performance

Performance of firms is of vital importance for investors, stakeholders and economy at large because a company's financial performance is directly influenced by its market position. Profitability can be decomposed into its main components: net turnover and net profit margin. If a high turnover means better use of assets owned by the company and therefore better efficiency, a higher profit margin means that the entity has substantial market power. Risk and growth are two other important factors influencing a firm's financial performance. Since market value is conditioned by the company's results, the level of risk exposure can cause changes in its market value. Economic growth is another component that helps to achieve a better position on the financial markets, because market value also takes into consideration expected future profits.

The size of the company can have a positive effect on financial performance because larger firms can use this advantage to get some financial benefits in business relations. Large companies have easier access to the most important factors of production, including human resources. Also, large organizations often get cheaper funding. Total assets are considered to positively influence the company's financial performance,

assets greater meaning less risk. A large volume of sales (turnover) is not necessarily correlated with improved performance. Studies that have examined the relationship between turnover and corporate performance were inconclusive.

2.3.1 Firm characteristics and policies

Certain firm characteristics are associated with high performance of the firm. These include size (Love and Rachinsky, 2007), growth rate, dividends, liquidity (Gurbuz et al., 2010) and sales (Forbes, 2002). The forms that have better growth rate can afford better machinery, and then gradually the assets and size of the firm will increase. Large firms attract better managers and workers who in turn contribute to the performance of the firm. So, both firm and its people support each other's goals.

Although many studies have been conducted on the individual determinants of firm but a very few have modeled all the factors. There is a much larger gap for the developing economies (Maher and Andersson, 1999). A few studies have been conducted in Pakistan on firm performance determinants; one was conducted in 2010 on the effects of capital financing patterns on firm performance. Another study was conducted by Yasser et al. (2011) which investigate the effect of board characteristics on firm performance. Wahla et al. (2012) analyzed the impact of ownership structure on firm performance. There is no study up till now to have modeled various determinants of firm performance for Pakistani firms, this study attempts to fill this gap of empirical research.

2.3.2 Economic Condition

Economic condition of the country can affect a firm's performance on multiple fronts. Cost of borrowings can negatively influence the firm's capability to generate finances and invest in projects (Ntim, 2009). Prices of utilities, high costs associated with plant and machinery due to either deterioration of currency or import costs, high inflation rate and low income level of people can decrease the demand for industrial goods and hence negatively impact the firm's performance (Forbes, 2002).

2.3.3 Extreme Values

Extreme values may be defined as deviations from the median of probability distributions. Extreme values are those that are less than or greater than an upper or a lower bound, that is, outliers or contaminations. They represent the maximum and

minimum of a random variable in a range of observations. However, other extremes such as the second or third of the largest or smallest may be of interest. Extreme value theory (EVT) is a statistical technique that is especially useful in modeling of tail/ extremes of a distribution. EVT focuses on the observations that lie in the tail and attempts to fit a distribution to these observations. It then provides the functionality to extrapolate into unknown areas of the tail. EVT start not from the distribution of returns but from the probability distribution of extreme returns. There are two well-known methods of applying EVT, the Block Maxima approach and the Peaks Over Threshold approach. The Block Maxima Method is the traditional method used to analyze data with seasonality as for instance hydrological data. However, the threshold method uses data more efficiently. The groups of models for threshold exceedances are more modern and powerful than the Block Maxima models (Mcneil, Frey and Embrechts, 2005). The Block Maxima considers the maximum the variable takes in successive periods, for example month or years. The selected observations constitute the extreme events, also called block maxima.

2.3.4 The Generalized Extreme Value Distribution

The Generalized Extreme Value (GEV) distribution is a family of continuous probability distributions developed within extreme value theory. Extreme value theory provides the statistical framework to make inferences about the probability of very rare or extreme events. The GEV distribution unites the Gumbel, Fréchet and Weibull also known as type I, II and III extreme value distributions. The GEV distribution is parameterized with a shape parameter, location parameter and scale parameter. The GEV is equivalent to the type I, II and III, respectively, when a shape parameter is equal to 0, greater than 0, and lower than 0. Based on the extreme value theorem the GEV distribution is the limit distribution of properly normalized maxima of a sequence of independent and identically distributed random variables. Thus, the GEV distribution is used as an approximation to model the maxima of long (finite) sequences of random variables.

2.3.52 Generalized Pareto Distribution Model

The Generalized Pareto Distribution (GPD) was introduced by Pikands (1975) and has since been further studied by Davison, Smith (1984), Castillo (1997, 2008) and other. The generalized Pareto distribution has three basic forms, each corresponding

to a limiting distribution of exceedence data from a different class of underlying distributions. Distributions whose tails decrease exponentially, such as the normal, lead to a generalized Pareto shape parameter of zero. Distributions whose tails decrease as a polynomial, such as Student's *t*, lead to a positive shape parameter. Distributions whose tails are finite, such as the beta, lead to a negative shape parameter. The GPD is used in the tails of distribution fit objects of the pareto tails class. The GPD allows a continuous range of possible shapes that includes both the exponential and Pareto distributions as special cases. You can use either of those distributions to model a particular dataset of exceedences. The generalized Pareto distribution allows you to "let the data decide" which distribution is appropriate.

