RISK BASED CAPITAL, ASSET ALLOCATION, FIRM SIZE AND INVESTMENT RETURNS OF INSURANCE COMPANIES IN KENYA

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DECLARATION

Declaration by the Candidate

This PhD thesis is my original work and has not been submitted to this or any other university or institution of higher learning for the award of any degree.

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DEDICATION

I dedicate this Doctoral Thesis to:

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ABBREVIATIONS AND ACRONYMS

AA: Asset Allocation

AKI: Association of Kenya Insurers

APT: Arbitrage Pricing Theory

ARMP: Actuarial Risk Management Practices

CAPM: Capital Asset Pricing Model

CAR: Capital Adequacy Ratio

CAT: Catastrophe

CII: Chattered Insurance Institute

CTE: Conditional Tail Expectation

EIOPA: European Insurance Occupational Pension Authority

ERM: Enterprise Risk Management

EU: European Union

EVT: Extreme Value Theory

FSB: Financial Service Board

IRA: Insurance Regulatory Authority

MCR: Minimum Capital Requirement

MPT: Modern Portfolio Theory

NSE: Nairobi Securities Exchange

OLS: Ordinary Least Squares

ORSA: Own Risk and Solvency Assessment

POT: Peak over Threshold

RBC: Risk Based Capital

RBS: Risk Based Supervision

ROA: Return on Assets

S.E Standard Error

VaR: Value at Risk

VIF: Variance Inflation Factor

ABSTRACT

The recent wave of corporate failures across the globe and more importantly local insurance companies, that have been declared insolvent despite holding the minimum capital requirement as per the insurance act, has been a concern to both the industry players and regulators. This has triggered increased government regulation and the adoption of Risk Based Capital (RBC), where risks are identified in a timely manner and capital is injected early enough to prevent a company from collapsing. The link between RBC and investment returns remains imprecise due to divergence in findings. The differences in research outcomes is attributable to how the study variables were operationalized, selection of variables and control variables, the econometric models used and differences at contextualization, which give rise to conceptual, methodological and contextual gaps. The study's main goal was to establish the relationship among risk based capital, asset allocation, firm size and investment returns of insurance companies in Kenya. The study first looked at the relationship between RBC and investment returns, then explored the effect of asset allocation as an intervening variable and firm size as a moderating variable. The joint effect of all variables on investment returns was also tested. Risk based capital was calculated by incorporating capital required for market risk, insurance, credit and operational risk which is computed by applying a set of defined risk factors. Asset allocation was measured using a composite score of investment vehicle and time horizon. Gross written premium and total assets were used as a measure of the size of the firm and investment income ratio as an indicator of investment returns. The population under study encompassed 63 insurance companies licenced by Insurance Regulatory Authority. A longitudinal (panel) design was used to describe the association amongst variables on the study duration. Moreover, secondary data was collected from the insurance companies' annual returns submitted to IRA for a period of 5 years (2014-2018) which yielded suitable data points for analysis. Test of normality, linearity, homogeneity of variance, multicollinearity, independence and cointegration were undertaken with the findings meeting the requirements to undertake linear regression analysis. Multiple linear regression was applied in determining the nature of the relationship among variables based on 5% significance level and the stated study hypothesis. Coefficient of determination (R^2) was derived to show how the model fits the data. The findings of the study revealed that the relationship between RBC and investment returns was found to be significant. After introduction of asset allocation as an intervening variable, there was an effect on the relationship between RBC and investment returns thus an indication of mediation. Gross written premiums and total assets had a moderating effect on the relationship between risk based capital and investment returns. The results showed that RBC, asset allocation and firm size had a joint effect on investment returns of insurance companies in Kenya. This study has generally contributed to the field of finance and risk management and, particularly risk based capital and the effect of asset allocation and firm size on insurance companies' investment returns. The study has also contributed to policy especially in the implementation of the risk based supervision model in the insurance industry. The results would help portfolio managers to diversify their investment to maximize their returns without being concerned on the amount of capital to hold. This is attributed to by the study findings which indicate a positive relationship between RBC and investment returns, thus allowing the managers to justify high risk investments that attract a high risk factors.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Risk based capital (RBC) of any insurance or Reinsurance Company is used as a measure of guaranteed solvability in case of any financial distress (Kochanski, 2010). An insurance company should have enough capital to withstand any harsh economic condition. This has been addressed by the development of risk based supervision framework which is expected to oversee that all insurers and reinsurers incorporate all the risks they encounter when determining the capital to hold. RBC is derived from capital charges imposed to specific risks an insurance company faces on its underwriting business and on its investment portfolio. This has an influence on insurance companies' asset management thus informing asset allocation and the expected investment returns (Johansen, 2011). A company's size on the other hand would influence its risk based capital, since the total amount of premium a company underwrites informs the amount of premium reserves. Furthermore, its claims reserves will influence the insurance risk capital, while its assets composition informs market and credit risk capital (Liebwein, 2006). Insurers recognize how important it is to separate investment management and the core insurance business because investment returns act as a backing for their reserves and capital, which is very important in maximizing these returns (Smith, 1989).

This study was conceptualized on Makowitz (1952) modern portfolio theory, Redington (1952) immunization theory, Tippet (1928) extreme value theory, and Sklar (1959) copulas theory. Makowitz (1952) introduced the concept of portfolio selection to maximize investment returns. On the other hand, risk based capital is a driver of asset allocation and has to be considered when an insurance company is making its investment decisions. Investments in government securities are deemed to be risk free thus having no capital charge imposed on them. Conversely, investments in land and buildings, property or shares both listed and unlisted attract a capital charge due to the uncertainty of the investment returns, which has an overall effect on the risk

based capital (IRA, 2016). Redington immunization theory was developed by Frank Mitchell Redington as a strategy to ensure that fluctuations in interest rates do not adjust the value of a portfolio. This theory is widely used in asset liability management and is applicable when insurers use investments returns as a backing for their reserves and capital. The extreme value theorem developed by Tippet (1928) deals with any extreme anomalies from the median. This theory is mostly applied in the field of managing risk in assessing the effect of extreme scenarios, majorly the outliers in an event, thus applicable in the concept of RBC. Sklar's (1959) theory deals with the derivation of multivariate cumulative distribution which can be broken down to a copula and in terms of its marginal. The applicability of the theory has been used in determining the risk adjusted capital.

Risk based capital looks at the entire balance sheet where the risks facing both assets and liabilities of insurers are considered when determining the solvency position (Bragt et al., 2010). Insurance companies usually collect premiums from policy holders and create a pool of funds for claims payment and investments. The concept of RBC imposes capital charges to the nature and type of insurance business underwritten. Some classes under the insurance business are deemed high risk compared to others, thus attracting a high capital charge. This will have an impact to the insurance risk capital charge, and the overall risk based capital. Capital charges are further imposed on various types of investments depending on the perceived risks on the selection of investments. RBC influences insurance companies' asset management, since some investments are deemed risk free based on the investment vehicle, and in turn may influence the investment returns of a company.

1.1.1 Risk Based Capital

Kochanski (2010) defines RBC as the appropriate capital an insurance company has in place to survive a one in two-hundred-year crisis. This definition is based on solvency II risk based framework which provides a holistic assessment on the risks an insurance company takes in its

operations. The Society of Actuaries, (2016) further defines risk based capital as the capital an insurance company holds, to meet risks that can be quantified on their portfolio mix in a one-year expectation of new business. RBC may be calibrated at valuation at risk (VaR) 99.5% over one year or adopt a conditional tail expectation (CTE) methodology, which is deemed favourable than VaR if there is risk of large losses. This means a one in two-hundred-year event of the change in the economic value over a one-year horizon. The change in economic value is usually given as all assets minus all liabilities within the period. According to Liebwein (2006), risk based capital gives a true reflection of the capital which an underwriter holds to attain a certain safety level considering the size of the company and the amount of risk they hold.

Risk based capital for an insurance company can be looked at in two different perspectives. The first perspective is that it can be affected from a requirement by the industry regulator, where it determines the total minimum capital an insurance company needs to have in place in order to be operational and to be licenced by the regulator. The second approach is from a financial management point of view, where the insurance company undertakes its own initiative to analyse the amount of business it underwrites, where it invests, the capital it holds and the overall risk exposure in order to determine the additional capital it requires as a buffer to survive any crisis that may arise (Dickinson, 1997). This study focused on the second perspective, where risk based capital is considered so that management can make prudent investment decisions which will be beneficial to the insurance companies.

Castries (2005) further opines the importance of capital adequacy for insurance companies. He acknowledges the complexity of insurance industry where companies operate in reverse cycle. This means that an insurance company receives payments before delivery of the services they promise. This notion makes capital to be a key factor in the operation of an insurance company. Determining adequacy of the capital is of concern to the company, the policy holders and the regulator. Therefore, availability of adequate capital is a commodity that must be optimally

exploited. Risk based capital introduces the optimization of the required capital by factoring in all the risks the company faces, by imposing capital charges on both the asset and liabilities of insurance companies.

The introduction of RBC assumes that it will cover all quantifiable risks for existing business in an insurance company and what they will underwrite in the next twelve months (EIOPA, 2014). Diversification effects are also considered by using the correlation matrices when aggregating the appropriate capital. RBC may be derived from a standard formula across the insurance industry or by using internal models which is reviewed by the industry regulator. This formula aims to capture a higher percentage of quantifiable risk that most insurers are exposed to. The calculation method is homogenous in nature and is not tailored to any single risk profile, thus the value varying from one company to another. Planchet and Tomas (2014) further explains that RBC considers any uncertainty arising from any logical and parameters estimation, but not for stochastic fluctuations and process risk. The process risk has been disregarded as insignificant with minimal impact, thus being included in systemic and parameter risk component to simplify the risk based capital standard formulae.

To calculate risk based capital for insurance companies, a factor, which is predetermined as a percentage is calculated and applied to assets the company holds, premiums it underwrites, claims incurred, expenses and reserves being held. The capital charge is higher for those items which are deemed high risks and lower and lower for items which are considered less risky (Bragt et al., 2010). Insurance risk capital for short term business is calculated by checking the company's capital compared to variations in the premium and claim reserves, which is calculated as an accumulation risk factors revolving around the product and the reserves held for the various class of business. For life insurance risk, the capital buffer is calculated as the difference between the liability of the policyholder, computed using stressed risk factors, less the liability of the policyholder using assumptions based on best estimate.

Market risk capital is derived from the application of a capital charge to the asset value of the balance sheet. The capital for cessions to the reinsurance companies is also calculated by applying risk factors thus determining the credit risk capital. Operational risk capital is computed as the highest of; 30% of the square root of sum of squares of the capital allocated for insurance risk, market risk and credit risk or 3% of the gross earned premium over the last twelve months. There are various control levels where intervention from the regulator may be taken based on a company's solvency position. These are company action level, regulatory action, authorised control and mandatory control (Afande & Maina, 2015).

1.1.2 Asset Allocation

Asset allocation is a unique way of diversifying capital for investments in various classes of assets in any accepted jurisdiction, which is a key component in determining investment returns of any investor (Brown et al., 2009). Asset allocation involves selecting a portfolio which focuses on risk reduction and maximize investment returns. The investor ought to make choices between asset classes e.g. bonds and stocks, under the assumption of capital markets where asset classes are not under-priced or overpriced. It is clear to all investors that asset allocation is important. The question that many try to answer is the level of importance (Bendrich & Bergstrom, 2015). An investor's return on any portfolio selected is highly dependent on asset allocation whereas asset timing and security selection doesn't have a significant impact (Brinson et al., 1986).

Investors may take different approaches in determining where to invest and how to allocate assets in a manner they will attain maximum returns. One of the methods used is tactical asset allocation which is based on Markowitz (1952) portfolio selection theory. Brennan (1997) indicates that tactical asset allocation is a form of myopic or single period strategy in investment, since it assumes that an investor adopts the mean-variance rule of the single period rate of return of the invested portfolio. However, this raises difficulties in the sense that the

expected rate of returns over a defined period, which are inputs of the model are not the actual returns, but rather the internal rate of returns over a long period. The second difficulty is that tactical asset allocation is pegged on variation of time or the likelihood of returns on assets, which may only be applicable if an investor has a logarithmic utility function.

Jensen et al. (2002) applied tactical asset allocation to commodity futures to a diversified portfolio to outline the benefits of using this approach. The reason behind this was that the commodity futures offered a unique asset class which is good for portfolio diversification purposes. The results of this application confirmed that there was enhanced performance of the entire portfolio, and that adding short futures in an investment portfolio actually improves its performance in expansive policy periods. Faber (2007) took a calculable approach to tactical asset allocation by defining a simple model which investors could easily adopt. This method involved using simple and mechanical logic, similar assumptions in terms of model and parameters, to all asset classes and price based only. The model was applied to over twenty markets which showed consistency in the results. The risk adjusted returns also recorded improvement by using the quantified tactical approach in asset diversification.

Another technique which investors may opt to use on how to allocate assets is the dynamic asset allocation approach. This method entails adjusting of asset classes which will fit the conditions of the market. Brennan and Xia (2002) used dynamic asset allocation to address the problems faced by an investor of finite horizon on nominal assets while factoring in inflation. This approach was a means of responding to current risks the investment portfolio might be facing, and to take advantage of any trends to maximize returns. The focus area was on power utility companies, whose real interest and inflation rates were stochastic in nature. The assumption was that the equity premium was constant and that risk free securities were not in existence. Through dynamic asset allocation, they adopted a viable portfolio mix which maximized the investment returns. Liu et al. (2003) opted for dynamic asset allocation with

event risk. They took into consideration the fluctuations in prices and volatility on investment strategies which was occasioned by risk events. Through dynamic asset allocation, they provided a systematic solution to the optimum portfolio problem. The ultimate investment solution they opted for was a buy and hold strategy and at the same time a dynamic strategy in investment of the portfolio.

An investor may opt for an integrated asset allocation approach in order to maximize the investment portfolio returns. This approach was introduced by Sharpe (1987) where he provided a framework key element which can be used in asset allocation decisions. Integrated asset allocation seeks to optimize an investors net worth. This approach looks at the current net worth of an investor, which is assets minus liabilities, and the standard deviation of the future net worth. Batocchio et al. (2006) reviewed the concept of optimum asset allocation for investors in pension fund under the risk of mortality in two phases, accumulation and decumulation. Their intention was to identify how an investor would maximize expected utility by a pension fund when a member dies, by looking at the managed wealth in entirety and retrospective calculated reserve. From their findings, they alluded that an optimal investment in the risky assets decreases and increases during accumulation and decumulation phases respectively.

Basak et al. (2007) assessed optimal asset allocation by analysing how a fund manager takes risks, due to portfolio performance attributed to by increasing and complex relationship of funds flow. From the research findings, they alluded that the ultimate aim of the fund manager was to optimize the returns on investments, while taking minimum risks in the money markets, due to the volatility of the portfolio and risk tolerance levels. Fombellida and Zapatero (2010) used optimal stochastic techniques to determine how an investor can optimally allocate assets to minimize the risk, and at the same time maximize the expected returns. Their focus area was on defined benefits pension funds where an investor invests in a savings fund, risky stock and

in bonds, and further minimize the actuarial liabilities from zero along a time horizon which is finite, which proved that the investor would optimize their assets for maximum possible returns.

Ibboston and Kaplan (2000) used balanced mutual funds and pension funds data to try and get an understanding on the percentage which asset allocation policy explains performance, explicitly 40%, 90% or 100% in terms of how policy can affect the variability of returns over time. Their findings were that 90% of variability of returns on funds over time was explained by asset allocation and only 40% of deviation of returns amongst funds. On average, asset allocation policy described slightly higher than one hundred percent of the level of returns.

1.1.3 Firm Size

Firm size can be defined as the amount of assets owned by a company that have productive proficiencies (Hasan et al., 2016). Shalit and Sankar (1977) stipulated that the size of the firm plays a vital role in industrial organization and applied macroeconomics. They further stated that firm size has been confirmed as a robust empirical variable in many studies despite using alternative indicators. In an organization, firm size, a specific internal factor of a firm's characteristics, has a role in determining its behaviour with respect to risk management thus influencing its performance. The size of an insurance company can be measured using the total assets, gross premium written or the capital it holds (Mwangi & Angima 2016).

Fiala and Hedija (2015) analysed firm size using three indicators; revenue, number of employees and total assets, to analyse the law of comparable effect (Gibrat's law) which states that the size of a firm is a random walk independent of the size of the company. Despite all the three indicators rejecting the Gibrat's law, they were deemed a viable measure while undertaking regression analysis. One of the most commonly used indicators to measure firm size is total assets (Hoque & James, 2000). A firm which has more assets tends to operate with less constraints and have an advantage because of the capital they hold, thus having a

competitive edge by being more agile and taking higher risks without major implications to its available capital (Yegon et al., 2014). The capital available which is a determinant of risk based capital is derived at by looking at the assets of an insurance company and determining which ones are admissible as per the different tiers described by the Insurance Regulatory Authority.