Currently, economic theory does not offer any guide about the specific form of the probability density function that best describes returns. Therefore, selecting between the competing candidate limiting laws is derives from qualitative characteristics of the relevant economic process. Therefore, granted that interest rates are significantly fat tailed and their variance is not bounded, their behavior is most likely to be well described by the Frechet distribution.

The three parameter of asymptotic distribution of extremes: τ, αn and βn can be estimated empirically. There are three approaches to this task . The first approach, called parametric, consist of estimating these parameters by assuming that realized extremes are drawn exactly from this distribution. There are two commonly used parametric methods: the maximum likelihood method and the regression method. The maximum likelihood method provides efficient estimates, while the regression method provides a graphical method for determining the type of asymptotic distribution. The second approach known as non parametric is based on the direct tail index estimation of the parent variable X. and does not assume that extremes are drawn exactly from the asymptotic distribution.

The method of L- moments is applied to estimate mean or location $\lambda 1$, the scale $\lambda 2$, the L- skewness, $\tau 3$; and the L Kurtosis, $\tau 4$. The L – statics are similar to the ordinary moments, however, they are more efficient and tractable compared to the ordinary moments. The first four L – moments for a given distribution are defined as follows:

$\lambda 1 = E[X]$,

$\lambda 2 = ½ E[X2.2-X1.2]$,

$\lambda 3 = 1/3E [X3.3-2X2.3+X1.3]'$

$\lambda 4 = ¼ E[X4.4 – 3X3.4 + 3X2.4 –X1.4]$,

where Xr:n is the rth order statistic of a random sample of size n. There is a direct linear relationship between L- moments and probability weighted moments (PWM). Therefore, sample values of the L- moments can be obtained by exploiting these relationships via plotting position estimated of the probability weighted moments.

Any distribution can be summarized by values of L moments, $\lambda 1$ and $\lambda 2$ and L ratios $\tau 3$ and $\tau 4$. L ratios are similar to the ordinary moment ratios:

L skewness ($\tau 3$) $=\lambda 3/\lambda 2$

L Kurtosis ($\tau 4$) $=\lambda 4/\lambda 3$

2.4 Empirical Literature

Aktas and Oncu (2006) examined the stock market reaction to extreme events using the Evidence from Turkey. The study was based on the Efficient Market Hypothesis (EMH) which assumes that market prices reflect all available information and expectation, and that any new information is properly incorporated into prices without any delay. Sharp fall of security prices during the turbulent times is a very unique opportunity for testing validity of EMH. Unexpected events can put more stress on the financial market, and market participants may lose their ability to asses rationally the valuation implications of event. The empirical results generally show that at the first trading day after rejection of the motion, historical estimation of betas was highly significant exploratory variables. Also, there is no clear sign for under reaction or over-reaction of investors that violates the assumptions of EMH.

Chen, Bin and Chen (2005) examined the impacts of political events on foreign institutional investors and stock returns from emerging market with evidence from Taiwan. The study set to estimate the possible valuation impact of various relevant political events on Taiwan's stock market performance, including abnormal return behaviors and volatility shifts; and investigates the potential role that foreign

institutional ownership might play in such stock price reactions. They applied both the market-adjusted event-study approach and the risk-adjusted multivariate regression analysis to examine the price movement patterns of two portfolios of Taiwanese common stocks (50 high-foreign-holding firms vs. 50 low-foreign-holding firms) surrounding the occurrence dates of nine major political incidents. The study first calculated the average proportion of shares outstanding held by Qualified Foreign Institution Investors (QFIIs) during the January 1996 - June 2002 period for all firms that were listed on the Taiwan Stock Exchange (TSE) while firms listed on the over-the-counter market were excluded. The findings indicate that price reactions to most of the political events are rather insignificant, implying those events are largely uninformative with only a few exceptions. The abnormal return behaviors are also frequently comparable between firms with small and large foreign institutional ownerships.

Worthington and Valadkhani (2003) carried out an empirical application using intervention analysis on measuring the impact of natural disasters on capital markets. The data set employed consists of daily price and accumulation returns over the period 31 December 1982 to 1 January 2002 for the All Ordinaries Index (AOI) and a record of forty-two severe storms, floods, cyclones, earthquakes and bushfires during this period with an insured loss in excess of AUD 5 million and/or total loss in excess of AUD100 million. Autoregressive moving average (ARMA) models are used to model the returns and the inclusion of news arrival in the form of the natural disasters is specified using intervention analysis. The results indicate bushfires, cyclones and earthquakes have a major effect on market returns, unlike severe storms and floods.

Nakamura (2011) examined the impact of the earthquake on the output gap and prices in Japan. The study notes that the Great East Japan Earthquake on March 11th caused devastating damage in Japan. Economic activity in Japan was severely constrained as a result of supply side problems caused by damage to production facilities, disruption to supply chains, and power shortages.

Hanai and Kalbani (2013) studied the impact of financial crisis on relationship between stock price and financial performance: study of companies from Muscat Securities Market (MSM). For accomplishment of the study objective, performance of services sector companies from MSM 30 index were examined by analyzing their

quarterly data from January 2005 till December 2012, for the possible change in relationship between stock prices and financial performance. Sales, gross profit, net profit, earning per share (EPS), return on equity, return on assets, gross profit margin and average share price were taken as variables for study, and predictive regression models were developed to analyze the change in relationship between stock prices and financial performance, possibly due to financial crisis. In the regression model the share price was taken as dependent variable and other variables as independent. The results showed that the relationship changes during financial crisis as compared to before or after the crisis. Interestingly, it seems that investors give more importance to the financial performance during the financial crisis as compared to other times. As well as, some companies showed weak relation and others have a strong relation which means in depth study of those companies is needed to reveal reasons for this variation. Overall, it was found that the share prices of Omani companies listed on MSM, in services sector showed change in relationship with their financial performance during financial crisis.

Tan (2010) examined financial distress and firm performance using evidence from the Asian financial crisis for the years 1995- 2002. Using a sample of 277 firms from eight East Asian economies, the relationship between financial distress and firm performance during the Asian Financial Crisis of 1997-1998 was tested. The crisis provides an exogenous shock which reduces the endogeneity issues between firm performance and leverage. The results from this study reaffirm that firms with low financial leverage tend to perform better than firms with high financial leverage. Additionally, the crisis magnifies the negative relationship between financial distress and firm performance. High leverage firms experience worse performance during a crisis. Overall, the results reaffirm the negative relationship between leverage and firm performance from prior research. In addition, the crisis strengthens this relationship it magnifies the negative relationship between firm performance and financial leverage.

Chaudhury (2011) examined the financial crisis and the behavior of stock prices using the daily returns of thirty one major US stocks and the S&P 500 over the 2007/08 period. In addition to the first four unconditional moments, Chaudhury (2011) also examine correlation, portfolio risk reduction benefit of diversification, beta, market

model's explanatory power, Jensen's Alpha, conditional variance dynamics and lower tail percentiles (Value at Risk). For the purposes of comparison, they divided the two year sample period into three sub-periods: the pre-crisis period (January 1, 2007 to August 31, 2007), and the early (September 1, 2007 to July 14, 2008) and later (July 15, 2008 to December 31, 2008) stages of the crisis. Findings show that the unconditional mean daily returns fell significantly to negative levels and the unconditional volatility exploded to more than three times the pre-crisis level. The financials declined the most on a cumulative basis with substantial deterioration in the early (41.67%) as well as the later (33.72%) stages of the crisis and their unconditional volatility shot up the most, reaching about five times the pre-crisis level compared to three to four times for the nonfinancial stocks and the S&P 500. Contrary to popular belief, Chaudhury (2011) found that the correlation between the financial and nonfinancial stocks declined in course of the crisis possibly due to the rise in the sector specific stream of news for the financial stocks. The crisis drove the beta risk, as captured by the market model beta, up for financial as well non-financial stocks in our sample. But the increase in beta was only mild for an average non-financial stock (+4.34%) while that for an average financial stock was large (+24.38%).

Chaudhury (2013) examined how the financial crisis affect the daily stock returns using the daily returns of thirty one major US stocks and the S&P 500 over the 2007/08 period. As expected, the most sizable impact of the crisis was on the unconditional standard deviation of daily returns that shot up to more than three times the pre-crisis level for the non-financial stocks, four times for the S&P 500 and five times for the financial stocks. Contrary to the belief of some, we find that it is the failure to forecast the unprecedented level of unconditional volatility and not the VaR measure or the Normality assumption that led to the widespread underestimation of risk capital during the crisis.

Kawaguchi, Sa-Aadu and Shilling (2012) examined REIT stock price volatility during the financial crisis. The study specifically sought to examine the volatility implications of equity REIT stock returns over the sample period from January 1985 through October 2012. The study was founded on Merton (1974) model of equity volatility which presents a model of equity and debt valuation in which financial markets are assumed to be perfect. The study finds find a negative "leverage effect" in

the pre- and post-Greenspan era, but not during the Greenspan era (circa 1994 to 2006). The researchers argue that the positive elasticity of variance with respect to the value of equity during the Greenspan era can be explained by low and declining interest rates, which triggered a wealth transfer from REIT equity holders to REIT debt holders.

Gangopadhyay, Haley, and Zhang (2010) conducted an examination of share price behavior surrounding the 2005 hurricanes Katrina and Rita. The study used event study methodology in attempts to determine whether the occurrence of back-to-back 2005 hurricanes, Katrina and Rita, caused investors' perceptions of insurance company stocks to be blown to and fro like many of the objects that were in the hurricanes' paths. The data used contains 58 property-liability insurers for which daily return data, covering 2002–2005. The analysis show that statistically significant reactions did occur as insurer share prices reacted negatively to hurricane Katrina. The reaction of insurer share prices to Rita was significant, though mixed, with positive/negative results being influenced by Rita's changing circumstances. Our study also reveals the level of underwriting exposure to be a significant determinant in the magnitude of the insurer share price reactions.