Gross premium written can also be used to measure the size of an insurance company. The premium underwritten is a representative of the sales an insurance company has made within a defined period. The premium growth rate is used to measure an increase in the market share of an insurance company where the gross premium written is used to determine the growth rate. Insurance companies with high premium(s) volumes and major in size are expected to respond faster when there are changes in the market as compared to small companies. They can diversify their risks in an effective way and maintain adequate capital while maximizing their underwriting profits and investment income (Kaya, 2015).

Dang et al. (2017) alluded that firm size is deemed important in many empirical analyses and is often used as a measure within firm characteristics. There are several indicators of firm size which can be measured empirically using the measurement effect or size effect. Total assets, total sales and market capitalization are some of the indicators which are adopted when measuring firm size. There is evidence from several empirical analyses that some measures of firm size are considered favourable than others based on the situations. Different indicators will lead to different findings during analysis. It is therefore recommended that the choice of indicators for firm size is fully supported theoretically and empirically, based on the context of the research.

1.1.4 Investment Returns

Investment returns are a financial measure used to monitor performance of a business entity by analysing the cost of investment, amount invested, and the benefits accumulated from the nature of investment (Preuss, 2016). Insurance companies reflect invested income in premiums quoted

to policy holders, thus emphasizing on the importance of separating the management of the insurance underwriting business and the management of insurance investments which back up their capital and reserves (Smith, 1989). Investment strategies should be beneficial to both the policy holders and the shareholders and at the same time to be in line with the regulatory requirements. Striking a balance which will incorporate all the stakeholders' interests has been a challenge.

Insurance investment risk is different from that of a typical fund manager in the sense that investment risks for fund managers are both absolute, meaning that market value of the fund will rise and fall at a period and relative meaning that it may over or under perform the benchmark. Concentration is more on the asset side of the client and little or no consideration on the liabilities. Insurance companies' investment has to look at both the assets and liability sides of the company since they bear the liability of indemnifying policyholders. This makes it difficult for the companies to go for the perceived high risk high return investments.

Investment returns are vital for any company which intends to be profitable. Investment returns should positively co-vary with current stock but negatively co-vary with future stock based on the effect of discount rates on investment returns (Lamont, 2010). The investment income ratio gives a true reflection on how profitable an insurance company is by considering the investment income and the earned premiums/ life fund. Previous regulatory regimes which didn't have a holistic view of the risks of the entire balance sheet or compliance based regimes, had concentration limits on where insurance companies had to invest and what percentage of the total assets will be in certain asset classes. Risk based supervision regime gives companies greater investment flexibilities and allow better management of assets in respect to the size, complexity and risk appetite of the companies (Liebwein, 2006).

1.1.5 Insurance Companies in Kenya

As per the Insurance Regulatory Authority (IRA) annual report (2018), the insurance industry in Kenya has portrayed growth in the past five years. There are a total of sixty-three insurance companies licenced in Kenya. Thirty-seven transact general insurance business and twenty-six transact life insurance, with a gross premium income of about two hundred and nine billion Kenya shillings and an asset base of five hundred and nine billion Kenya shillings. The asset base and gross premium written determines the size of the companies thus vary across the industry. All these companies need to adhere to the risk based supervision model introduced by the regulator to enhance stability in the sector.

Enterprise risk management is vital for insurance companies since it informs the management team on capitalization and pricing decisions. The introduction of risk based supervision model ensures that insurance companies are cushioned from the volatility and imperfections of the market. This is done by addressing the risks the companies face in totality, by looking at the balance sheet, both from the liability side and its assets. Quantification of enterprise risk management will assist in determining the capital adequacy for such adverse scenarios (Yow & Sherris, 2008).

The concept of risk based capital is a quantitative approach contained in the first pillar of risk based supervision framework for the insurance industry adopted by the Insurance Regulatory Authority in 2013. Solvency II was adopted in Europe in the insurance industry in comparison to Basel II in the banking industry (Johansen & Grosen, 2011). Insurance companies' revenue stream is dependent on underwriting profits and investment returns. Asset allocation is key in determining where to invest. Portfolio managers in the insurance industry have to strike a balance between asset allocation, the risk charges imposed and the anticipated returns. Insurance companies are also supposed to adhere to the qualitative requirements of the risk based supervision framework, have fully fledged risk management and compliance department,

actuarial capabilities and internal audit department to act as control functions of the organization. These functions enable an insurance company to perform its own assessment of risk and solvency position. (EIOPA, 2014). Currently, all insurance companies are required to file quarterly returns using a template provided by the regulator (IRA, 2016).

A large percentage of assets of insurance companies has been held in investments, which are income generating, thus prompting companies to develop investment strategies that are feasible and can maximize their investment returns. Asset allocation is a determinant in investment decisions of insurance companies depending on their nature of business, which can be short term or long term business. Regulatory changes in the insurance sector from rule based to risk based supervision has a major impact on asset allocation. Risk based supervision focuses on both asset risk and liability risk, unlike previous regime which focused on the liability risk alone (Bragt et al., 2010). Based on the above description, every asset an insurance company holds attract a risk charge depending on the factors incorporated in the standard formulae of RBC. Portfolio managers have a task in balancing the investments in assets where the risk charges are low so as not to impact negatively on the capital available which is used to calculate RBC.

1.2 Research Problem

Proliferation of sophisticated financial assets within the insurance industry has spawned the emergence of complex risk management models. Risk based capital concept was introduced in the insurance industry so that stakeholders of insurers can have an all-inclusive analysis of all risks an insurance company faces on both its assets and liabilities. This concept is important in assisting insurance companies determine adequately their capital based on the size, nature and complexity of their business. It retracts from the compliance based approach of holding a fixed amount of capital to a more informed decision on capital available in accordance to the risk exposure of the company. Portfolio managers face a challenge of trying to make the best investment decision without attracting high capital charges, and at the same time quantifying

the differences in risk adjusted returns resulting from investments in various asset classes and potential adjusting of insurance company's portfolios as per the risk based capitals (Majtanova & Marcinech, 2017).

The global financial crisis in the year 2008 raised serious questions on the stability of the insurance sector and effectiveness of financial regulations. One factor blamed as a potential source of this crisis was inadequate capitalization of companies to survive adverse crisis. Notably, most insurance companies tend to take greater risks by charging less premiums to attract more customers. This in turn has led to major losses thus affecting the capital available for the companies to operate efficiently (Afande & Maina, 2015). The recent wave of corporate failures across the globe such as collapse of AIG, and more importantly local insurance companies such as Invesco Insurance (2008), Standard Assurance (2009), Stallion Insurance (2009), Blue shield Insurance (2011) and Concord Insurance (2013) despite holding the minimum capital requirement as per the insurance act, have been declared insolvent. These companies were placed under statutory management by the regulator, while some of them are under liquidation. Other companies issued profit warnings such as CIC Insurance (2016), Sanlam (2016/8), Britam (2017/8), due to impairment of financial assets covering corporate bonds and general performance of the stock market. This has triggered increased government regulation to avert further collapses of these corporations. It has led to the adoption of RBC, where risks are identified in a timely manner and capital is injected early enough to prevent a company from collapsing (Hogan, Meredith & Pan, 2015).

The link between RBC and earnings from investments remains imprecise due to divergence in findings. The differences in research outcomes is attributable to how the study variables were operationalized, choice of variables and control variables, the econometric models used and dissimilarities at contextualization, which give rise to methodological, conceptual, and contextual gaps. Various empirical studies have adopted various metrics to measure RBC as

well as investment returns. Hogan, Meredith and Pan (2015) used credit and market risk as proxies for risk based capital while Lastra (2004) utilized additional indicators of RBC (insurance and operational risk) and documented insignificant RBC-returns link. Likewise, most studies undertaken empirically have been largely bivariate in nature focus on either the link between RBC and investment returns, or RBC and asset allocation, or asset allocation and investment returns. However, the RBC-returns link is not usually direct, but it is explained by several control variables such as asset allocation, size of the firm, age of the firm among others. This study therefore extends RBC-returns link by incorporating asset allocation and firm size to bridge these conceptual gaps.

The choice of econometric model, study timeframe and sampling issues are the major sources of contradicting findings in RBC-investor relationship. Different empirical studies have adopted distinct models such as internal models, standard approach models as well as VaR models. Looking at the various empirical studies, there are differences in methodological approach of RBC when determining the investment returns. Disputes arise in the suitability of the 99.5% VaR in the model on the best estimate, minimum capital requirement and risk margin. Scholars argue out that the proposed RBC model will have a deviation from the anticipated 99.5% confidence interval thus not giving an assurance that the intended purpose will be met (Eling et al. 2007; Doff, 2008; Eling & Pankoke, 2014). On the other hand, some of the studies deemed that the time horizon of 1 year 99.5% Value at Risk is not adequate, analysing all asset classes and investment vehicles is not viable and laxity in reviewing both asset and liability of a company's balance sheet. The model used could only set possible outcomes for bonds and stock markets but lacked simulated data for other assets. It also excluded correlation between products implying that the risk drivers were independent (Long Vu, 2015; Majtanova & Marcinech, 2017). This study intends to include all the investments portfolio and not only bonds, and at the same time adopt the 99.5% VaR or a conditional tail

expectation (CTE) methodology in determining the RBC as per the risk based supervision model.

At contextual level, institutional and cultural differences across countries where research was carried out is another possible explanation of divergence in findings. A number of these studies were undertaken in European and American context, others were carried out in Asian nations and some in African context. The intra-countries institutional dissimilarities to some extent explain the RBC-investor relationship indecisive results and, at the same time, raises concern about whether the RBC-investor link which originated from industrialised countries are applicable in developing countries, and therefore giving rise to contextual gaps. Most studies, however, have been conducted in developed countries where RBC regulatory environment is different, and the results may not be generalized to a frontier market like Kenya. Furthermore, Lastra (2004) argues that developing countries differ widely among themselves based on sectorial or industry differences.

To establish the causal link between RBC and investment returns, this study goes beyond the previous studies since it incorporates asset allocation and firm size as intervening and moderating variables. This study sought to answer the question: how does asset allocation and firm size influence the relationship between risk based capital and investment returns of insurance companies in Kenya?

1.3 Research Objectives

The study's core objective was to determine the relationship among risk based capital, asset allocation, firm size and investment returns of Insurance Companies in Kenya. The specific objectives were to:

i. Determine the effect of risk based capital on investment returns of insurance companies in Kenya;

ii. Establish the effect of asset allocation on the relationship between risk based capital and investment returns of insurance companies in Kenya;

iii. Examine the effect of firm size on the relationship between risk based capital and investment returns of insurance companies in Kenya; and

iv. Establish the joint effect of risk based capital, asset allocation, and firm size on investment returns of insurance companies in Kenya.

1.4 Value of the Study

The outcomes of this study adds to the prevailing understanding on the relationship between the risk based capital and investment returns of insurance companies, and the literature around the mediating effect of asset allocation on the relationship amongst RBC and investment returns, how firm size acts as a moderating variable on the relationship between RBC and investment returns and the combined effect of RBC, asset allocation and firm size on investment returns. The study also highlighted research gaps and areas of further research as well as providing references for future researchers.

As per the study findings, shareholders of insurance companies will be able to make informed decisions in assessing when to inject capital to meet the regulatory requirements by attaining the required solvency margins. Managing Directors would also be able to monitor the resilience of their companies during extreme financial crisis as per the calibration of risk based capital formulae, and the aggregate capital they would be expected to hold in order to survive. Portfolio managers will also be able to understand how risk based capital can affect the decision making on where to invest, which portfolio to select and how it affects the returns on investments. The study findings also form a basis for insurance companies' investment policies to be drafted in line with the risk based capital under the risk based supervision. The study findings will give the portfolio managers leeway in deciding on where to invest based on the risk appetite of the company and capitalization, which in turn may lead to high expected returns.

From a policy perspective, the study will assist the regulators to understand the effect of the quantitative requirements under RBS on the investment returns of insurance companies. It will also give a clear indication of how the risk capital charges for subclasses cumulatively affect the capital available and eventually the risk based capital. This can be used to form a basis of reducing the percentages of the risk charges. Policy makers will get insights on how RBC will affect investment returns of insurers. The study findings have also highlighted the importance of adequate capitalization of insurance companies and enable the regulator to understand the importance of revenue diversification, which will reduce the solvency risk of insurance companies. This will encourage companies to seek multiple sources of income within the sector and diversify their investments.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter examines the key theories on risk based capital, asset allocation, firm size and investment returns of insurance companies. The theoretical foundation on modern portfolio theory, Redington immunization theory, extreme value theory and Sklar's theory has been covered in the chapter. It looks at the empirical studies regarding risk based capital and investment returns, the relationship among RBC, asset allocation and investment returns and the relationship among RBC, asset allocation, firm size and investment returns.

2.2 Theoretical Foundation

The main constructs that are used in this study are based on different theoretical groundings. The theories explain the association between risk based capital and investment returns of insurance firms. Modern portfolio theory is discussed in detail regarding asset allocation and investment returns and the risks associated. Redington immunization theory is discussed regarding asset liability management and the whole balance sheet approach in assessing risks as required in the risk based supervision regime. Extreme value theory also looks at the risk charges involved in various asset classes and liabilities of insurance companies which forms the concept of stress testing while determining the risk based capital. Sklar's copulas theorem is discussed regarding risk based capital as per the regulators concept.

2.2.1 Modern Portfolio Theory

Markowitz (1952) introduced the concept of modern portfolio theory (MPT) regarding portfolio selection to maximize returns. This theory focused on the rule that investors should maximize discounted anticipated returns. The approach means that the investor is considering the expected or anticipated return as what they desire and the variance of the return as an undesirable event, thus leading to the expected returns-variance of returns rule. It is probable that investors should fully diversify their portfolio to maximize expected returns. The law of

large numbers is likely to ensure that the yield of the returns that is received is almost the same as the anticipated yield.

On the aspect of risk and return, Markowitz theory specifies that the risk of an asset is not its risk in isolation, but a full compilation of the various asset risks to the risk of cumulative or aggregate portfolio. In the context of a portfolio, the risks involved are both systemic/market risk and the unsystemic risk, also known as diversifiable risk. The theory introduced the concept of portfolio selection for investors' optimum returns. Furthermore, the theory indicates that there is a contributory effect of all the risks each asset is being held to the overall risk of the portfolio. There have been various developments and criticism of Markowitz theory on portfolio selection. Treynor (1962) developed the Capital Asset Pricing Model, CAPM based on portfolio selection theory.

The concept of a single period mean variance CAPM was further advanced by Sharpe (1964) and Mossin (1966) autonomously. Sharpe (1964) assumed all investors normally adopt the mean variance rule, i.e., they select mean–variance effective portfolios, there is also an assumption that lending and borrowing is limitless at a rate which is risk free, and is not dependent on the on loan amount. Torbin (1958) derived the capital market line and efficient frontier concept based on Markowitz theory, looking at investment balance and portfolio decisions in his write up on liquidity preference as a behaviour towards risk. Marling and Emanuelson (2012) alluded that the variance of portfolio doesn't fully measure the risks an investor takes. Their argument is that one cannot know the VaR of a portfolio if only the variance and mean is known without recognizing the underlying distribution, hence Markowitz model does not advice an investor which portfolio they can afford and are willing to take certain risk to get bankrupted.

The concept of risk based capital is to have an overview of all the possible risks an insurance company might be facing holistically on the balance sheet (both assets and liabilities). This

affects the investment returns either positively or negatively, since a company must select an investment portfolio which offers maximum returns, but at the same time consider the risk charges, which in turn affect the risk based capital. This study focuses on how risk based capital affects investment returns of insurance firms in Kenya. The risk charge imposed by RBC on investments such as in the securities exchange affect the expected return on investment with asset allocation as a contributing factor, thus making this theory viable for the study.

2.2.2 Redington Immunization Theory

Redington immunization theory (1952) was developed by Frank Mitchell Redington as a strategy to ensure that interest rates variations do not affect the worth of an investment portfolio. The theory is used in Asset Liability Management. The idea behind this theory was to structure assets in a manner that the net present value on its local minimum of 0 at i_0 ,which means that the net present value of the assets equals to the current value of liabilities at interest rate i_0 , and the derivative of the present value function of the assets equals the derivative of the present value functions of the liabilities at interest rate i_0.

Some of the disadvantages of this theory is that, even if the Redington immunization conditions are met, it is still uncertain to conclude that the assets fully cover the liabilities of a firm. Firstly, Taylor series third and higher order terms are ignored, so any conclusion made on assets exceeding the values of liabilities can be deemed valid if changes in the interest rate are sufficiently small. Secondly, to satisfy the conditions of Redington immunization, one will have to reorganize the value of the portfolio of assets since their value changes over time. Thirdly, other factors which may have an influence on the pay outs of any assets are not considered. The theory only investigates the variations of the interest rates.