Kirui, Wawire and Onono (2014) examined macroeconomic variables, volatility and stock market returns using a case of Nairobi Securities Exchange, Kenya. This study sought to evaluate the relationship between Gross Domestic Product, Treasury bill rate, exchange rate, inflation and stock market return in Nairobi Securities Exchange Limited. The study determined the response of the stock returns to a shock in each of the macroeconomic variables. The effect of changes in each of the macroeconomic variable on the volatility of stock returns in Nairobi Securities exchange limited was also determined. Engle-Granger two step method was used to establish the co integrating relationship between stock returns and the macroeconomic variables. Threshold Genaralized Autoregressive Conditional Heteroscedasticity (TGARCH) model was used to capture the leverage effects and volatility persistence at the NSE. Published time series quarterly data from 2000 to 2012 was sourced from the Central Bank of Kenya, Kenya National Bureau of Statistics. Empirical results of the regression model revealed that exchange rate showed a significant relationship with stock returns. Gross Domestic Product, Inflation and the Treasury bill rate indicated

insignificant relationships. The effects of one standard deviation shock on each of the macroeconomic variable on stock returns revealed that shock in exchange rate was negative but eventually reverted back to equilibrium thereafter. The results of the TGARCH model for exchange rate, Gross Domestic Product and Treasury bill rate revealed that the impact of news was asymmetric and there was presence of leverage effects. There was absence of volatility persistence among all the macroeconomic variables.

2.5 Summary of the Study

From the above literature, it is evident that the performance of organizations is affected by the occurrence of extreme risk events. Different studies from different countries around the globe have been presented showing different results with some indicating that the extreme risks affect performance of organizations while others indicating that they do not affect. There is no study that has focused on the relationship between the extreme risk and the performance of firms listed at the Nairobi Securities Exchange in Kenya. This study therefore sought to fill this research gap by seeking to answer one research question: How do extreme risks affect the performance of firms listed at the Nairobi Securities Exchange?

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter details the approach used in this research project. The section is divided into 3.2 which cover the research design, 3.3 population and sample, 3.4 data and data collection and 3.5 data analysis which has 3.5.1 conceptual framework and 3.5.2 analytical models.

3.2 Research design

The research used descriptive design because it enables description of a phenomenon so as to build a profile on it. The study describes the manner in which extreme risk has affected financial performance of companies listed at the Nairobi Securities Exchange.

3.3 Population and the Sample

Mugenda and Mugenda (2003) define population as the entire group of individuals or objects to which researcher is interested in generalizing the conclusions on. The population of this study was the 62 firms (Appendix 1) listed at the NSE as at 31st December, 2014. The sample comprised of 12 firms(Appendix 1a) listed at the NSE as at 31st December, 2014. Random sampling was used in determining the sample

3.4 Data and Data Collection Instruments

This study used secondary data from the Nairobi Securities Exchange and relevant financial statements in the annual reports of the respective organizations involved in the study. Additional data was obtained from published financial journals, internet, and relevant textbooks. The data was collected through a schedule drawn to give direction on the particulars of data relevant to the study. This was done to ensure that the study focuses on the objective. The study covered ten years from 2005 to 2014. Daily averages were applied for those periods that the extreme events occurred.

3.5 Data Analysis

Data processing and analysis is a process in which raw data is ordered and organized so that useful information can be extracted (Mugenda and Mugenda, 2003; Cooper and Schindler, 2011). In this study, the collected data was first edited to eliminate

ambiguity and obvious errors as well as enhance consistency and accuracy as advised by Flick (2006).

After the data was fully organized, an appropriate analytical tool was be adopted to bring out the quantitative meaning of the data (swift and Piff 200). Many probability distributions have been suggested in financial literature to model extreme risk.
In this study, the generalized extreme value distribution (GEV) and Generalized pareto distribution (GPA) were used to model extreme risk. The parameters of each distribution were estimated using the L Moments and the best fit distribution was selected based on comparison of results of four goodness of fit tests applied to the values predicted by the candidate distributions.

3.5.1 Conceptual Framework

As revealed in the various studies noted in Chapter 2, firm performance is inversely related to extreme risk.

PERF = *f (*ERISK) (1)

In this study, records of extreme values have been analyzed using GEV and GDP distributions. L- moments have been used for parameter estimation for the candidate distributions.

The method of L- moments is extensively discussed in Hosking and Wallis (1997) but in summary it is a modification of the probability weighted moments (PWMs) method presented in Greenwood et al. (1979).

The PWMs of the r^{th} order for a distribution function is represented in the integral form as (Greenwood et al,1979):

$$\beta_r = \int_0^1 x(F)F(x)^r\,dF \qquad (2)$$

r = 0.1, 2, ….

This may be compared to ordinary moments defined by (Gubareva and Gartsman,2010):

$$E(Xr) = \int_0^1 x(F)^r \, dF, r = 0.1.2.... \quad (3)$$

Where χ (F) is the quantile which is inverse to the cumulative distribution function F (χ).

The L- Moments λ_r, of a random X is definable in terms of PWMs (Chen et al, 2006). In particular, the first four L-moments ($\lambda_1, \lambda_2, \lambda_3$ and λ_4) are given as (Hosking and Wallis, 1997):

$$\lambda_1 = \beta_0 \quad (4a)$$

$$\lambda_2 = 2\beta_1 - \beta_0 \quad (4b)$$

$$\lambda_3 = 2\beta_2 - 6\beta_1 + \beta_0 \quad (4c)$$

$$\lambda_4 = 20\beta_3 + 12\beta_1 - \beta_0 \quad (4d)$$

While the general form is given by (Gubareva and Gartsman, 2010):

$\lambda_{r+1} = (-1)^{r-k} \sum_{k=0}^{r} P_{k=0}^{*} \beta_k$ in which the coefficients $P_{r,k}^{*}$ are defined as:

$$P_{r,k}^{*} = (-1)^{r-k} \binom{r}{k} \binom{r+k}{k} = \frac{(-1)^{r-k}(r+k)!}{(k!)^2 (r-k)!} \quad (5)$$

3.5.2 Analytical Models

The L moments ratios used for expressing the parameter estimates are calculated as:

L = Coefficient of variation (L-CV) = $\tau \frac{\lambda_2}{\lambda_1}$ (6)

L - Skewness (τ_3) = $\frac{\lambda_3}{\lambda_2}$ (7)

L - Kurtosis (τ_4) = $\frac{\lambda_4}{\lambda_2}$ (8)

These quantiles are analogous to the conventional moments ratios, that is τ is the coefficient of variation (L-CV); τ_3, the L-Skewness and τ_4 the L-Kurtosis. Parameters are estimated by equating the sample L-moments with the distribution L-moments

The unbiased sample estimators of β_i of the first four PWMs for any distribution can be computed as follows (Hosking and Wallis,1997):

$$\beta_0 = \frac{1}{n}\sum_{j=1}^{n} x_{(j)} \qquad (9a)$$

$$\beta_1 = \sum_{j=1}^{n-1}\left[\frac{(n-j)}{n(n-1)}\right]X_{(j)} \qquad (9b)$$

$$\beta_2 = \sum_{j=1}^{n-2}\left[\frac{(n-j)(n-j-1)}{n(n-1)(n-2)}\right]X_{(j)} \qquad (9c)$$

$$\beta_2 = \sum_{j=1}^{n-3}\left[\frac{(n-j)(n-j-1)(n-j-2}{n(n-1)(n-2)(n-3)}\right]X_{(j)} \qquad (9d)$$

Where $X_{(j)}$ represents the ranked annual maximum series in which $X_{(1)}$ is the highest share price and $X_{(n)}$ is the lowest.

Estimates of the parameters of the selected distribution were obtained in this study following L-moments approach using the respective equations given in the following table. ξ is the location parameter, α is the scale parameter while K is the shape parameter.

L-MOMENTS PARAMETER ESTIMATES FOR SELECTED PROBABILITY DISTRIBUTION FUNCTIONS (AHMAD ET AL,2011)

Distribution	Quintile function	Parameter estimates
GEV	$X(F) = \xi + \frac{\alpha}{K}\{1-(-lNf)^k\}$	$\alpha = \frac{l_2 k}{\Gamma(1+k)\Gamma(1+2^{-k})}$

		$\xi = l_1 + \frac{a(\Gamma(1+K)-1)}{K}$ $K = 7.8590C + 2.9554C^2$ $C = \frac{2}{3+\tau_3} - \frac{\ln 2}{Ln3}$
GPA	$X(F) = \xi + \frac{\alpha}{K}\{1-(1-f)^K\}$	$\alpha = L_2[(K+1)(K+2)]$ $\xi = l_1 - l_2(k+2)$ $K = \frac{(1+3\tau_3)}{((1+\tau_3)}$

The adequacy of the probability distribution models in fitting the observed peak share price data were evaluated by goodness of fit tests of criteria. The methods applied are root mean square (RMSE), relative root mean square error (RRMSE), mean absolute index (MADI) and probability plot correlation coefficient (PPCC).The first three methods asses the fitted distributions at a site by summarizing the deviation between observed prices and computed prices and in particular the relative root mean square (RRMSE) provides a better of the overall fit of a distribution as it calculates each error in proportion to the size of observation thereby reducing the influence of the outliers which are common features of share price data. PPCC is a measure of the linearity of the probability plot (Filliben, 1975). It gives the correlation between the ordered observations and corresponding fitted quantiles determined by a plotting position (Abdulkarim and Chowdhury,1995). The results of the tests enabled the ascertaining of how sufficiently close a given distribution fits the observed data and hence the choice from the candidate distributions the one that best fits the observed data.

The formulae for the tests are:

$$RMSE = \left(\frac{\Sigma(x_i - y_i)^2}{n-m} \right)^{\frac{1}{2}} \qquad (10)$$

$$RRMSE = \left(\frac{\Sigma \left(\frac{x_i - y_i}{x_i} \right)^2}{n - m} \right)^{\frac{1}{2}} \quad (11)$$

$$MADI = \frac{1}{N} \sum_{i=1}^{N} \left| \frac{x_i - y_i}{x_i} \right| \quad (12)$$

Where X_i are the observed values, y_i the predicted values from the assumed probability distributions, N the number of data points while the number of parameters estimated for the distribution is denoted by m. PPCC is defined mathematically by equation (12) as:

$$PPCC = \frac{\Sigma[(x_i - \bar{x})(y_i - \bar{y})}{\Sigma[(x_i - \bar{x})^2 \Sigma(y_i - \bar{y})^{2^{1/2}}} \quad (13)$$

Where $\bar{x}$ and $\bar{y}$ represents the mean values of the observed and predicted quantiles respectively.

A value of PPCC near 1 suggests that the observed data could have been drawn from the fitted distribution at a site. In summary, the smallest of RMSE, RRMSE and MADI correspond to the best distribution while in the case of PPCC; the distribution whose value of PPCC is nearest to 1 is considered the best.

3.5.2 Analytical model

The analytical model below was used in this study

PERF = α_0 +β SECOND MOMENT (SIGMA) (14)

CHAPTER FOUR
DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the results of data analysis and the discussion of results. Section 4.2 discusses the summary statistics. Section 4.3 examines the estimated model. Section 4.4 is the discussion of results. Section 4.5 is the summary of the chapter.