Several scholars have used the concept of immunization to analyse various categories of investments such as bond portfolio, pension and further reviewed multiple liabilities, floating rate notes and contingent immunization as a strategy of managing risk. Some researchers have

further improved on Redington immunization theory to address certain risks, while others have critiqued it and highlighted its weaknesses. Fisher and Weil (1971) opted on relaxing the assumptions of flat yield curve as per Redington's theory and empirically tested their model. Their duration matching strategy as per the empirical analysis suggested that a collection of long term bonds which is adequately selected can be risk less. However, this was disputed by Ingersoll (1983), who postulated that Fisher and Weil (1971) assessment had not been autonomously established, and that their research was a simulation and not empirical, since the findings were not based on actual market bond prices, but rather artificial bond prices derived from indices.

Shiu (1987) focused on single liability immunization and further extended the assumptions made by Fisher and Weil of interest rates were flat, meaning they are independent of time, and considered cases where the shocks associated with interest rates are dependent of time. He further disputed the traditional assumption of duration drift where it was assumed that it wouldn't be problematic if one rebalances their portfolio without cost implications. The study findings alluded that there is a contrary association amongst duration and interest rates, if one increases the other one decreases and vice versa. The extension to Fisher- Weil immunization theory is that a period- matched portfolio is not essentially riskless, since the interest rates might change over time, as well as the portfolio losing its value. Shiu (1990) further criticizes Redington's theory by indicating that it doesn't give a clear distinction between long term and short term interest rates, therefore assuming all yield curves are flat. This in turn may lead to arbitrage opportunities and at the same time assume that interest rate shocks are minimal.

Reitano (1991) explored the option of directional immunization, where he specified the yield curve shift directional vector and further reviewed non-directional immunization rather than the flat yield curve, which an assumption of one interest rate had applied to all discounted cash flows. In his approach, points along the yield curve are defined as partial durations. The

measures are then compiled to form a directional measure in a duration which reflect portfolio sensitivity. He further models the yield curve as vector of yields which are assumed to be functionally dependent. The yield curve changes are identified with vector shifts thus pursuing immunization at a multivariate context.

Barber (1999) generalized several immunization theories previously developed thus proving that Redington (1952)'s immunization, Fisher and Weil (1971) immunization, and other immunization theorems can be generalized to affine term structures. This allows generality in defining durations which can be applicable to multiple models. The duration coverage condition gives an assurance that each liability can be immunized separately. The study further shows that the ratio of asset to liabilities is globally convex and not purely locally immunized as per Redington's assumption of equality in assets and liabilities; and asset cash flow being more dispersed than liability cash flows. Additionally, it extends the feasibility of term structure models in the sense that one can empirically determine the best model based on historical changes of term structure; and not assuming a parallel shift or a particular model.

Wang et al. (2009) further extended the immunization theory to address longevity risks of life insurance companies, due to the changes of their liability influenced by mortality changes, which is similar to change in interest rates. The study's main objective was to obtain optimal product mix, which included life policies and annuities, to enable insurers who transact long-term business realise better natural hedging effect through immunization. Their valuations are inclusive of the interest rate risk as described by Redington (1952) but further analyses mortality risk over time.

Based on the above discussion, the adoption of the word immunization by Redington was to signify the investments in such a way that any business that is in existence is immune to the general changes of interest rates. This study looks at how risk based capital affects the returns on investments of insurance companies in Kenya. The concept of determining risk based capital

involves imposing capital charges across the entire balance sheet based on how risky the asset or liability is deemed. This concept of provision of high capital to assets which are high risk to cushion insurance companies against shocks or adverse scenario applies immunization theory as described by Frank Redington, thus making the theory relevant to this study.

2.2.3 Extreme Value Theorem

Tippet (1928) developed the theory of extreme value (EVT) which deals with the extreme deviances from the median. This theory has been extensively used in the area of risk management of financial portfolios by statistically modelling extreme events and computing extreme risk measures. EVT can be used to model the influence of any adverse scenario or situations which have extreme stress on any portfolio an investor holds. The two main models used for extreme values used over time and are the peaks-over-threshold (POT) models and block maxima models. These models are used for bulky data collected from large samples of identically distributed observations. For example, if hourly, daily or weekly transactions on trading of an instrument are recorded, the model that will be suitable to analyse quarterly or annual maximum would be the block maxima method due to the bulkiness of the data.

McNeil and Saladin (1997) reviewed the peaks over threshold model (POT) while modelling tails for severe losses distribution. Their focus was to seek a model which explains large losses in insurance. From their findings, they alluded that despite peak over threshold model being advocated in determining the large tail distributions, where excess losses over high threshold have been modelled using the generalized pareto distribution, there are some concerns to this approach. This method requires that there is sufficient data in order to use the POT method and adopt the generalized pareto distribution for modelling large losses. The other concern was that it was difficult to determine the threshold at which the tail behaviour in the model is said to begin, and how many excesses will be required to adequately determine the loss severity threshold to compare the quantile estimates accurately. Estimating the high quantiles also

posed a serious challenge in their study, with a tail index of 1 and a beta parameter of 10. However, the high beta is termed as unrealistic in the insurance practice.

McNeil (1999) continued to support the extreme value theorem and specifically the POT model arguing that it is a suitable method for analysing the extremes of market, credit, insurance and operational risks. The simplicity of this model can be used in estimating the measures of tail risks and further provide useful stochastic modelling for determining the Valuation at Risk (VaR) and an alternative of VaR to market risks. He argued out that EVT can be used to capture high level fluctuations of the market by taking into consideration the extremes over and above volatility risks; and that the method can be proven by back testing the data on historical series of returns. The study further introduced the review of multivariate extreme events, where this method can be used to model the tails of multivariate distributions. This method looked at the dependence structure of extreme events by using the block maxima model in EVT.

Embretch (2000) studied some of the limitations and potentials of the theory in extreme value as a risk management tool. In his assessment he alludes that EVT can be used as a complement to the Valuation at Risk model, since it factors in modelling of extreme and rare events. The second observation was that the EVT model is consistent between risk factors across different markets and jurisdictions, unlike the use of scenario analysis. The third observation was the smoothness and ability to extrapolate EVT, in the sense that it avoids any biases in the tail estimates and can be extrapolated to produce confidence intervals beyond the 99% VaR. The fourth observation was that EVT yields a common approach towards operational risk and that both theoretical and computational tools are available. Despite having a number of positive attributes in the field of risk management, some of the drawbacks that Embretch (2000) observed were that there are still some theoretical issues that are unresolved, for example, the multiple dependent risk factors. He further argues that EVT assumes that the extreme losses

experienced do not go beyond ten years ago, and that the stability is questionable since there is no guarantee for convergence of estimated parameters.

Diebold et al. (2000) researched on the applicability of extreme value theory and looked at some of the pitfalls and opportunities of the theory in financial risk management. One of the observations of the analysis was that EVT gives an opportunity to analyse data beyond the boundaries of the observed data; and estimate extreme quantiles and probabilities by fitting a model specific to the data on extreme events and not the entire data. The estimated model would be specific to the extremities of the distribution rather than the centre of distribution. In assessing financial risk, Diebold et al. (2000) observed that high frequency financial returns are conditionally heteroskedastic in nature; and not independent and identical distribution as assumed in the application of extreme value theory. Attempting to generalize the dependant data, which involved removal of the clusters in extreme conditions, had proven to affect the volatility clustering found in financial asset returns, thus reducing the effectiveness of EVT in financial risk analysis. The use of per period maxima method could be adopted to reduce the dependence of the data, however it may reduce the efficiency.

Gilli and Kellezi (2006) further analysed the applicability of extreme value theory in evaluating financial risks, by applying the theory to calculate tail risk measures and interrelated confidence intervals to various stock market indices. Their study focused on the two methods used in EVT, the peaks over threshold and the block maxima models. One of the challenges of using the block maxima method was determining the suitable choice of periods when defining the blocks. The peak over threshold method (POT) was used to look in to distributions beyond a certain threshold. Both methods proved adequate to model the financial risks, but peak over threshold was considered superior than the block maxima method, since it was superior in exploiting the information in the data samples. These findings were adequate to prove that EVT can be applicable in measuring extreme events in financial risk analysis.

Rocco (2014) highlighted some of the considerable advantages and drawbacks of the extreme value theory and its applicability in finance. Some of the positives in the study findings were that EVT has a strong theoretical underpinning and offers tools for modelling extreme events, which are paramount in finance, since it gives the importance of extreme events in the profitability of an investment portfolio. The second positive was that EVT offer various approaches ranging from point processes to non-parametric methods, thus ideal in modelling various types of extreme events. The third advantage is that the applicability of parametric approaches allows for prediction of extreme future events which is quite important in risk assessment.

Some of the drawbacks of EVT as per Rocco (2014) were that there are difficulties applying EVT in multivariate and it's not as straight forward as the univariate and can lead to some computation limitations. The second drawback was the parameters dependence on the estimation of extreme quantiles given that it is still a grey area and no substantive methodology has been adopted. The third drawback was that EVT relies on data of extreme events, which happen rarely but at the same time requires large amounts of data for applicability. Despite the drawbacks, it is still considered as an applicable theory in modelling extreme events.

Extreme value theorem has also been applied in recent developments in finance such as the use of cryptocurrency. Gkillasa and Katsiampab (2018) have reviewed the applicability of EVT on the five major crypto currencies namely, Litecoin, Ethereum, Bitcoin Cash, Ripple and Bitcoin. The study focused on the tail behaviour of the cryptocurrencies by applying extreme value theory, estimating the Valuation at Risk and the expected shortfalls. Their study reviewed the applicability of EVT in financial risk analysis, since the behaviour of cryptocurrencies is totally unique and not similar to the traditional currencies. Despite the uniqueness, their study alluded that EVT was successfully applicable and determined which cryptocurrency is deemed riskier

than the others. An evaluation of the tail distribution by applying the generalized Pareto distribution model confirmed the applicability of EVT in cryptocurrencies.

In conclusion, Embretch and Hofert (2011) alluded that the financial service sector is experiencing adequate transformations. The insurance industry is prone to huge disastrous losses for which the requested cover is only just available. Traded financial assets are becoming more complex thus indicating that there is need for advanced methods of risk management. The required risk transfers mechanism and risk management practices indicates the convergence of finance and insurance at the product level. The extreme value theory is important methodologically regarding risk management in insurance, reinsurance and finance. This study focused on how RBC affects investment returns of insurance companies. When determining RBC, capital charges are imposed on insurance, market and credit risks. The extreme value theory concept is used when defining the insurance risk capital charge, which is imposed on the premium reserve and claims reserves on short term insurance business, and on mortality, longevity, morbidity, expenses, lapses and catastrophe on long term insurance business. The determination of the sub variables that are used to compute RBC adopts the concept of EVT thus its viability in this study.

2.2.4 Sklar's Theorem

Sklar's theorem was introduced by Sklar (1959) stating that a multivariate cumulative distribution can be expressed and broken down in terms of its marginal and a copula. The copula describes the dependence part of the distribution. Ruschendors (2009) further proved Sklar's theorem on the basis of distributional transformation of real random variables and its application. This process allowed for treatment of any general distributions, including the discrete parts, similar to continuous distributions. The distributional transformation was further implemented in a stochastic ordering and adequately defining the conditional value at risk measure. After successful implementation of the distributional transformation, the findings

were that some consideration was not required on the discrete or mixed type distribution in comparison to the continuous distribution. This is in line with what is defined in Sklar's (1959) theorem. The concept of distributional transformation is currently applicable to risk measures. It is preferable in comparison to the conditional tail expectation (CTE), since CTE does not define coherent risk measure unless it is restricted to continuous distribution. Using distributional transformation and defining the modified version as conditional value at risk, it allows one to use other distributions other than continuous distribution.

The proof for Sklar's theorem is straight forward when the distribution is continuous. The challenge is when even one of the marginal has a discrete function. For marginal which are continuous in nature, a copula is uniquely defined. Durante et al. (2012) extended this theorem by adopting an analytical regularization technique, to factor any discrete components of the marginal and establishing a copula associated in an arbitrary distribution function. They provided an extension of Lemma which states that, for every dimensional distribution function which has continuous marginal, there exists a unique additional copula. This means that for random variables, a copula is determined via an established formula which shows an element of convergence to the copula. Durante et al. (2013) further reviewed Sklar's theorem from a topological point of view. This involved use of topological arguments which included compactness of the copula (under weak topology) and a few properties of the distribution functions.

Faugeras (2013) derived a probabilistic proof of Sklar's theorem by using a continuation technique which is simplified and a series of progressive arguments. The focus was purely on a probabilistic approach rather than an analytic approach in determining the copula; and further assuming that the distribution function (F) is unknown but to be continuous in nature, and instead of the samples being independent and identically distributed random variables, they are distributed according to the unknown function (F). This approach established that copula

associated with the distribution function tend to converge when analysed. It showed a strong consistency in determining the copula for both continuous and discrete distributions purely from a probabilistic reasoning, rather than an analytical approach, and use of a function with compact support and strong regularity conditions. The study also showed the possibility of applying Sklar's theorem using an unknown distribution function (F) with both continuous and discontinuous marginal and determining the respective copula.

Schmelzer (2015) extended the applicability of Sklar's theorem on belief functions (a method of quantification of uncertainties that generalizes probability theory by considering all the available evidence), that are minitive in nature. From the analysis, it was proven that even if the theory is applicable to joint function and marginal distribution function, it can still be applied to the joint and marginal minitive belief functions. This means that a single copula's assumption could be used in characterizing the dependence relationship between random sets. The extension to Sklar's theorem is the applicability of copulas to belief (containment) functions without associated random sets being involved.

Habiboellah (2007) indicates that a copula can be compared to correlation invariant under transformation of risk. The Gaussian copula model is used as a valuation tool for debt obligations which are collateralized and has been accepted as a standard market model. Sklar's theory has been widely used both in mathematical economics and quantitative risk analysis. In risk management and portfolio management, copulas are used in stress testing and scenario analysis. The concept of RBC is used by the regulators to ensure that insurance companies are well capitalized and can survive the economic shocks that they may face in the future. This is the concept of stress testing of the company's balance sheet to create multiple what if scenarios thus being in tandem with the copula's theorem hence its applicability in this research. Market risk capital charge, insurance risk capital charge, credit risk capital charge and operational risk capital charge, imposed while deriving the RBC as per the standard formulae adopts the copulas

methodology. Through the aggregation of the risks, an insurance company can determine the capital allocation to cover the quantitative risks it may face (Tang & Valdez, 2006).

2.3 Empirical Literature Review

Previous studies regarding RBC, asset allocation, firm size and investment returns have been reviewed. From the studies, various researchers used different variables to have an understanding on how they influence investment returns. A summary of these empirical studies has been tabulated indicating the research findings and the research gaps.

2.3.1 Risk Based Capital and Investment Returns

The concept of RBC gives an overview of the entire risks an insurance company is facing on both its liabilities and assets side of the balance sheet. This affects the investment returns either positively or negatively (Eling & Pankoke, 2014 a). Eling et al. (2007) outlined the approach in which the first pillar of RBS, which is the MCR and the RBC, was being developed. The researchers established that the methodology used focused fully on the models which are already available. Despite it being evidential that models which are complex tend to be more successful, including aspects of dynamic cash-flow, it does not necessarily mean that complexity will yield value. The ultimate model choice should be reached at by considering the costs involved in development, and further suggested that future research should be done on how various solvency models can be used to measure financial distress. Their study focused on the complexity of the models being used in determining the capitalization of insurance companies and did not incorporate how the process of capitalization affects the risk capital charge and investment.

Fare et al. (2004) looked at how profit efficiency in the banking industry is affected by risk based capital. Their objective was to assess the profit efficiency using a new method and also to see how risk based capital affects this profit efficiency. The measure which was used concentrated on deviations from maximizing profits due to technical inefficiencies. These inefficiencies included failure in oversight by the managers and allocative inefficiencies caused

by wrong inputs and outputs which are not optimal. The model used included both a risk weighted capital ratio and a leverage ratio, which led to the identification of how the constraints affect the banks' profits. The sampling was random for a period of three years for banks in the United States. Their findings confirmed that allocative inefficiencies are a major driver of profit or loss in comparison to technical inefficiencies, and that risk based capital have a significant effect on the allocative inefficiencies. Despite the study incorporating the effect of capitalization on allocative inefficiencies and profits of banks, the context is within the banking sector and doesn't incorporate how risk based capital specifically affects the investment returns of insurance companies.

Kochanski (2010) reviewed how RBC has an effect to unit linked products in the German insurance market, arguing that the defined RBC standard formulae only considered the traditional life insurance products and doesn't consider innovative life products. He further outlined the importance of lapse risk for innovative insurance products and gave out an alternative for calculating the net risk based capital formulae. His findings were that the main risks that the German unit linked product faced were market risks and lapse risks, whereas mortality risk and expense risks were considered negligible. However, the study was particular on market risk and lapse risk, which is applicable to long term insurance business, and did not investigate how the new derived risk based capital model will affect the investment returns of insurance companies.

Marlina and Puyarti (2013) conducted a study on how risk based capital affect the productivity of a specific insurance company in Asia for a five-year duration. Risk based capital was calculated as a ratio of the level of solvability and the minimum level of solvability. Their focus on profitability was on return on asset and return on equity. The methodology adopted was simple linear regression and Pearson correlation with a 95 percent confidence level. In their findings, risk based capital explained about 29% variation on return on equity and 10%

variation on return on assets. As per the study findings, the variations in the profitability measures were explained by risk based capital. The study focused on return on assets and return on equity of a specific insurance company and did not look at how risk based capital would affect the investment returns of the entire insurance industry.

Cheng and Weiss (2013) looked at the relationship between risk based capital and a firm's risk taking in property liability insurance for a fifteen-year duration. The study was comparing pre and post risk based supervision regulation on capital adequacy. The methodology used was three stage least square approximation to explore how risk based capital relates with underwriting risk and asset risk. The research findings established that risk and capital are positively related, that is, when risk based capital increases, there was an increase in underwriting and asset risk prior to adoption of risk based supervision model. After introduction of RBS, both marginally and undercapitalized insurers increased their investment risk ratios and underwriting risk ratios. The study did not look at how risk based capital informs investment decisions, and in turn affects the investment returns of insurance companies.

Bett and Wepukhulu (2019) analyzed how insurance companies' performance is affected by the risk based supervision model under the Kenyan context. The indicators used under the RBS model were, capital adequacy, actuarial valuations and growth in investments while considering the concentration limits set by the IRA. Financial performance was measured by the return on assets, return on capital deployed and earnings. The study incorporated all the insurance companies licensed by IRA. The study conducted the Pearson moment correlation analysis and later undertook multiple regression analysis by looking at the association between capital adequacy and performance, actuarial valuation and performance; and investments and financial performance. The study findings were that capital adequacy and investments affected financial performance in a positively significant manner, and that actuarial valuation had a negative significant influence on financial performance. The study would have been improved

if it would have analyzed the computed risk based capital and its effects on investment returns, looking at specifically income from investment and not underwriting profit.

2.3.2 Risk Based Capital, Asset Allocation and Investment Returns

Asset allocation is a key component in determining investment returns and can influence the association amongst RBC and investment returns of insurance corporations. Markowitz (1952) portfolio selection theory introduced a scientific approach of optimal asset allocation by outlining the risks an investor is willing to face and the anticipated returns. Eling and Pankoke (2014 b) analysed the equity risk of the solvency (risk based) supervision model which is a determinant of the RBC in the risk based supervision structure for insurance companies. The equity risk module contained a symmetric alteration mechanism termed equity dampener, which was meant to decrease procyclicality of required capital and thus systemic risk in the insurance sector. The researchers adopted a three steps approach to critique the module: first by analysing the vulnerability of the equity risk module in accordance to the underlying technical basis, then working out probable basis risk (i.e., nonconformities of insurers' actual equity risk from the RBS equity risk) and, founded on these results, quantify the effect of the symmetric alteration mechanism on the aims of RBS. They concluded that application of the standard model would not give a 99.5% confidence level as expected in the RBS approach thus portraying uncertainty on the intended goal to be achieved. This study did not put into consideration how risk based capital will affect investment returns with asset allocation as the intervening variable and firm size as the moderating variable.

Andonov et al. (2012) reviewed the changes in pension funds tactical allocation on an annual basis by getting the difference between the targeted asset class in year t, in comparison to the previous year then multiplied by the standard set on the return of that asset class at a given time t. Their finding was that approximately 80% of pension funds actively manage their total assets, which created substantial differences in their returns. Majority of the funds follow laid out

standard procedures on asset allocation instead of investing in multiple asset classes despite the opportunity it presents. Their study only focused on one product of insurance companies (pensions) and not all products an insurer underwrites. It also did not look at risk based capital and how it affects asset allocation and eventually investment returns of insurance companies. Xiong et al. (2010) study on the equivalent prominence of asset allocation and active management findings were that despite market return, asset allocation influenced portfolio's returns. Active management also played an important role.

Beath (2014) reviewed the performance of defined benefit funds and how the funds relate to asset allocation. He analysed information on the performance of realized investments of the United States pension funds over a thirteen-year period and examined how the performance influenced the decision of asset allocation of the funds. He observed that there was a wide variation in the allocations of portfolio, returns, and investing costs of various asset classes which led to the major differences in the investment performance of direct benefit plans. The study looked at public traded assets and standardization of private equity to remove any bias. This study considered the concept of risk based capital and how it affects investment returns without standardizing any assets when determining asset allocation.

Brown et al. (2009) reviewed the performance of portfolios containing multiple asset classes and based on asset allocation decisions. They decomposed the returns of the endowment funds by bench marking, timing of the market and selection of security which reflected the investment decision in a typical endowment. Their findings clearly showed that asset allocation was not related to portfolio returns in cross sections, but from the data analysis it appeared to influence risk adjusted performance indirectly.

Ibbotson and Kaplan (2000) study focused on the true impact of asset allocation on returns by assessing what percentage asset allocation policy affect performance within a range of 40 to 90 percent. In their methodology, they divided compound annualized asset allocation policy by the

compound annualized portfolio return over a given time. This was to create a portfolio benchmark asset classes that matched the balanced fund asset allocation policy. Their findings confirmed that about 100% return amount was explained by asset allocation. This study did not put into consideration the effect of risk based capital on an insurance company to allocate its assets for maximum returns. In their methodology, the only indicator for asset allocation was time horizon. This study factored in investment vehicle as additional indicator of asset allocation.

2.3.3 Risk Based Capital, Firm Size and Investment Returns

Hall and Weiss (1967) alluded that increased capital in a firm is likely to increase the total profits of the firm and earnings per dollar, due to its higher echelon in comparison to other industry players. Their study focused on firm size and how it affects profitability of a firm. The sample used was five hundred largest industrial corporations in a seven-year duration. Firm size was the independent variable which the reciprocal of the log of total assets was used as an indicator. On the other hand, profitability was measured using rate of return after tax on the year end equity and analysed as the dependent variable. Their findings were that size of a firm leads to a high profitability rate and that there is significant capital requirement barrier, which may have an effect on the profit rates. This investigation however did not look at the effect of firm size as a moderating variable on the association amongst risk based capital and investment returns.

Kim (1997) reviewed the explanatory effect of beta, size of the firm, book to market equity and earnings price ratio on the mean stock returns. He adopted a cross sectional regression model for analysis of the data. His findings were that book to market value, beta and earning price ratio had a substantial explanatory influence on stock returns. On the contrary, firm size was barely significant while using monthly returns and totally insignificant when using quarterly

returns. This study did not look at how firm size can moderate the relationship between risk based capitalization a firm and its investment returns.

Stanwick and Stanwick (1998) sought to study the relationship between corporate social performance with the size of the firm, environmental performance and financial performance of the organization. The population sample was based on the top five hundred firms listed in fortune corporate reputation index, for a six-year period (from 1987 to 1992). Corporate social performance was computed using the corporate reputation index, firm size was measured using total sales, financial performance was defined using a ratio of total profits and annual sales level of the firm, while environmental performance was computed using the level of emitted pollution as per toxic release inventory report. Regression analysis was performed to analyse the relationship between variables. The results showed that there was a positive significant connection between corporate social performance and firm size, financial performance and environmental performance. However, the study did not look at the capitalization of a firm from a risk perspective, while considering its size, and the overall effect to investment returns.

Lee (2009) examined the implication of firm size on the productivity of public firms in the United States while incorporating the determinants of performance. The size of the sample was a total of seven thousand public firms listed in the United States stock exchanges over a twenty-year period. The study applied ordinary least square method to the panel data which was used for regression analysis. The size of the firm was measured by log of total assets. Profit variation was measured in three categories, which entailed general economic conditions, firms and industry specific factors. The proxy for general economic conditions was annual growth rate, while that of firm's market environment was market concentration. The overall findings of the study were that market concentration has a significant influence on the profitability of the firm, while firm size played a dominant role in explaining the profitability of the firm. The study concentrated on the overall profitability of the firm and not specific to investment returns. It

also didn't look into the risk based capitalization of the firm, its effect in investment returns and how firm size affects this relationship.

Abdullahi et al. (2011) did an empirical analysis on how firm size, through a sectoral approach, can affect the risk and return of firms listed in the Nigeria's stock exchange. The study adopted a multi factor model basing it on arbitrage pricing theory, to analyse how sectoral size affects risk and return. Ordinary Least Square (OLS) estimation procedure was used in their study. Regression analysis was conducted to confirm if sector size had an influence on sectoral returns. Their findings were that sectoral size had no direct significance on the sectoral returns of the listed firms on Nigeria's stock exchange. This study did not look at how a firm is capitalized from analysing the risks and its effect on investment returns, and at the same time how the size of a firm would affect this relationship.

According to EIOPA (2014), most insurance companies fail because of poor management rather than lack of risk based capital. It is because of this reason that solvency II focuses on good governance under the second pillar. This imposes high standards of risk management practices and own assessment of solvency and risk (ORSA) in insurance companies. Johansen (2011) research analysed critically the introduction of risk based supervision regulation to the insurance and reinsurance market in the EU from a regulatory perspective. He looked at the fundamentals of solvency II in comparison with Basel II regarding the three pillars which are majorly interested in safeguarding the policyholders. Based on his findings, there is concerns around the cyclical effects as well as systemic risk in relation to the fundamentals of risk based supervision. The study focused generally on the regulatory supervision model and wasn't specific on the quantitative aspect of the model, which entails risk based capital, and its implication in allocation of assets and eventually the investment returns.

Dogan (2013) analysed how the size of a firm affected the profitability of companies listed in the Istanbul stock exchange. The sample size was two hundred firms for a duration of four

years (2008-2011). The indicator for the firm's profitability was return on assets (ROA) while those of firm size were total assets, sales and the overall number of personnel. To evaluate the relationship amongst the variables, the study adopted correlational analysis and regression analysis which was linear. The conclusions of the study were that all the indicators of firm size had a positive impact on profitability of the firms. This study did not consider the aspect of risk based capital and exactly how it affects the investment returns of a company. It also didn't consider any intervening effect on the relationship between firm size and profitability. The above concerns are being met by the current study.

Niresh and Velnampy (2014) explored how profitability is affected by the size of a firm, specifically on manufacturing firms in Sri Lanka. They focused on fifteen companies listed in the Colombo stock market for a duration of five years (2008 to 2012). The return on assets and the net profits were used as indicators of profitability, while the total sales and assets were used as indicators for firm size. For empirical analysis, the study adopted correlation and regression methods. The study findings established that there was no affiliation between firm size and profitability on the firms selected. This study did not consider the capitalization of the firms from a risk point of view, the allocation of assets, and the size of the firm, and their implications to investment returns. The current study incorporates all the above variables and analyses the joint effect of these variables to investment returns of insurance companies in Kenya.

Mwangi and Angima (2016) sought to identify a moderating variable which would influence the association amongst actuarial risk management practices and financial performance of insurance companies that underwrite property and casualty business. The methodology adopted was conceptual and empirical literature review. Their findings were that there was a moderating effect of firms' specific characteristics; quality of management, years of operation of the company and its size, on the relationship between actuarial risk management practice and financial performance of property and casualty insurers. Mutunga and Owino (2017) looked at

the moderating role of firm size, on the relationship amongst financial performance and micro factors of manufacturing companies in Kenya. They opted for a descriptive research design and used regression and correlational analysis to analyse the data collected. The study findings showed that the link concerning the independent variable (micro factors) and dependent variable (financial performance) was statistically significant. There was also a positive moderating effect when they introduced firm size as a moderator, on the relationship between the two variables. Despite looking at the moderating effect of firm size between micro factors and performance, the study did not entail risk based capitalization and wasn't specific on investment returns.

2.3.4 Risk Based Capital, Asset Allocation, Firm Size and Investment Returns

Wyman (2005) did a study on the risk based regulation to have a clear understanding on various risk based regime and develop one which is superior and applicable to the entire Europe. It was acknowledged that the study was done within a short duration and did not analyse fully all the aspects of the various models, but rather gave a clear overview of most of the solvency assessment frameworks used across the world to fully understand any differences or similarities they present. From the findings, there was clarity on the differences between the existing framework and the proposed risk based framework which factors in more analysis of the risks both in the company's assets and liabilities. They observed that there were some similarities and consistency in most of the principles contained by the European Commission, IAIS and the IAA. From their findings, they also noted that while the key values contained in the newer regimes had similarities, there was still a variety of approaches chosen in applying those principles. Different regimes had to make a choice between simplicity of the model and a sophisticated model.

Putra (2018) study focused on how the profitability of insurance companies that undertake life business in Indonesia is affected by income growth, claims ratio and risk based capital.

Profitability, which was the dependant variable, was determined using return on assets (ROA), income was measured using the percentage increase of income for the current year from the previous year, claims ratio was computed as a ratio between the claims incurred and earned premiums, and total assets was measured using the figure given by the insurer on the assets they hold, while the risk based capital was calculated as a ratio between the adjustment in admitted assets and liabilities over the solvability. The data used was panel data for a seven-year duration and multiple regression analysis was done. The findings were that revenue growth and assets don't have a significant effect on profitability, while claims ratio and risk based capital have a negative significant effect to profitability. However, revenue growth, claims ratio, total assets and risk based capital have a joint effect on profitability of the insurance companies. This study will take a similar approach, but the main focus will be on how asset allocation, firm size and risk based capital would jointly affect investment income.

Djayadi et al. (2018) carried out a study on how risk based capital is affected by investment results, premium income, claims and profitability of insurance companies. The study period was a five-year duration between 2013 and 2017, with a study population of ten insurance companies registered by the financial service authority. The study used secondary data published by the insurance companies and panel data regression analysis was conducted. The findings were that, investment results had a positive relation to RBC and not significant, while premium income, claims, profitability and investments do not have a significant effect on RBC. The choice of risk based capital as a dependent variable would have been the major problem on determining the significance on the relationship among these variables. This study uses RBC as an independent variable and how its relationship with investment income, with the intervening effect of asset allocation and moderating effect of firm size.

2.4 Summary of Previous Studies and Research Gaps

A summary of studies that were done previously in respect to the research variables of risk based capital, asset allocation, firm size and investment returns is highlighted in Table 2.1 below.

Table 2.1 Summary of Literature and Knowledge Gaps

Researcher(S)	Focus of the Study	Results	Research Gap	Focus of Current Study
Abdullahi et al. (2011)	A sectorial analysis on how firm size affects the risk and returns in the Nigerian stock market.	Sectoral size had no direct significance on the sectoral returns of the listed firms.	Did not consider effect of RBC on investment returns. A contextual gap since it did not focus on insurance industry.	Considers effect of RBC on investment returns. Focuses on insurance companies.
Andonov et al. (2012)	The possibility of large pension funds beating the market by evaluating the selected security, allocation of assets, the liquidity limits and timing of the market.	Their finding was that approximately 80% of retirement funds actively manage their total assets, which created substantial differences in their returns. Majority of the funds follow laid out standard procedures on asset allocation instead of investing in multiple asset classes despite the opportunity it presents.	Did not consider effect of RBC on asset allocation.	Considers effect of RBC on asset allocation.
Beath (2014)	A review of the defined benefit pension funds' performance based on asset allocation for a 15 year duration in the United States.	Their findings were that there was a wide variation of the allocated portfolio, returns, and investment costs of various asset classes which led to the major differences in the investment performance of direct benefit plans.	The research focused on pension funds in the US market and not insurance companies. Effect of RBC was not considered.	Effect of RBC, asset allocation and size of the firm on investment returns is considered.
Bett and Wepukhulu (2019)	How commercial performance of the Insurance Firms in Kenya is affected by the Risk Based Supervision Methodology.	The research findings were that capital adequacy and investments had an effect on financial performance which was positive and significant, and that actuarial valuation had an	Did not put into consideration the intervening effect of asset allocation and moderating effect of firm size.	Influence of RBC, asset allocation and Firm size on investment returns is considered.