4.2 Summary Statistics

Table 4.1 Summary Statistics for Maxima Share Prices for the Period 2005 to 2014

	Unil	Kaku	Rea	Sasi	Car	Cmc	Hutchin	Kaw	Marshal	Nation	Tps	Uchumi
Mean	108.75	68.53	23.64	48.56	46.22	54.31	20.25	95.13	16.96	286.40	77.63	23.49
Std Dev	25.90	28.90	8.64	61.42	19.62	61.46	0.00	44.43	7.76	114.12	29.63	5.81
Variance	670.9	834.9	74.69	3772.1	384.9	3777.8	0.00	1973.5	60.25	13024.4	877.66	33.81
Kurtosis	3.12	1.77	0.69	2.63	0.88	4.21		1.42	0.97	2.01	0.35	3.19
Skewness	1.65	0.06	0.90	1.89	0.59	2.03		0.18	0.34	0.28	0.58	1.24
Range	59.00	74.75	26.70	181.00	57.80	178.00	0.00	110.25	24.50	280.00	90.25	19.10
Minimum	71.00	29.25	6.55	9.00	10.20	15.00	20.25	36.75	5.50	150.00	34.75	15.90
Maximum	130.00	104.00	33.25	190.00	68.00	193.00	20.25	147.00	30.00	430.00	125.00	35.00

Note: 1. Unil = Uniliver, Kaku=Kakuzi, Rea= Rea Vipingo, Sasi=Sasini, Car=Car & Generl, CMC=CMC Motors, Hutchin=Hutchinson Biemer, Kaw=Kenya Airways, Marshal=Marshalls Ltd, Nation=Nation Media Group, Tps=Tourism Promotion Services, Uchumi= Uchumi Supermarkets Ltd

Table 4.1 provides the summary statistics for the maximal share prices for the companies in the Agricultural, Motor Vehicle and Commercial Services segments of the NSE. The results show that there was highest movement in Nation Media Group shares of magnitude KSh. 280 over the sample period. There was no movement in the share prices of Hutchinson Biemer Ltd over the sample period. Unilever, Uchumi Ltd and CMC Ltd display a kurtosis exceeding 3.0. The Nation Media Group displays the highest variation in share prices with a standard deviation of 114.2.

Table 4.2 Summary Statistics for Minima Share Prices for the Period 2005 to 2014

	Unil	Kaku	Rea	Sasi	Car	Cmc	Hutchin	Kaw	Mars	Nation	Tps	Uchumi
Mean	67.50	38.19	11.90	12.26	23.97	19.22	20.25	27.11	27.95	140.00	43.35	10.86
Std Dev.	19.36	19.99	4.51	7.59	9.47	15.49	0.00	9.77	15.69	50.71	16.74	3.84
Variance	375.00	399.42	20.30	57.60	89.73	240.09	0.00	95.44	246.09	2571.11	280.16	14.75
Kurtosis	1.20	1.37	0.72	0.01	0.34	0.30		2.93	1.39	4.09	0.05	0.97
Skewness	0.00	0.58	0.91	1.01	0.08	1.42		0.16	0.55	1.69	0.62	0.79
Range	45.00	52.60	14.10	22.40	31.30	38.00	0.00	20.00	41.20	186.00	53.25	11.30
Minimum	45.00	14.90	2.85	3.85	8.70	9.00	20.25	16.00	8.80	78.00	19.75	6.50
Maximum	90.00	67.50	16.95	26.25	40.00	47.00	20.25	36.00	50.00	264.00	73.00	17.80

Note: 1. Unil = Unilever, Kaku=Kakuzi, Rea= Rea Vipingo, Sasi=Sasini, Car=Car & Generl, CMC=CMC Motors, Hutchin=Hutchings Biemer, Kaw=Kenya Airways, Marshal=Marshalls Ltd, Nation=Nation Media Group, Tps=Tourism Promotion Services, Uchumi= Uchumi Supermarkets Ltd

Table 4.2 displays the summary statistics for the minimal share prices for the companies in the Agricultural, Motor Vehicle and Commercial Services segments of the NSE. It is evident that again there was highest movement in Nation Media Group shares of magnitude KSh. 186 over the sample period. There was no movement in the share prices of Hutchinson Biemer Ltd over the same period. Only the share prices of Nation Media Group Ltd display a kurtosis exceeding 3.0. The Nation Media Group again displays the highest variation in share prices with a standard deviation of 50.71. The kurtosis for the Kenya Airways minima prices is higher compared to those of the maxima prices.

4.3 Effect of Extreme Risk on Firm Performance

This section discusses the results of analyzing the relationship between extreme risk and firm financial performance.

4.3.1 Results of Correlation Analysis

The results of correlation analysis showed that there is a positive and significant correlation of 0.47 between financial performance and the extreme risk of the firms. However, the correlation between financial performance and extreme risk was positive but low at 0.14.

4.3.2 Results of the Model Goodness of Fit

The value for R2 using the maximal values was 0.22. This means that changes in extreme risk of the firm explains 22 percent of the variation in the share prices and returns of companies. However, the value for R2 using minimal share prices was only

0.09. Therefore, the variation extreme risk could only explain 9 percent of the changes in the share prices and returns of the firms. Though the models poorly fit the data they clear show that extreme risk is very important and should be actively managed.