Researcher(S)	Focus of the Study	Results	Research Gap	Focus of Current Study
		effect on financial performance which was negative significant		
Brown et al. (2009)	The relationship between asset allocation and portfolio returns.	Their finding was that there is no relationship between asset allocation and portfolio returns in cross sections but appears to circuitously effect risk adjusted performance.	Did not look at the effect of RBC on the allocation of asset and investment returns.	Considers the effect of RBC on performance intervened by asset allocation with firm size as a moderating effect.
Cheng and Weiss (2013)	How RBC affects asset and underwriting risks of a Property Liability Insurance Firm.	Risk and capital are positively related, that is, when risk based capital increases, there was an increase in underwriting and asset risk prior to adoption of risk based supervision model.	The study did not look at how risk based capital informs investment decisions and in turn affects the investment returns of insurance corporations.	Considers the effect of RBC on investment returns. Considers the effect of the company's size on the link between RBC and Investment returns.
Dogan (2013)	The effect of the size of a firm on its profitability. Evidence from Turkey.	The findings of the study was that all the indicators of firm size had an effect which was positive, on profitability of the firms.	This study didn't address the aspect of risk based capital and how it affects the investment returns of a company. It also didn't consider any mediating effect on the relationship between firm size and investment returns.	Considers the effect of RBC on investment returns. Considers the intervening effect of asset allocation on the association between RBC and Investment returns.
Doff (2008)	An analysis of the proposed Solvency II regulations.	The choice of VaR as a risk measure is unable to estimate the insolvency cost of an insurer as the current RBS declares.	The study focused on RBC model and its viability but not its effect in investment returns.	Looks at the effect of RBC which is a quantitative requirement in RBS on investment returns.
Djayadi et al. (2018)	The Model of Insurance Companies Risk Based Capital.	Investment results had a positive relation to RBC and not significant, while premium income, claims, profitability and investment do not have a significant effect on RBC	The research didn't consider how asset allocation and firm size intervenes and moderates the relationship amongst risk based capital	Considers the effect of RBC on investment returns. Considers the moderating effect of GWP and total assets on the relationship

Researcher(S)	Focus of the Study	Results	Research Gap	Focus of Current Study
			and investment returns respectively.	between RBC and Investment returns.
Eling and Pankoke (2014)	Application of risk based supervision standard formulae using a VaR of 99.5%.	An application of the standard model would not give a 99.5% confidence level as expected in the solvency II approach thus portraying uncertainty on the intended goal to be achieved.	Did not look at how the deviations will affect the investment returns of insurance companies. Did not consider the effect of the standard model on asset allocation.	The study concentrates on the quantitative aspect of RBS under pillar 1 which is RBC and investment returns.
Fare et al. (2004)	How profit efficiency in the banking industry is affected by RBC requirements.	Allocative inefficiencies is a major driver of profit loss in comparison to technical inefficiencies, and that risk based capital have a significant effect on the allocative inefficiencies.	The study did not look at the effect of RBC on investment returns. A contextual gap since it focuses on the banking sector.	Considers effect of RBC on investment returns intervened by asset allocation with firm size as a moderating effect. Focuses on insurance sector.
Hall and Weiss (1967)	The size of a Firm and its implications on profitability.	Size of a firm leads to a high profitability rate and that there is significant capital requirement barrier, which may have an effect on the profit rates.	The study did not look at the effect of RBC on investment returns. Firm size wasn't looked at as a moderating variable on RBC's relationship to Investment Returns.	Considers the effect of RBC on investment returns intervened by asset allocation with firm size as a moderating effect.
Ibbotson and Kaplan (2000)	Level of impact of asset allocation on returns of mutual funds.	In their findings, about 100% return amount was explained by asset allocation.	The study concentrated on mutual funds. It did not look at RBC and asset allocation in insurance companies.	The study focuses on insurance industry and how risk based regulations on investment returns.
Idzorek (2010)	How asset allocation affects returns variation.	The finding was that asset allocation is an imperative aspect in explaining returns variations.	The study did not consider effect of RBC on asset allocation in insurance companies.	The study considers RBC effect on investment returns, asset allocation being a contributing factor.
Kim (1997)	Implications of the size of a Firm, its, Book-To-Market,	Book to market value, beta and earning price ratio had a noteworthy explanatory	The study did not incorporate firm size as a moderating	The study considers RBC effect on investment returns

Researcher(S)	Focus of the Study	Results	Research Gap	Focus of Current Study
	and Earnings Price on the expected Stock Returns.	effect on stock returns. Firm size was barely substantial while using monthly returns and totally insignificant when using quarterly returns.	effect on RBC and investment returns.	with firm size as a moderating variable.
Kochanski (2010)	The effect of Risk based capital in relation to unit linked products in the German market.	The study findings were that the main risks related to German unit linked products with death benefits as a guarantee were market and lapse risks. Mortality and expense risks were insignificant, and the type of death benefits has no effect on RBC	Did not consider effect of RBC on investment returns.	Looks at effect of RBC on investment returns.
Kuen Siu (2015)	A continuous random motion approach for Asset Allocation with Hidden Economic Environment.	An optimal portfolio strategy was identified using stochastic flow of approach.	The moderating effect of firm size on investment returns after identifying optimal portfolio was not incorporated.	Apart from asset allocation determining investment returns, it also looks at the moderating effect of Firm size in RBC and Investment returns.
Long Vu (2015)	Optimizing an investment portfolio under solvency II.	Their finding was that the optimal asset allocation that maximizes the insurers surplus at time T = 1 shows strong variation depending on the insurer's initial surplus.	Methodology used was not based on the 99.5% VaR and did not include correlations between sub-modules of the markets risk module.	Considers collective effect of RBC on investment returns putting into consideration all types of investment and not restricted to bonds and stock markets.
Lee (2009)	The size of the Firm and its role in Performance. Evidence from US Public Firms.	Market concentration has a substantial effect on the profitability of the firm while firm size played a dominant part in explaining the firm's profitability.	The study was fixated on the overall profitability of the firm and not specific to investment returns. It also doesn't look into the risk based capitalization of the firm, its effect in investment returns	Focuses on the investment returns of insurance companies and the effect of RBC. Considers the intervening effect of asset allocation and moderating effect of firm size.

Researcher(S)	Focus of the Study	Results	Research Gap	Focus of Current Study
			and how firm size affects this relationship.	
Marlina and Puyarti (2013	Effect of risk based capital to profitability in Jasindo Insurance Company.	Risk based capital explained about 29% variation on return on equity and 10% variation on return on assets.	Did not consider the intervening effect of asset allocation and moderating effect of firm size. Did not consider return on investment as a profitability measure.	Considers the effect of RBC on investment returns. Considers size of the firm as a moderator on the relationship between RBC and Investment returns
Mutunga and Owino (2017)	Firm size, as a moderating variable, on the association among Micro Factors and Financial Performance of Manufacturing Companies in Kenya.	The association between the predictor variable (micro factors) and dependent variable (financial performance) was statistically significant. There was also a positive moderating effect when they introduced firm size as a moderator, on the relationship between the two variables.	Did not consider effect of RBC on investment returns. Did not consider the moderation effect of firm size the relationship between RBC and investment returns.	Considers the effect of RBC on investment returns. Considers firm size as a moderator on the relationship between RBC and Investment returns
Mwangi and Angima (2016)	Identification of the moderating effect of firm characteristics on the relationship between Actuarial Risk Management Practices and Financial Performance of Property and Casualty Insurance Companies.	Their findings were that there was a moderating effect of firms' specific characteristics e.g. quality of management, years of operation of the company and its size, on the relationship between actuarial risk management practice and financial performance of property and casualty insurers.	The effect of risk based capital on investment returns was not considered. Focused on ARMP and performance which is under pillar II of solvency regime.	Considers the quantitative requirements on risk based supervision and the effect it has on investment returns which is a measure of performance.
Niresh and Velnampy (2014)	The implications of the size of a Firm and its Success: A Study of Listed	There was no relationship between firm size and profitability on the firms selected.	Did not consider the capitalization of the firms from a risk point of view, the allocation of assets, and the size of the	Considers the effect of RBC on investment returns. Considers the moderating effect of firm size on the

Researcher(S)	Focus of the Study	Results	Research Gap	Focus of Current Study
	Manufacturing Companies in Sri Lanka.		firm, and their implications to investment returns.	relationship between RBC and Investment returns
Putra (2018)	How profitability of Life Insurance Companies in Indonesia is influenced by the risk based capital, income growth, assets and claim ratios.	Revenue growth and assets don't affect profitability significantly, while claims ratio and risk based capital significantly affect profitability but in a negative way. However, revenue growth, claims ratio, total assets and risk based capital have a joint effect on profitability of the insurance companies.	The effect of risk based capital on investment returns was not considered. Did not put into consideration the moderation effect of firm size the relationship. between RBC and investment returns	Considers the moderating effect of firm size on the relationship between RBC and Investment returns
Stanwick and Stanwick (1998	An Empirical study on the relationship between the size of an organization, its corporate social, financial and environmental performance.	As per the study findings, there was a positive relationship between the variables which was significant.	The study did not look at the capitalization of a firm from a risk perspective, while considering its size, and the overall effect to investment returns.	Considers the moderating effect of the size of the firm on the association between RBC and Investment returns.
Waweru and Kisaka (2012)	The effect of implementing of enterprise risk management on the value of the firms listed in the Nairobi Security Exchange.	As per the study findings, an increase of ERM implementation in companies has a positive effect on the value of the firm.	The study focused on NSE and did not consider effects of RBC on investment returns.	Considers the effect of RBC on investment returns and focuses on the insurance sector.
Wen et al. (2013)	Basel II requirements and its implications on asset allocation.	There is a significant effect of Basel III on capital requirements which will influence banks to consider capital constraints when constructing their investment portfolios.	The study concentrated on the banking sector.	Looks at the RBS implications on insurance companies' investment decisions and returns.
Xiong et al. (2010)	Equivalent Significance of Asset Allocation and Active Management.	The study defined that portfolio total return was based on market return, policy return on asset	The study did not take into consideration the effect of the risk factors as per the	The study will look at all the risk factors under RBC on investment returns of insurance companies.

Researcher(S)	Focus of the Study	Results	Research Gap	Focus of Current Study
		allocation and dynamic portfolio management.	RBS model and its implications on the choice of investment vehicle, on investment returns	

2.5 The Conceptual Framework and Research Hypotheses

This study adopts Markowitz portfolio selection theory since it gives an explanation on asset allocation, the risk associated and return on investment. Redington immunization theory will also be adopted regarding asset liability management and the whole balance sheet approach in assessing risks as required in the risk based supervision regime. The variables of the study, the conceptual framework and the research hypotheses are discussed as follows.

2.5.1 The Conceptual Framework

The study focused on the relationship among risk based capital, asset allocation, firm size and investment returns of insurance companies. The dependent variable in the study was investment returns. Investment returns of insurance companies was measured by the Investment Income Ratio over time. The independent variable in this study was risk based capital. RBC varies from one company to another despite the standard formulae issued by the regulator. This variable was determined from the principles of the RBC standard formulae and various risk capital charges per class of business as required by various regulation. According to EIOPA (2014) underlying assumptions on RBC, the value will be determined by using the standard formulae as per the risk based supervision model.

Asset allocation was considered as the intervening variable since there was possibility of it affecting the relationship between RBC and investment returns. Investors tend to determine their asset allocation based on their risk tolerance, cost and the investment vehicles. This is what the study kept into consideration. The relationship between RBC and investment returns was

perceived to be moderated by firm size. Firm size was measured in terms of total assets and gross premiums written.

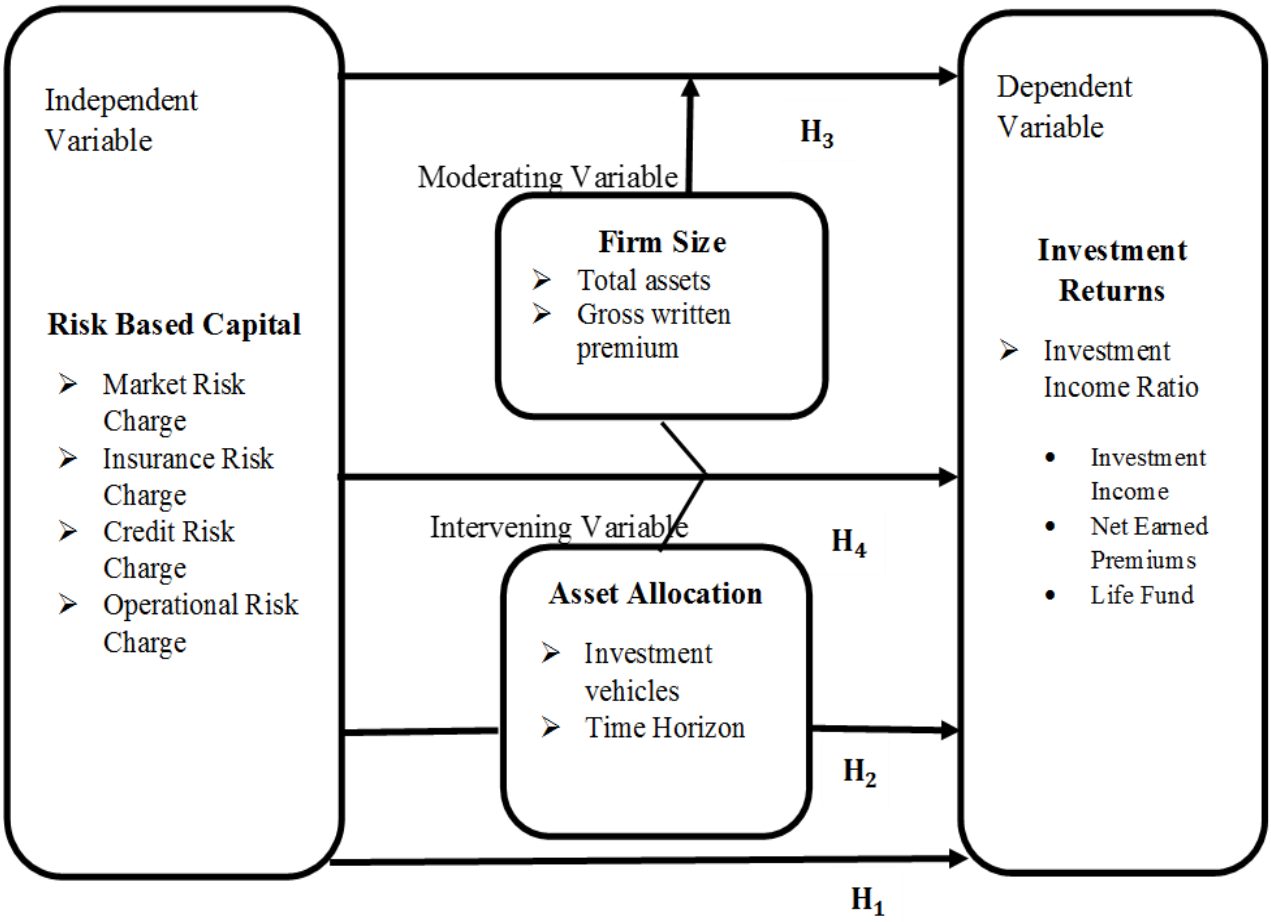

Figure 2.1 Conceptual Model

2.5.2 Research Hypotheses

This study intended to establish the relationship between risk based capital and investment returns, the moderating effect of firm size on the relationship between risk based capital and investment returns, and the intervening effect of asset allocation on the relationship between RBC and investment returns of insurance companies in Kenya by testing four null hypotheses. The null hypotheses that were tested in the study are as follows:

H_1: The effect of risk based capital on investment returns of insurance companies in Kenya is not significant.

H_2: The relationship between risk based capital and investment returns of insurance companies in Kenya is not intervened by asset allocation.

H_3: The relationship between risk based capital and investment returns of insurance companies is not moderated by firm size:

H_4: The joint effect of risk based capital, asset allocation, and firm size on investment returns of insurance companies in Kenya is not significant.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter highlights the steps that were taken to perform the research study. The research philosophy, the research design, the study population, data collection methods, diagnostic tests, operationalization of the study variables and data analysis procedures are discussed.

3.2 Research Philosophy

Scholars use different approach while undertaking a study to achieve a certain goal. There are two distinguished research philosophies, namely phenomenological and positivistic paradigm. Phenomenological approach deals with being appreciative of the human conduct from the scholar's point of view, which is usually subjective in nature. Further on investigating the realism within a phenomenological perspective is perceived as influencing that reality. Miller and Salkind (2002) point out that this paradigm focuses on how people end up using their own experience to relate it to a certain concept instead of measuring it. On the other hand, a positivistic paradigm revolves around beliefs of how one can be logical to others in research, and it is mainly founded on the assumptions that all researchers are not perfect. It asserts that any real event can be observed empirically and explained logically by performing an analysis. It reviews whether any theory expectations are consistent with specifics that can be acquired via our senses.

As suggested by Miller and Salkind (2002), positivism is an ideal approach to investigate the nature of relationships in empirical investigations that have hypotheses. Moreover, positivistic paradigm supports quantitative methods with numerical data which are subject to analytical and descriptive statistics. As a result, the choice of positivism in this thesis permitted use of conceptual models, quantitative measurement of variables, hypotheses testing and extensive view of findings. These are essential features in descriptive research designs. Therefore,

positivism was the well-suited philosophical stance since it enabled the attainment of the study's objectives.

3.3 Research Design

Research design is an outline for undertaking a study with adequate control over any interference of the finding's validity by any factors. It is used as a means of answering a research question by structuring the research and showing how facets of the research work hand in hand in addressing the outlined problem. (Burns & Grove, 2003). As such, research design comprises of a roadmap of the intended execution by the researcher from hypothesis formulation, its operational implications to the absolute analysis of the data. Notably, the rigor of an empirical investigation largely depends on how a researcher chooses the appropriate research design.

Generally, research designs can be divided into three major types: namely, exploratory, causal and descriptive (Lappe, 2000). An exploratory research is carried out in circumstances where there is limited information on the situation at hand, or information is unavailable on how research issues or analogous problems have been resolved in the past. As such, far-reaching primary effort needs to be done in order to gain understanding with the phenomena at hand, and to clearly comprehend what is happening, prior to developing a model and configuring a rigorous design for an in-depth analysis. As a result, exploratory studies are carried through to further comprehend the nature of the problem since a small number of empirical investigations might have been undertaken in that particular field of study. Exploratory research designs are essential when some facts are identified, but more data is required to develop a practical theoretical framework. Overall, exploratory studies are vital for getting a good understanding of the phenomena of interest and knowledge advancement via successive hypothesis testing and theory building. It is founded on question approach where the researcher's focus on the 'why' questions and an explanation is given to the audience to validate the occurrence of an event.