4.3.3 Results of ANOVA

The analysis of variance shows that the model can explain only 2.14 of the total 9.65 variability in the financial performance of the firms using maximal share prices. The F-statistic is 2.85 with a p-value of 0.12. Therefore, the relationship is not statistically significant at 10 percent level. The results also show that the model can explain only 0.18 of the total 9.65 variance of the minimal share prices. The F-statistic is 0.18 with a p-value of 0.67. Therefore, the relationship is not statistically significant at 10 percent level.

4.3.4 Results of the Estimated Models

Table 4.3 The Relationship between Extreme Risk and Return Using Maximal Share Prices

	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.5348	0.3907	-1.3687	0.2010
sigma	0.0198	0.0117	1.6893	0.1220

The results in Table 4.3 indicate that there is a positive relationship between extreme risk as measured by sigma and financial performance of the firm. However, this relationship is not statistically significant at 10 percent level.

Table 4.4 The Relationship between Extreme Risk and Return Using Minimal Share Prices

	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.1996	0.4853	-0.4113	0.6895
sigma	0.0147	0.0338	0.4345	0.6731

Source: Authors computations

The results in Table 4.4 indicate that there is a positive relationship between extreme risk as measured by sigma and financial performance of the firm. However, this relationship is not statistically significant at 10 percent level.

4.3.5 Results of Fitting Extreme Value Models to Maximal and Minimal Share Prices

The results for fitting the maxima share prices are presented in table 4.5 below. Likewise, the results for the minima share prices are displayed in the same table

Table 4.5 Results of the Fitting GEV and GPD Models to Extreme Share Prices

PANEL A: Estimated GEV Models								
	Maxima				Minima			
Company	**Mu**	**Sigma**	**Xi**	**NLL**	**Mu**	**Sigma**	**Xi**	**NLL**
Car & General	45.131	28.488	-1.246	39.902	20.924	8.963	-0.311	36.023
CMC	16.557	5.619	1.853	38.293	10.895	7.428	3.911	27.807
HBL	22.721	15.026	6.079	-16.195	22.721	15.026	6.079	-16.195
Kakuzi	69.572	55.694	-1.617	43.015	27.536	12.973	0.237	42.778
Kenya Airways	46.884	37.206	0.018	52.131	15.504	9.263	-0.054	37.866
Marshalls	19.932	10.673	0.170	40.472	13.999	6.680	-0.174	33.916
Nation Media	223.934	77.505	0.243	60.624	117.911	32.797	0.092	51.182
Rea Vipingo	24.394	8.812	-0.994	33.010	13.201	3.723	-0.992	26.171
Sasini	17.283	10.982	0.940	45.168	8.304	4.494	0.276	32.386
TPS	65.321	23.867	-0.079	47.141	36.496	13.641	-0.092	41.450
Uchumi	21.104	4.282	-0.022	21.137	9.232	2.892	-0.021	18.438
Unilever	103.639	28.511	-1.081	15.861	67.651	22.375	-1.000	16.452
PANEL B: Estimated GPD Model								
Company	**Mu**	**Sigma**	**Xi**	**NLL**	**Mu**	**Sigma**	**Xi**	**NLL**
Car & General		17.885	-0.993	14.508		9.899	-0.989	4.668
CMC		166.667	-1.000	15.339		32.677	-1.256	4.894
HBL		0.618	-2.470	-18.845		0.618	-2.470	-18.845
Kakuzi		65.999	-1.346	24.245		29.837	-1.084	9.222
Kenya Airways		86.236	-0.989	26.886		19.274	-1.013	17.505
Marshalls		37.010	-1.423	10.594		23.208	-1.546	8.853
Nation Media		199.62	-1.108	19.463		36.665	0.151	23.747
Rea Vipingo		8.381	-1.015	8.257		2.555	-1.310	0.262
Sasini		190.388	-1.153	14.637		17.151	-1.124	10.176
TPS		64.926	1.298	11.656		25.781	-1.120	5.202
Uchumi		7.677	-0.324	13.566		7.144	-1.050	3.478
Unilever		102.715	-1.711	13.491		33.439	-1.113	6.227

Table 4.5 displays the results of fitting the GEV and the GPD models to extreme share prices on the Market for sample of firms studied. The variables Mu, Sigma and Xi stand for the estimated mean, the standard deviation and the kurtosis of the extreme distributions. NLL indicates the log-likelihood value of the model and the higher the NLL parameter the better the fit. In Panel A except for Unilever Ltd the results indicate that the GEV model fits the maximal share prices better than the minimal share prices. In Panel B except for the Nation Media Group Ltd the GPD fits maximal share prices better than minimal share prices. Overall, the GEV distribution fits the data better than the GPD distribution. The results show that overall the GEV fits best the extreme share prices of Nation Media Group Ltd in the sample.

4.4. Discussion

The high range and kurtosis of the extreme minima prices of the Nation Media Group indicates that it is more prone to extreme and negative changes in share prices. Consequently, this company is more exposed to extreme risk than any other in the sample. Therefore, the management of this company should consider seriously the management of extreme risk.

Unilever, Uchumi Ltd and CMC Ltd each display a kurtosis exceeding 3.0 for the extreme maxima share prices. This means that these companies have the potential to perform better with good management. There is a higher probability of reporting extremely high profits in any given financial year. However, poor management among other factors may militate against this.