Causal research design is concerned with understanding the association amongst cause and effect. It is mainly conducted via numerous controlled experiments to facilitate testing of cause and effects. More specifically, it explores the effect of one variable on another. There are basically three types of experimental research designs (causal). The first one is true experimental research design which is important in proving or disapproving research hypothesis. Secondly, pre experimental research design is applicable where numerous groups are observed after taking into consideration the element of cause and effect. Lastly, quasi-experimental research design is where an explanatory variable is controlled but the group contributors are not arbitrarily assigned based on the prevailing conditions. One of the key advantages of causal studies is that the researcher has a stronger hold on the study variables to successfully obtain the specific desired outcomes.

A descriptive study on the other hand is carried out to establish and in a position to describe the characteristics of the study variables of concern in a situation. The aim of a descriptive study is to describe pertinent aspects of the phenomena of interest from an industry-oriented, organizational, individual, or other standpoint. Descriptive studies accurately and systematically describe characteristics and facts of a given population of interest. It also provides accurate account or portrayal of a particular individual, group or situation. Descriptive research equally portrays the characteristics of situations, persons, groups and incidence with which certain phenomenon happens. In fact, this design document and describe various aspects of a situation as it naturally occurs. Finally, descriptive study plays a vital role in discovering the relationship or associations among/between selected variables.

According to Sekaran (1992), descriptive design can either be cross-sectional or longitudinal. Cross-sectional encompasses attaining a sample from the study population and evaluating its characteristics. Cross-sectional studies have no time dimension and relies mainly on the existing variations instead of changes following an intervention. Moreover, groups are chosen

on the basis of prevailing variations instead of random allocation. As a result, the researchers utilizing cross-sectional research designs can only use passive approach to make causal inferences based on the empirical findings. Longitudinal (panel data) on the other hand refers to bringing together observations on a cross-section of countries, companies or households over a period of time.

This study adopted longitudinal (panel) design which was used to describe the relationship between variables over time. Combining cross-sectional and time series dataset is important for the following reasons. To begin with, risk based capital, asset allocation, firm size and investment returns may vary over a duration and therefore it is important to utilize panel approach since the time series dimension of the study variables provides a wealth of information overlooked in cross-sectional studies. Secondly, panel data studies inflate the degree of freedom and sample size which is necessary when a comparatively large number of regressors are used. Thirdly, panel data takes into account probable endogeneity of the regressors, while at the time controlling for firm –specific effects which cross-sectional studies does not take into consideration.

3.4 Data Collection

Secondary data was collected from the returns submitted annually to the Insurance Regulatory Authority by insurance companies for a five-year period (2014-2018), which was adequate in computing the risk based capital, asset allocation, firm size, and the investment returns. For risk based capital, data on market risk capital charge, insurance risk capital charge, credit risk capital charge and operational risk capital charge was collected and used to compute the composite score. Data on the duration of investment and investment vehicle was collected for computation of asset allocation score.

Data on the gross written premiums and total assets held by insurance companies was also collected to be used as indicators of firm size, while the investment income and earned premiums data was collected in order to compute the investment income ratio, as an indicator of investment returns. The data points generated for each insurance company in the five-year duration were adequate for analysis.

3.5 Diagnostic Tests

Porta (2014) defines diagnostic tests as the estimation procedures in research for evaluating whether the assumptions of classical linear regression have been complied with. These assumptions include normality, linearity, homoscedasticity, multicollinearity and independence test. Co integration test was also carried out as a diagnostic test for panel data.

3.6 Population

According to Porta (2014) population makes reference to the entire set of individuals, events or objects possessing collective features that fit in to a given description. The population assist the researcher including other interested parties to ascertain the items to be either included or excluded from the study. As at 31st December 2018, the Insurance Regulatory Authority had licenced 63 insurance companies to operate in Kenya. The study focused on all the 63 insurance companies that transact both long term (life) and short term (general) insurance business. A census survey was conducted for the study owing to the small size of the population. All the companies registered during the period and those which were not be in existence either through mergers and acquisition or market exit were still incorporated.

Sturge's rule was employed to work out the appropriate number of classes in grouping the distribution of observations. This approach has widely been applied by a number of scholars such as Mirie (2014) and is often preferred for modest numbers and yields analogous findings to alternative formulas and thereby producing reasonable widths of statistical charts such as histogram. The Sturge's rule is given by $K = 1 + 3.3222 (\log n)$ where K denotes the number of classes and n refers to the number of observations.

3.6.1 Normality Test

The assumption of linear regression model is the data is normally distributed. Ghasemi and Zahediasl (2012) indicate that normality can be tested using both visual and statistical techniques. The most commonly used visual tests are; histograms, stem and leaf plots, P-P plot, Q-Q plot and box plot. Data is normally distributed when the histograms a symmetrical and equally form a bell shape curve with the vast of frequency scores concentrated in the middle and smaller frequencies at the extreme ends. A straight line is formed by the P-P plot is an indication of normality.

According to Ghasemi and Zahediasl (2012), other normality tests can be adopted as a supplementary to the graphical tests. These tests include Shapiro Wilks test, Kolmogorov Sminorv test, Lilliefors corrected test, D'Agostino skewness test, D'Agostino kurtosis test Anderson Darling test and Anscombe-Glynn kurtosis test. When the tests are conducted, they equate the scores from the sample with the normally distributed set of scores. Kolmogorov Sminorv test is founded on the extreme variation between the observed distribution and the cumulative normal distribution. D'Agostino skewness and kurtosis tests describe the normality test based on skewness and kurtosis coefficients respectively. Shapiro Wilk test is undertaken based on the correlation between the data and the normally distributed set of scores. This study utilized both statistical and graphical methods to assess normality.

The statistical technique adopted involved the use of Shapiro-Wilk test in which data is assumed to be significant if the statistic is statistically insignificant ($p > 0.05$). However, Shapiro-Wilk test is preferred it is a powerful test of non-normality and is able to detect even slight departures from normality even with small sample sizes. Any variable that fails the statistical test was subjected to graphical methods of assessing normality. Histogram was visually examined to assess the normality. Furthermore, assessment of the skewness and

kurtosis as an additional normality test over and above the graphical test was carried out. Non-normal data can be transformed using natural log transformations.

3.6.2 Linearity Test

Linearity exists when the dependent variable is a linear function of the predictor variables as well as the random error. Assessing non-linearity is important since correlation, regression and other general linear models assume linearity. Linearity can be established by means of both graphical and statistical methods. The widely applied statistical methods for testing linearity include; Ramsey's RESET test, tolerance factor, eta correlation coefficient and ANOVA test. Graphical methods involve inspection of scatterplots to ascertain whether linearity exists. In this technique, standardized residuals are plotted against the standardized estimates of criterion variable and if the plot exhibits a random patter, then it infers presence of linearity.

This study integrated both statistical (Ramsey's RESET test) and graphical methods (scatter plots) to test for linearity. Ramsey's RESET test statistically computes both linear and non-linear elements of a pair of variables. A p-value of greater than 0.05 ($P > 0.05$) imply that there is a linear association between the variables. Regarding the scatter plot, linearity is assumed to exist when the data values form an oval shape. If the data does not assume linearity the treatment option that can be used is data transformation through logs or reciprocal methods.

3.6.3 Homogeneity of Variance Test

Homogeneity of variance (homoscedasticity) is a classical assumption that predictor variable displays equivalent degree of variance across entire values of predictor variable. It connotes a circumstance in which the error term is constant across all values of the predictor variables. The absence of homogeneity of variances is referred to as heteroscedasticity which is a gross violation of this assumption of regression analysis. Heteroscedasticity often has a potential of giving false positive results by producing inflated alpha values. Two widely used approaches

to assessing homogeneity of variances involve graphical and statistical methods. Homogeneity of variance can graphically be assessed via normal probability (P-P) plot. Normally, when the Homogeneity of variance assumption is met, the outliers produces a cloud of dots with no particular pattern.

Erjavec (2011) reviewed various methods of conducting homogeneity of variance for suitability of data analysis. One of the tests reviewed was Bartlett's test which is used to measure if a population has equal variance. The test is deemed to be very sensitive to deviations from the normal to the differences in the data population thus not recommended for routine use, unless there is a strong evidence for normality of the data. The second test reviewed was Levene (1960)'s test which is less sensitive from the deviations from the mean. Due to this fact, it is recommended as a favourable test for homogeneity of variance and requires variable transformation if the data breaches this requirement.

The third test to be reviewed was Brown–Forsythe (1974) test which is an adjustment of the Levene's test. This test is based on the same logic of deviation when assessing normality, but unlike Levene's test which focuses in deviation from the mean, it focuses on the dispersion variable deviating from the median. This method provides a good robustness against non-normal data hence recommended in practical applications. The fourth test reviewed was the O'Brien (1979) test which is still a modification of Levene's test. The difference is that the test modifies the dispersion variable to include additional weight, so as to factor in any suspected kurtosis in the distribution. These tests are not the only ones in determining homogeneity of variance but are widely used in empirical research and are easily available in statistical analysis software. This study adopted Levene (1960)'s test to measure homogeneity of variance since its less sensitive from the deviations from the mean; and deemed favourable test and requires variable transformation if the data breaches this requirement.

3.6.4 Multicollinearity Test

The occurrence of multicollinearity can be experienced if the relationship between two independent variables in a regression model is strong. In a situation where multicollinearity exists, the condition overestimates the residual/error term of estimates of beta values, leads to misleading results as well as reducing reliability of study findings. Consequently, this causes the individual predictor coefficients to become unstable. Sweet and Grace-Martin (2012) outlined various methods of identifying multicollinearity in a particular data set. One of the indicators outlined is when high standard errors which are greater than the coefficients are observed. The other method is identifying the level of variance inflation factor and the tolerance levels. A higher inflation factor and a low tolerance level indicates that there is presence of multicollinearity.

One can further confirm if there is multicollinearity by dividing the data set into two, then run each model separately. If the results indicate that the coefficients are wildly different, it is an indication of multicollinearity. Changes in the coefficients when adding or removing the predictor variables can also be used in determining multicollinearity. If the predictor variables are totally independent, any introductions or removal won't affect the coefficients drastically. This study adopted the variance inflation factor (VIF) to ascertain whether multicollinearity is existent among the variables. VIF measures the severity of multicollinearity in Panel regression analysis. VIF values of < 10 signifies absence of multicollinearity. Apart from VIF, tolerance value (reciprocal of VIF) can also be used to assess the multicollinearity. A tolerance value which is > 0.1 indicates absence of multicollinearity.

3.6.5 Serial Independence Test

According to Weber and Monarchi (1982), one of the assumptions when performing linear regression analysis is that the disturbance should have zero covariance, meaning that the variables should be serially independent. Gross violation of this assumption makes errors in

one period to be correlated with their own values in other periods thus causing the problem of autocorrelation. Generally, all-time series variables are capable of displaying autocorrelation with the varies a certain period depending on values of similar series in prior periods.

Autocorrelated disturbance distorts the efficiency of regression estimators when performing linear regression analysis, thus testing for independence is required. One of the most effective and convenient tests for independence is the Durbin- Watson test. A coefficient between 1.5 and 2.5 indicates that the variables are independent. Anything above 2.5 would require an alteration of original model using lagged model techniques. This study adopted the Durbin-Watson test to check for serial independence due to its effectiveness and convenience. Autocorrelation can be corrected by model re-specification, using the Cochrane-Orcutt procedure or Autoregressive Least Squares

3.6.6 Panel Unit Root Test

According to Herranz (2017) a unit root is a stochastic trend of random probability distribution process comprising time series models that causes serious challenges in statistical inferences. A unit root remains to one of the principal cause of non-stationary in time series studies. Unit roots can either be non-stationery autoregressive or autoregressive moving average time series processes, which may include a trend or an intercept. Some time series processes may include both an intercept and a trend. Unit root test are used to address the null hypothesis of a unit root or the alternate hypothesis of a time series which is stationery. The test is also used in determining where some variables in the model are non-stationery, since time series data suffers stationery problems. Non-stationary data may cause serious false regressions because of non-constant mean and variance.

There is various test which can be used to check if the model is non-stationary in nature. Some of the unit root test include: Dickey Fuller unit root test, which is commonly used as a standard autoregressive model with a Gaussian white noise, which is probabilistic in nature without any

deterministic components. The Dickey Fuller test was further extended to Augmented Dickey Fuller test, in order to incorporate both autoregressive (AR) time series and autoregressive moving average (ARMA) time series processes. This method is usually sensitive to the choice and number of lags and is commonly used as a unit root test. If the P value in the unit root test is less than 0.05, the unit root null hypothesis is rejected. The treatment option for unit root is differentiating the non-stationery data. This study adopted the Augmented Dickey Fuller unit root test for panel data due to its commonality in testing for unit root and sensitivity to the number and choice of lags. A p-value of < 0.05 implies that the statistical assumption of stationarity has been met.

3.6.7 Cointegration Test

Variables are termed to cointegrate if two non-stationary time series variables move together through time. If variables are cointegrated, the treatment is differencing the non-stationary data. Granger (1981) introduced the concept of cointegration and its relationship with error correcting model. His approach relied on the premise that data needs to be critically looked at before determining the model to be used in econometric analysis. Engle and Granger (1987) further extended the concept of cointegration by developing estimation procedures and tests using empirical examples. Some of the methods suggested for testing for cointegration include; Durbin Watson statistic, which is used to test if the residuals appear to be stationery. If the residuals are non-stationary, the figure will tend to move towards zero thus rejecting non-cointegration. The second method involved using Dickey Fuller's description of performing an auxiliary regression. This method assumes that the first order model is correct.

The third method which was described was the use of augmented Dickey Fuller test which is more advanced and analyses beyond the first order case and involve higher order cases. The fourth method described was the use of restricted vector auto regression test (RVAR). This test is usually interpreted by testing the significance of the error correction term. It is based on the

sum of squares of t statistics. The fifth method described was the augmented restricted vector auto regression test (AVAR), which is similar to restricted vector auto regression test but involves higher order cases. The sixth test reviewed was the unrestricted vector auto regression (UVAR) which is unrestricted for the satisfaction of cointegration constraints. This method assumes the first order system. A triangulation technique is used on the coefficient matrix where the F tests from the two regression models, and the overall test would be the sums of the F's multiplied by their degrees of freedoms.

The seventh test reviewed was the augmented unrestricted vector auto regression (AUVAR), which is a higher version of the unrestricted vector auto regression by incorporating higher order cases. Johansen (1988) introduced a statistical analysis on cointegration by testing linear hypothesis on cointegration vectors. Johansen test focused on two elements, the trace and the eigenvalue. In this test, the p value is monitored in order to check the statistical significance level. P <0.05 implies that regression coefficients are statistically significant. If this is not the case, the treatment option is differencing non-stationary data. This study adopted Johansen test to check for cointegration.

Table 3.1 Summary of Diagnostic Tests

Assumption	**Description**	**Test**	**Interpretation**	**Treatment**
Normality Test	Data which is normal distributed will form a bell-shaped curve graphically. Both graphical and statistical techniques was used to assess normality.	Shapiro Wilk test Skewness and Kurtosis Graphical Display (Histogram)	P > 0.05 indicates the variables are normally distributed Bell shaped curve indicates the variables are normally distributed.	Application of square roots or logs.
Linearity Test	Linearity exists when the dependent variable is a linear function of the predictor variables as well as the random error.	Ramsey's RESET test Scatter plots	P >0.05 implies linear association between the variables.	Data transformation through logs or reciprocal methods.
Homogeneity of Variance test	Homogeneity of variance (homoscedasticity) is a classical assumption that dependent	Levene's test	Statistic is significant at 0.05 and above.	Variance stabilization transformation

Assumption	Description	Test	Interpretation	Treatment
	variable shows analogous degree of variance across entire values of independent variable.			of data using logs or reciprocals.
Multicollinearity test	Multicollinearity refers to unacceptably high degree of correlation among independent variables which results to large standard errors (residuals).	Variance Inflation Factor (VIF)	VIF factor >10 implies serious multicollinearity.	Dropping collinear variables or obtaining additional data.
Serial Independence Test	The variables should not be correlated with the error terms.	Durbin-Watson test	Coefficient between 1.5 and 2.5 indicates independent observations.	Alteration of original model using lagged model techniques.
Panel Unit root test	Unit root test is used to determine whether some variables in the model are non-stationary since time series data suffers stationary problems. Non-stationary data causes serious spurious regressions because of non-constant mean and variance.	Augmented Dickey-Fuller test	If $p < 0.05$ data is stationery	Differencing non-stationary data.
Cointegration test	Two non-stationary time series variables are cointegrated if the move together through time.	Johansen Test	$P < 0.05$ implies that regression coefficients are statistically significant.	Differencing non-stationary data.