Overall, the above results underline the importance of extreme risk management by companies in Kenya. The exposure to extreme events in business is considerable and can adversely or fortuitously affect company performance. It partly depends on how well management of these firms manages the extreme risk.

Lastly, the fact that the extreme share prices are well described by the GEV distribution than the GPD means that the stock market is more prone to extreme price changes. As indicated above, for some companies, especially Nation Media Group, such extreme movements are value destroying whereas, for others like Unilever, Uchumi Ltd and CMC Ltd they are value enhancing. Therefore, judicious portfolio managers are likely to earn higher returns for the investors.

4.5 Summary

In summary, the results of the data analysis demonstrate that overall extreme risk positively impact on firm performance. However, the analysis of extreme share prices shows that there is a differential impact of extreme risk from one company to another. On one hand, extreme risk negatively impacts on the financial performance of Nation Media Group Ltd. On the other, hand extreme risk positively impacts on the performance of Unilever, Uchumi Ltd and CMC Ltd over the sample period. It all depends at least on how well extreme risk is managed.

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter details the results and findings on the effects of extreme risk on the performance of firms listed at the NSE. The findings are outlined according to the objective of the study. This section provides a discussion on the findings, conclusion and recommendation to the study.

5.2 Summary of the Study

The objective of the study is to establish the relationship between extreme risk and the performance of financial institutions listed at the NSE in Kenya. The Kenyan economy has experienced a spate of extreme events including post-election violence which paralyzed operations at the market, impact of the financial crisis experienced in Europe and the increased terrorism attacks among others. The research sought to understand the existing relationship, if any, between extreme risk and performance of firms listed at the NSE as measured by the share price for the period 2005 to 2014. The research was performed as a secondary research involving twelve firms listed at the NSE. Their share price over a period of ten years between 2005 and 2014 was reviewed to describe the manner in which extreme risk affected the performance of the said listed firms.

GPA and GEV distributions were used to model extreme risk. The parameters for each of the distribution including mean, standard deviation, kurtosis and skewness were estimated using L-moments.

From the analysis, it was established that there is positive and significant correlation between performance and the extreme risks. A change in extreme risk explains at least twenty two percent of the variation in the share price of the firms. Outstanding in the statistics is the impact extreme risk has on Nation Media Group share price

5.3 Conclusions

Extreme risk has a bearing in the overall firm performance. The management should thus embrace the challenges inherent in extreme risk and put in place mitigating

measures. The stock market players should also take interest in extreme risk. Some counters are more affected than others during a given extreme event. Therefore a balanced portfolio would minimize volatility in the overall returns of the portfolio.

5.4 Suggestions for Further Research

The research proposes that future researchers should focus on examining the reason as to why some share prices are more adversely affected than others on occurrence of an extreme. A case in point is share price of Nation Media Group which has alarming variation statistics.

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Appendix I: Firms listed at the Nairobi Securities Exchange as at 31ST December 2014

1. Kakuzi Limited
2. Athi River Mining
3. Bamburi Cement
4. Barclays Bank of Kenya Ltd
5. British American Tobacco - Kenya
6. British-American Investment Company Kenya
7. Car & General Kenya
8. Carbacid Kenya
9. Centum Kenya
10. CFC Stanbic
11. CIC Insurance
12. CFC Stanbic
13. CMC Holdings
14. Co-operative Bank of Kenya
15. Crown Paints
16. Diamond Trust Bank
17. East African Breweries
18. East African Cables
19. East African Portland Cement
20. Eaagads
21. Equity Bank
22. Eveready East Africa
23. Express Kenya
24. Home Afrika Limited
25. Housing Finance Company of Kenya
26. I&M Holdings
27. Jubilee Holdings
28. Kakuzi
29. Kapchorua Tea Company
30. KenGen
31. KenolKobil
32. Kenya Airways
33. Kenya Commercial Bank
34. Kenya Orchards
35. Kenya Power & Lighting
36. Kenya Re
37. Liberty Kenya
38. Limuru Tea
39. LongHorn Kenya
40. Marshalls East Africa
41. Mumias Sugar
42. Nation Media Group
43. National Bank of Kenya
44. NIC Bank
45. Olympia Capital Holdings
46. Pan Africa Insurance Holdings
47. REA Vipingo Plantations
48. Safaricom
49. Sameer Africa
50. Sasini
51. ScanGroup
52. Standard Chartered Bank Kenya
53. Standard Group
54. Total Kenya
55. TPS Serena
56. TransCentury
57. Uchumi
58. Unga Group

59. Williamson Tea Kenya
60. A. Baumann & Company Limited
61. Umeme Limited
62. CFC Insurance Company Limited

Source:www.nse.co.ke

Appendix 1a: Sampled of Firms Listed at the Nairobi Securities Exchange

1. Kakuzi Limited
2. Rea Vipingo
3. Sasini Limited
4. Car and General (K) Ltd
5. CMC Holdings Limited
6. Hutchings Biemer Limited
7. Kenya Airways Limited
8. Marshall (EA) Limited
9. Nation Media Group
10. Unilever Limited
11. TPS Eastern Africa Ltd
12. Uchumi Supermarkets Limited

Source:www.nse.co.ke