3.7 Operationalization of the Study Variables

Operationalization of study variables is how one defines and measures the variables used in a study. It is usually done by reviewing all the dimensions and properties denoted by the concept (Sekaran, 1992). The variables; risk based capital, asset allocation, firm size and investment returns, were operationalized based on the studies which have already been done. Risk based capital was operationalized based on the standard formulae issued by the Insurance Regulatory Authority and the solvency II standard model described by Bragt et al. (2010). Asset allocation was operationalized based on previous research and as described by Mwangi (2014) and Lenoir

and Tuchschmid (2001), firm size was operationalized as described by Mwangi (2014); Angima (2016) and Investment returns was operationalized as described by Lamont (2010).

Table 3.2 Operationalization of Study Variables

Variable	Indicator	Operational Definitions	Reference	Measure	Operationalization
Risk Based Capital (Independent)	Market Risk Capital Charge	Market risk encompasses equity risk, property risk and interest rate risk. It was calculated by applying a capital charge to balance sheet asset value.	Data collection sheet part A	Ratio	Operationalized based on the standard formulae issued by the Insurance Regulatory Authority and the solvency II standard model described by Bragt et al. (2010).
	Insurance Risk Capital Charge	The sum of the product of risk factors and the respective reserves for each class of business (general insurance) and the difference between policyholder's liability computed using stressed risk factors less policyholders' liability using best estimate assumptions (life insurance)	Data collection sheet part A	Ratio	
	Credit Risk Capital Charge	Capital required for reinsurance ceded calculated by applying risk factors as per the regulator's standard formulae.	Data collection sheet part A	Ratio	
	Operational Risk Capital Charge	30% of the square root of sum of squares of the capital required for insurance risk, market risk and credit risk or 3% of the gross earned premium over the last 12months	Data collection sheet part A	Ratio	
	Risk Based Capital	Square root of the sum of squares of capital required for Insurance risk, Market risk and Credit risk capital plus the capital required for operational risk.	Data collection sheet part A	Ratio	
Asset Allocation (Intervening)	Investment vehicles	Investment products available in the market for investors in order to generate returns.	Data collection sheet part B1	Ratio	As described by Mwangi (2014)
	Time Horizon	Duration of investment to maturity.	Data collection sheet part B2	Ratio	As described by Lenoir and Tuchschmid (2001)

Variable	Indicator	Operational Definitions	Reference	Measure	Operationalization
Firm size (Moderating)	Total assets	Log normal of the total assets.	Data collection sheet part C	Ratio	As described by Mwangi (2014) and Angima (2016)
	Gross premium written	Log normal of gross premium written	Data collection sheet part C	Ratio	
Investment Returns (Dependant)	Investment Income Ratio	The investment income ratio is a profitability determinant for insurance companies. It's the ratio of net investment income to net earned premiums for General Insurance Companies and Life Fund for Life Insurance Companies.	Data collection sheet part D	Ratio	As described by Lamont (2010).

3.8 Data Analysis

Sekaran (1992) defined a four step model regarding data analysis. The study adopted these steps by collecting, editing, standardizing coding and categorization of the data. Hypothesis testing and the goodness of fit was done. Descriptive statistics were calculated with the aim of presenting the quantitative description of the data. Measures of central tendency (the arithmetic mean, mode and median) was calculated. Coefficient of variation (ratio of standard deviation to the mean), kurtosis, and skewness was also computed. Test of normality and linearity was conducted to ensure that the data is normal distributed and has homogeneity of variance. The relationship between the study variables, RBC and investment returns, RBC and asset allocation, asset allocation and investment returns and the overall relationship among the variables was measured by correlation analysis. This established how suitable the data was for regression analysis to be performed.

Hierarchical multiple linear regression as described by Woltman et al. (2012) was used to evaluate the nature of the relationship among various variables based on the hypothesis in the study and at a significance level of 5%, and an adoption of the ordinary least square method (OLS) during analysis. The choice of OLS is justified on various grounds. One, this method

has stronger and attractive statistical features that makes it powerful methods of regression analysis. The widespread application of OLS in various statistical analyses is ascribed to its innate appeal and precise simplification and in comparison to other estimation techniques such as maximum likelihood. Moreover, OLS method plays a vital role in testing hypothesis.

All the study variables, that is, the independent, moderating and intervening was entered sequentially, and an assessment of their value was done. A variable was only retained in the model if its addition contributed to the model. The other variables were retested to ascertain if they were still contributory to the model. Any variable that did not contribute significantly was removed. Test of significance (P Value) was conducted. Coefficient of determination (R^2) was derived to show how the model fits the data. Unbalanced panel data was used for all the variables in the study which covered any new entrants or exits in the insurance industry.

3.8.1 Preliminary Data Analysis Methods

Risk based capital was determined by the standard formulae as per RBS model. It was a composition of operational risk, market risk, insurance risk, credit risk capital charges and an adjustment which considered the loss-absorbing capacity of technical provisions and deferred taxes. This will be as follows:

$$\mathbf{RBC} = \sqrt{\mathbf{IRC^2} + \mathbf{MRC^2} + \mathbf{CRC^2}} + \mathbf{Operational\ Risk} \quad \text{.....3.2}$$

Under life insurance risk, other sub risk modules were calculated which included, mortality risk, longevity risk, morbidity risk, expense risk, lapse risk and catastrophe risk. Under general insurance risk, the risk sub modules calculated were premium reserves, claims reserves, lapse and catastrophe risks. The formulae in 3.2 above was applicable.

Firm size was computed by taking the log normal of the total assets as the first indicator and the gross premium written as the second indicator as described by Mwangi and Angima (2016), while asset allocation was derived based on time horizon score which was computed as an

average of the ratio of annual investment duration per class and maximum investment duration within the year as described by Lenoir and Tuchschmid (2001) and investment vehicle score which was computed as a ratio of the amount of investment held per class and the total assets, and further computing the geometric mean of the identified sub variables as described by Mwangi (2014). The score was computed as follows:

$$\textbf{Time Horizon Score} = \frac{\boldsymbol{Annual\ Investment\ Duration\ per\ class}}{\boldsymbol{Maximum\ annual\ Investment\ Duration}} \quad \textbf{…….3.3}$$

$$\textbf{Investment Vehicle Score} = \frac{\boldsymbol{Investment\ held\ per\ class}}{\boldsymbol{Total\ Assets}} \quad \textbf{…….3.4}$$

$$\textbf{Asset Allocation Score} = \boldsymbol{Arithmetic\ mean}\ (\boldsymbol{TH + IV}) \quad \textbf{…….3.5}$$

Where TH= Time horizon score

IV= Investment vehicle score

Insurance companies returns on investment was measured by means of the investment income ratio as described by Lamont (2010). This ratio is normally used as a profitability determinant for insurance companies. The ratio was calculated as follows:

General Insurance Companies:

$$\textbf{Investment Income Ratio} = \frac{\boldsymbol{Net\ Investment\ Income}}{\boldsymbol{Net\ Earned\ Premium}} \quad \textbf{……3.6}$$

Life Insurance Companies:

$$\textbf{Investment Income Ratio} = \frac{\boldsymbol{Net\ Investment\ Income}}{\boldsymbol{Life\ Fund}} \quad \textbf{……3.7}$$

3.8.2 Relationship between RBC and Investment Returns

To determine the relationship between risk based capital and investment returns, linear regression model on the panel data was used. The model that was used is as follows:

$$\mathbf{IR_{it} = \beta_0 + \beta_1 RBC_{it} + \varepsilon_{it}} \quad \text{.....3.8}$$

Where:

IR is the investment income ratio during the period,

RBC is the Risk based capital,

β_0 : regression constant,

β_1 : regression coefficient,

ε_i: is random error term.

Adjusted R^2 was used to assess the outcome variable variation as a result of effects of the predictor variable. F- Test was undertaken to measure the model fit by testing the significance of the model. Beta coefficient (β) showed the effect variation in the dependent variable as result of a unit change in the predictor variable. T-test was used to evaluate the significance of the beta coefficient of the independent variable at 95% significance level.

3.8.3 Risk Based Capital, Asset Allocation and Investment Returns

According to Baron and Kenny (1986), four steps were followed to examine the intervening effect of asset allocation on the relationship between risk based capital and investment returns. The first step of the intervening analysis entailed a regression analysis on the relationship between RBC (independent variable) and investment returns (dependent variable), ignoring asset allocation (intervening variable).

The model was as follows:

$$\mathbf{IR_{it} = \beta_0 + \beta_1 RBC_{it} + \varepsilon_{it}} \quad \text{.....3.9}$$

Where

IR is the investment income ratio,

RBC is the risk based capital,

i is the cross sectional unit where i =1…. N, t is the time period where t=1…. T

β_0 : regression constant,

β_1 : regression coefficient,

ε_i: is the random error term.

If the relationship between risk based capital (RBC) and investment returns (IR) is statistically significant, then one can proceed to the next step of mediation analysis.

The second phase of the intervening analysis entailed a regression analysis on the relationship between asset allocation and RBC ignoring investment returns. The model was as follows:

$$\mathbf{AA_{it} = \beta_0 + \beta_1 RBC_{it} + \varepsilon_{it}} \quad \textbf{……..……..……3.10}$$

Where:

AA is the asset allocation score,

RBC is the Risk based capital,

i is the cross sectional unit where i =1…. N, t is the time period where t=1…..T

β_0 : regression constant,

β_1 : regression coefficient,

ε_i: is the random error term.

If the relationship between risk based capital (RBC) and asset allocation (AA) is statistically significant, then one can proceed to the next step of mediation analysis.

The third step of the intervening analysis involved a regression analysis on the relationship between asset allocation and investment returns ignoring RBC. The model was as follows:

$$\mathbf{IR_{it} = \beta_0 + \beta_1 AA_{it} + \varepsilon_{it}} \quad \textbf{……..……..……...……3.11}$$

Where:

IR is the investment income ratio,

AA is the asset allocation score,

i is the cross sectional unit where i =1…. N, t is the time where t=1…. T

β_0 : regression constant,

β_1 : regression coefficient,

ε_i: is the random error term.

If the association between asset allocation (AA) and investment returns (IR) is statistically significant, then one can proceed to the next step of mediation analysis.

Step four of the intervening analysis involved a regression analysis on the relationship between asset allocation (intervening variable), investment returns (dependent variable) and RBC (independent variable). The model was as follows:

$$\mathbf{IR_{it} = \beta_0 + \beta_1 RBC_{it} + \beta_2 AA_{it} + \varepsilon_{it}} \quad \textbf{.....3.12}$$

Where:

IR is the investment income ratio,

RBC is the risk based capital,

i is the cross sectional unit where i =1…. N, t is the time period where t=1…...T

AA is the asset allocation score,

β_0 : regression constant,

β_1 : regression coefficient,

ε_i: random error term.

Adjusted R^2 was used to assess the outcome variable variation as a result of effects of the predictor variable. F- Test was performed to assess the model fit by testing the significance of the model. Beta coefficient (β) showed the effect variation in the dependent variable as result of a unit change in the predictor variable. T-test was used to evaluate the significance of the beta coefficient of the independent variable at 95% significance level. If the relationship

between risk based capital (RBC) and investment returns (IR) becomes statistically insignificant when asset allocation (AA) is controlled for; then full mediation if inferred. However, if the relationship between risk based capital (RBC) and investment returns (IR) becomes statistically significant when asset allocation (AA) is controlled for, then partial mediation is presumed to have occurred.

3.8.4 Risk Based Capital, Firm Size and Investment Returns

According to Baron and Kenny (1986) methodology, multiple regression model was used to determine the moderating effect of firm size on the relationship between Risk based capital and investment returns. The model was as follows:

Model (a): Total asset as the moderator

$$\mathbf{IR = \beta_0 + \beta_1 RBC_{it} + \beta_2 TA_{it} + \beta_3((RBC_{it}) * (TA_{it})) + \varepsilon_{it}} \text{.....3.13}$$

Where:

IR is the investment income ratio,

β_0 : regression constant,

$\beta_1 \beta_2$ and β_3 regression coefficients,

RBC is Risk based capital,

TA is the total asset score.

ε_i: is the random error term.

Model (b): Gross premium written as the moderator

$$\mathbf{IR = \beta_0 + \beta_1 RBC_{it} + \beta_2 GWP_{it} + \beta_3((RBC_{it}) * (GWP_{it})) + \varepsilon_{it}} \text{.....3.14}$$

Where:

IR is the investment income ratio,

RBC is the Risk based capital,

β_0: The regression constant,

β_1, β_2 and β_3 are the regression coefficients,

GWP is the gross written premium,

ε_i: is the random error term.

Adjusted R^2 was used to assess the outcome variable variation as a result of effects of the predictor variable. F- Test was undertaken to assess the model fit by testing the significance of the model. Beta coefficient (β) showed the effect variation in the dependent variable as result of a unit change in the predictor variable. T-test was used to evaluate the significance of the beta coefficient of the independent variable at 95% significance level. Moderation effect is presumed if when changes in R^2 is high as a result of interaction between risk based capital (RBC) and firm size (measured by total assets and gross written premium). Similarly, moderation is confirmed if the betta coefficient (β) of the interaction term is statistically significant.

3.8.5 Risk Based Capital, Asset Allocation, Firm Size and Investment Returns

The relationship among risk based capital, asset allocation, firm size and investment returns was determined using multiple linear regression model. The model was as follows:

$$\mathbf{IR = \beta_0 + \beta_1 RBC_{it} + \beta_2 AA_{it} + \beta_3 TA_{it} + \beta_4 GWP_{it} \varepsilon_{it}} \quad \textbf{.....3.15}$$

Where:

IR the investment income ratio,

RBC is the risk based capital,

AA is the asset allocation score,

TA is the total asset score,

GWP is the gross written premium,

β_0 the regression constant,

$\beta_1 \beta_2 \beta_3$ and β_4 the regression coefficients,

ε_i: is the random error term.

Adjusted R^2 was used to assess the outcome variable variation as a result of effects of the predictor variable. F- Test was conducted to assess the model fit by testing the significance of the model. Beta coefficient (β) showed the effect variation in the dependent variable as result of a unit change in the predictor variable. T-test was used to evaluate the significance of the beta coefficient of the independent variable at 95% significance level.

Summary of statistical tests and hypothesis is shown in table 3.3 below.

Table 3.3: Summary of Research Objectives, Hypotheses, Analytical Methods Statistical test and Interpretation

Objectives	**Hypotheses**	**Analytical techniques**	**Interpretation**
Determine the effect of risk based capital on investment returns of insurance companies in Kenya	$\mathbf{H_1}$**:** The effect of risk based capital on investment returns of insurance companies in Kenya is not significant.	• Linear Regression Analysis. $\mathbf{IR = \beta_0 + \beta_1 RBC_{it} + \varepsilon_i}$ IR is the investment income ratio during the period, RBC is the Risk based capital, β_0 : regression constant, β_1 : regression coefficient, ε_i: random error term. • Correlation coefficient (Pearson).	• Relationship exists if β_1 Significant. • Correlation coefficient (Pearson) is significant.
Establish the effect of asset allocation on the relationship between risk based capital and investment returns of insurance companies in Kenya	$\mathbf{H_2}$**:** The relationship between risk based capital and investment returns of insurance companies in Kenya is not intervened by asset allocation.	Stepwise Regression Analysis. Step 1 $\mathbf{IR_{it} = \beta_0 + \beta_1 RBC_{it} + \varepsilon_{it}}$ Step 2 $\mathbf{AA_{it} = \beta_0 + \beta_1 RBC_{it} + \varepsilon_{it}}$ Step 3 $\mathbf{IR_{it} = \beta_0 + \beta_1 AA_{it} + \varepsilon_{it}}$ Step 4 $\mathbf{IR_{it} = \beta_0 + \beta_1 RBC_{it} + \beta_2 AA_{it} + \varepsilon_{it}}$ IR is the investment income ratio, RBC is the risk based capital, i is the cross sectional unit where i =1….N, t is the time period where t=1…...T AA is the asset allocation score, β_0 : regression constant, β_1 : regression coefficient, ε_i: Random error term • Correlation coefficient (Pearson).	• A mediating/intervening relationship exist if at least one of β1... β2 is significant. • RBC and IR is statistically significant • RBC and AA is statistically significant • AA and IR is statistically significant. • RBC and IR becomes statistically significant when AA is controlled for.

Objectives	Hypotheses	Analytical techniques	Interpretation
Examine the effect of firm size on the relationship between risk based capital and investment returns of insurance companies in Kenya	**H_3:** The relationship between risk based capital and investment returns of insurance companies is not moderated by firm size. **H_{3a}:** The relationship between risk based capital and investment returns of insurance companies is not moderated by total assets **H_{3b}:** The relationship between risk based capital and investment returns of insurance companies is not moderated by gross written premiums.	• Hierarchical Multiple Regression Analysis. $\mathbf{IR} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\mathbf{RBC_{it}} + \boldsymbol{\beta_2}\mathbf{TA_{it}} + \boldsymbol{\beta_3}((\mathbf{RBC_{it}}) * (\mathbf{TA_{it}})) + \boldsymbol{\varepsilon_{it}}$ $\mathbf{IR} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\mathbf{RBC_{it}} + \boldsymbol{\beta_2}\mathbf{GWP_{it}} + \boldsymbol{\beta_3}((\mathbf{RBC_{it}}) * (\mathbf{GWP_{it}})) + \boldsymbol{\varepsilon_{it}}$ Where: IR is the investment income ratio, β_0 : The regression constant, $\beta_1\beta_2$and β_3 are the regression coefficients, RBC is the Risk based capital, TA is the total asset score. GWP is the gross written premium score, ε_i: is the random error term. • Correlation coefficient (Pearson).	• Relationship exist if at least one of $\beta_1...\beta_3$ is significant • Correlation coefficient (Pearson) is significant.
Establish the joint effect of risk based capital, asset allocation, and firm size on investment returns of insurance companies in Kenya.	**H_4:** The joint effect of risk based capital, asset allocation, and firm size on investment returns of insurance companies in Kenya is not significant.	Multiple regression analysis $\mathbf{IR} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\mathbf{RBC_{it}} + \boldsymbol{\beta_2}\mathbf{AA_{it}} + \boldsymbol{\beta_3}\mathbf{TA_{it}} + \boldsymbol{\beta_4}\mathbf{GWP_{it}}\boldsymbol{\varepsilon_{it}}$ Where: IR the investment income ratio, RBC is the risk based capital, AA is the asset allocation score, TA is the total asset score, GWP is the gross written premium score, β_0 is the regression constant, $\beta_1\beta_2\beta_3$ and β_4 are the regression coefficie ε_i: is the random error term.	• Relationship exists if at least of the $\beta_1...\beta_4$ are significant. • Correlation coefficient (Pearson) is significant.

Source: Author, 2020

CHAPTER FOUR: DESCRIPTIVE DATA ANALYSIS AND PRESENTATION

4.1 Introduction

This study sought to establish the relationships among risk based capital, firm size, asset allocation and investment returns of insurance Companies in Kenya. To test the relationship among the variables, secondary data was collected. This chapter gives a presentation of the analysis of data, specifically focusing on normality test, linearity test, reliability test, homogeneity of variance test, multicollinearity test, independence test, unit root test, and model fitting test. It also incorporates overall descriptive statistics and individual variables descriptive through frequency tables.

In determining the ideal number of classes for the frequency distribution, the guide provided as per Sturge's rule was adopted. The number of classes was determined by the formulae k= 1+ 3.322 ($\log_{10} n$) where k is defined as the number of classes and n is the unit of analysis. The number of classes for the frequency distribution in this study was determined by using Sturge's rule where n = 63 and k = 7

4.2 Descriptive Statistics

A summary of descriptive analysis of the variables in the study is given in table 4.1 below. The minimum RBC in the insurance sector during the study period was registered as 11.4 million and the maximum at 5.06 billion Kenya Shillings. On average, the industry's risk based capital is at 1.1 billion Kenya shillings. The figures below are represented as log of RBC which was adopted for analysis purposes. The average investment income ratio for the industry was 0.8338. This indicates that most companies net investment income are less than the net earned premiums for general insurance companies or the life fund for life insurance companies.

The results further show that risk based capital, asset allocation and gross written premiums were negatively skewed (-.67, -.65 and -.63 respectively) while total assets and investment returns were positively skewed (.27 and 3.45 respectively). Total assets and gross written premiums had a negative kurtosis (-.6 and -.1) while RBC, AA and investment returns had positive kurtosis (.13,.17 and 17.48). The coefficient of variation is also presented with RBC recording .075, AA .19, total assets .05, gross written premium .06 and investment returns 1.25.

Table 4.1

Descriptive Statistics

	N	Least	Most	Mean	Standard Deviation	Kurtosis	Skewness	Coefficient of Variation
RBC	249	6.64	9.87	8.711	.65683	0.13723	-0.67392	0.07538
Asset Allocation	249	.01	.06	.0471	.00930	0.17722	-0.65260	0.19811
Total Assets	249	8.38	10.90	9.578	.57392	-0.60267	0.27836	0.05992
Gross Written Premium	248	7.33	10.31	9.161	.64575	-0.103005	-0.63608	0.06995
Investment Returns	249	-.23	.99	.379	.06806	17.481462	3.45621	1.25273
Valid N (list wise)	248							

Source: Research Data

4.2.1 Descriptive Statistics for Risk Based Capital

Risk based capital was calculated using the square root of the sum of squares of insurance risk capital charge, market risk capital charge credit risk capital charge and operational risk capital charge as described by Bragt et al. (2010). The results of the risk based capital held are reflected in table 4.2 below.

Table 4.2

Descriptive Statistics for Risk Based Capital

Range (Kshs)	**Frequency (No of Firms)**	**Percentage (%)**
Up to 250 Million	17	27.0
In excess of 250 up to 500 Million	3	4.8
Above 500 up to 1 Billion	20	31.7
Above 1 Billion up to 2 Billion	15	23.8
Over 2 Billion up to 3 Billion	3	4.8
Over 3 Billion up to 4 Billion	3	4.8
Over 4 Billion	2	3.2
Total Firms	**63**	**100**
Arithmetic Mean (Kshs)		1,041,247,909.204
Std. Deviation (Kshs)		1,068,987,664.061
Coefficient of Variation (ratio)		1.026
Kurtosis		4.85321
Skewness		2.17171
Minimum (Kshs)		11,442,635.544
Maximum (Kshs)		5,068,523,892.93

Source: Research Data

Most of the insurance companies (27%) held a risk based capital of up to 250 million, while 3.2% of the firms held a risk based capital of over 4 billion. The mean risk based capital was 1.041 billion with a minimum of 11.4 million and a maximum of 5.06 billion over the 5-year period average.

4.2.2 Descriptive Statistics for Asset Allocation

Asset allocation was measured using a composite score of the investment vehicle and the time horizon of the investment. Time horizon score was computed as a ratio of the investment portfolio average time for the year and maximum investment duration within the year. Investment vehicle score was computed as a ratio of the amount of investment held per class and the total assets. The final score was computed as the geometric mean of time horizon score and investment vehicle score as described by Mwangi (2014). The results of the asset allocation score are highlighted in table 4.3 below.

Table 4.3

Descriptive Statistics for Asset Allocation Score

Range (Asset Allocation Score)	**Frequency (No of Firms)**	**Percentage (%)**
0.01-0.03	3	4.8
0.031-0.04	12	19.0
0.041- 0.045	14	22.2
0.046- 0.050	11	17.5
0.051- 0.055	9	14.3
0.056- 0.058	10	15.9
Above 0.058	4	6.3
Total Firms	**63**	**100**
Arithmetic Mean (Ratio)		0.047
Std. Deviation (Ratio)		0.0087
C. of Variation (Ratio)		0.189
Kurtosis		0.187752261
Skewness		-0.658917306
Minimum (Ratio)		0.014
Maximum (Ratio)		0.059

Source: Research Data

From the asset allocation score, 22.2% of the insurance companies had a score of above 0.056 which established that most of the investment had a longer maturity period and similar investment vehicles (e.g. corporate and government bonds). On the other hand, 4.8 % of the insurers had a score of between 0.01-0.03 which reflected shorter term investments such as cash and cash equivalents. The maximum asset allocation score was 0.059 while the minimum was 0.014. The mean score of the industry was 0.047. To arrive at the composite score, the arithmetic mean was used by looking at the time horizon of the invested assets and the percentage of the investment vehicle of a particular asset to the total assets.

4.2.3 Descriptive Statistics for Firm Size

Firm size was measured using the log of total assets and the log of gross written premium as described by Mwangi (2014) and Angima (2016). The results of the total assets held are reflected in Table 4.4 below.

Table 4.4

Descriptive Statistics for Total Assets

Range (Kshs)	**Frequency (No of Firms)**	**Percentage (%)**
Up to 1Billion	8	12.7
Over 1.0 up to 2 Billion	11	17.5
Over 2.0 up to 3 Billion	10	15.9
Over 3.0 up to 4 Billion	5	7.9
Over 4.0 up to 5 Billion	9	14.3
Over 5 Billion up to 6 Billion	1	1.6
Over 6 Billion	19	30.2
Total Firms	**63**	**100**
Arithmetic Mean (Kshs)		7,914,526,730.90
Standard Deviation (Kshs)		12,323,519,142.87
Coefficient of Variation (ratio)		1.557
Kurtosis		9.83266
Skewness		3.08168
Minimum (Kshs)		272,157,737.00
Maximum (Kshs)		60,590,638,195.20

Source: Research Data

Table 4.4 above shows that most of the insurance companies (30.2%) hold assets worth over 6 Billion with 69.8% holding assets of less than 5 Billion on average in the five-year period. The industry mean during the period was 7.9 billion worth of assets with a least of 272 million and a maximum of 60.6 billion worth of assets.

The results for gross written premiums held as reflected in table 4.5 below showed that most insurance companies underwrite less than 3 billion worth of gross written premiums (42) with 11 underwriting a gross written premium of over 5 billion on average over the five-year period.

The industry average during the period of study was gross written premium of 3.2 billion with a minimum of 46 million and a maximum of 15.6 billion.

Table 4.5

Descriptive Statistics for Gross Written Premium

Range (Kshs)	**Frequency (No of Firms)**	**Percentage (%)**
Up to 500 Million	12	19.04
Over 0.5 up to 1 Billion	5	7.9
Over 1.0 up to 2 Billion	14	22.22
Over 2.0 up to 3 Billion	11	17.46
Over 3.0 up to 4 Billion	4	6.35
Over 4.0 up to 5 Billion	6	9.53
Over 5 Billion	11	17.46
Total Firms	**63**	**100**
Arithmetic Mean (Kshs)		3,230,048,551.74
Standard Deviation (Kshs)		3,392,128,588.47
Coefficient of Variation (ratio)		1.05
Kurtosis		2.928108
Skewness		1.771512
Minimum (Kshs)		46,543,600.00
Maximum (Kshs)		15,673,577,600.00

Source: Research Data

4.2.4 Descriptive Statistics for Investment Returns

The results for investment returns which was measured by investment income ratio is shown in table 4.6 below. Investment income ratio is used as one of the measures of profitability of an Insurance Firm which gives a reflection of an insurer's income purely from investment activities without incorporating operational income. Most of the insurance companies' investment income ratio ranges from -0.01 to 0.1 which accounts for 31.75% of the total firms under study. About 11.11% of insurance company under study have an average investment income ratio of over 0.5 with the highest having an average of 3.10 during the study period.

Table 4.6

Descriptive Statistics for Investment Income Ratio

Range (Investment Income Ratio)	**Frequency (No of Firms)**	**Percentage (%)**
-0.01-0.05	20	31.75
0.05-0.1	9	14.29
0.11-0.2	9	14.29
0.021- 0.3	10	15.87
0.031-0.4	6	9.52
0.41-0.5	2	3.17
Above 0.5	7	11.11
Total Firms	**63**	**100**
Arithmetic Mean (Ratio)		0.302304
Std. Deviation (Ratio		0.377479
Coefficient of Variation (Ratio)		1.248674
Kurtosis		17.4814623
Skewness		3.456214
Minimum (Ratio)		-0.225090
Maximum (Ratio)		3.1027

Source: Research Data

4.3 Pre-estimation Diagnostics

There are various assumptions that should be met to undertake classical linear regression as per Porta (2014). Normality test, linearity, homoscedasticity, multicollinearity, independence, unit root and cointegration tests were undertaken in order to evaluate these assumptions.

4.3.1 Normality Test

When undertaking multiple linear regression and correlation analysis, the sample data needs to be normally distributed. This study adopted multiple linear regression to analyse and test the formulated hypotheses. Preliminary normality tests were conducted to ascertain that the data was normally distributed, and all the attributes were met. Table 4.7 below reflects the normality test done by assessing the skewness and kurtosis.

Table 4.7

Test for Normality

	N	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
RBC	249	-.253	.154	.099	.307
Asset Allocation	249	-.164	.154	.189	.307
Total Assets	249	.293	.154	-.603	.307
Gross Written Premium	248	-.133	.155	-.136	.308
Investment Returns	249	.125	.154	-.016	.307
Valid N (list wise)	248				

Source: Research Data

A zero value indicates a perfectly normal distribution. Skewness doesn't make a substantive difference in analysis especially for a large sample. The skewness statistic for risk based capital was -0.253, asset allocation was -0.164, total assets was 0.293, gross written premium was -0.133 and investment returns was 0.125. The negative skewness for RBC, asset allocation and gross written premiums suggests that the distribution has a long tail to the left and is asymmetrical.

The positive skewness for total assets and investment returns imply that the distribution is skewed to the right. Risk based capital kurtosis statistic was 0.099, asset allocation was 0.189, total assets was -0.603, gross written premium was -0.136 and investment returns was -0.016. The negative kurtosis of total assets, gross written premium and investment returns suggests that their distribution is flatter than normal. These measures did not indicate departures from normality.

The study further conducted normality test using Shapiro-Wilk test. Table 4.8 below illustrates the results of the test.

Table 4.7b

Test of Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
RBC	.080	249	.201	.966	249	.375
Asset Allocation Score	.107	249	.086	.928	249	.063
Total Assets	.058	249	.491	.981	249	.472
GWP	.077	249	.329	.962	249	.323

a. Lilliefors Significance Correction

Source: Research Data

Table 4.7b above shows p value > 0.05 where RBC recorded a value of .375, asset allocation score at 0.063, total assets at 0.472 and 0.323 on the gross written premiums thus indicating the data was distributed normally.

Normality was also observed by assessing graphical displays (histograms) for each variable as shown below:

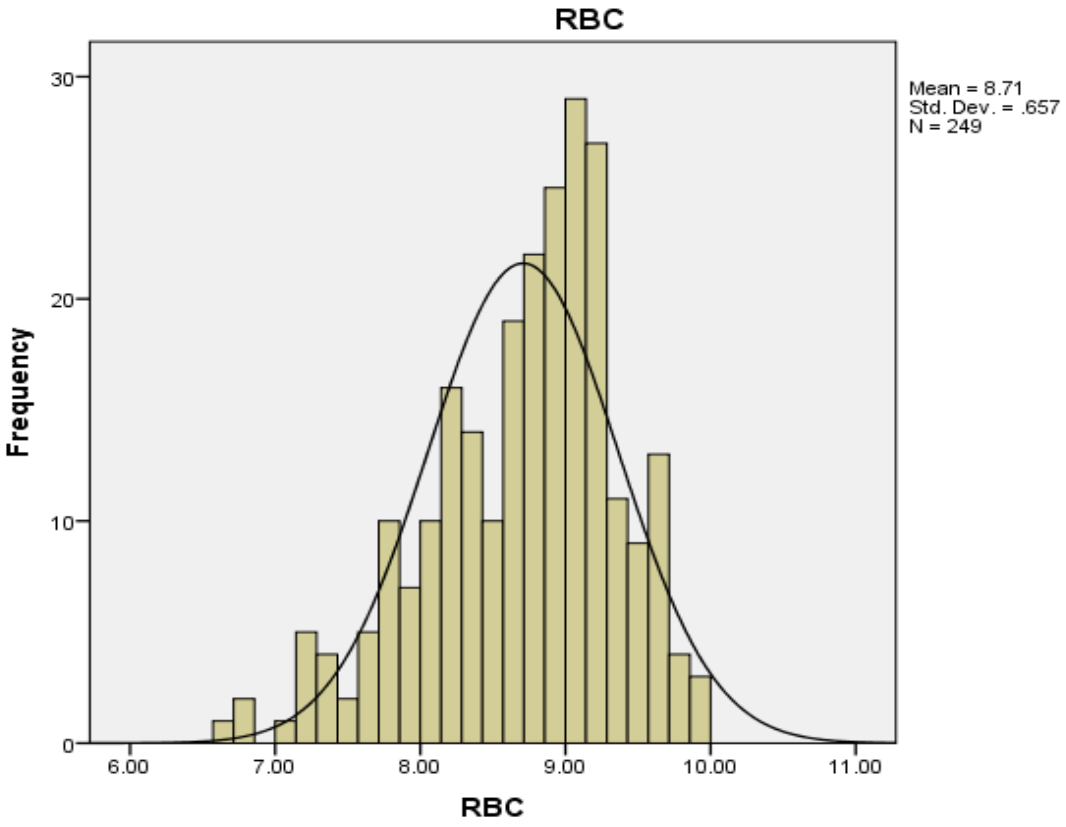

Figure 4.1 Histogram of Risk Based Capital

Source: Research Data

Scores for risk based capital show that it is normally distributed having a mean of 8.71 and a standard deviation of 0.675 as indicated in figure 4.1 above. The histogram adopts a bell shaped curve indicating the data is normally distributed thus appropriate for further analysis by means of parametric tests.

Figure 4.2 below shows that the score for asset allocation with a mean of 0.05 and a standard deviation of 0.009. The histogram did not adopt a fully bell shaped curve. Data transformation was required, which was done by obtaining the reciprocals of the asset allocation score before additional examination using parametric tests.

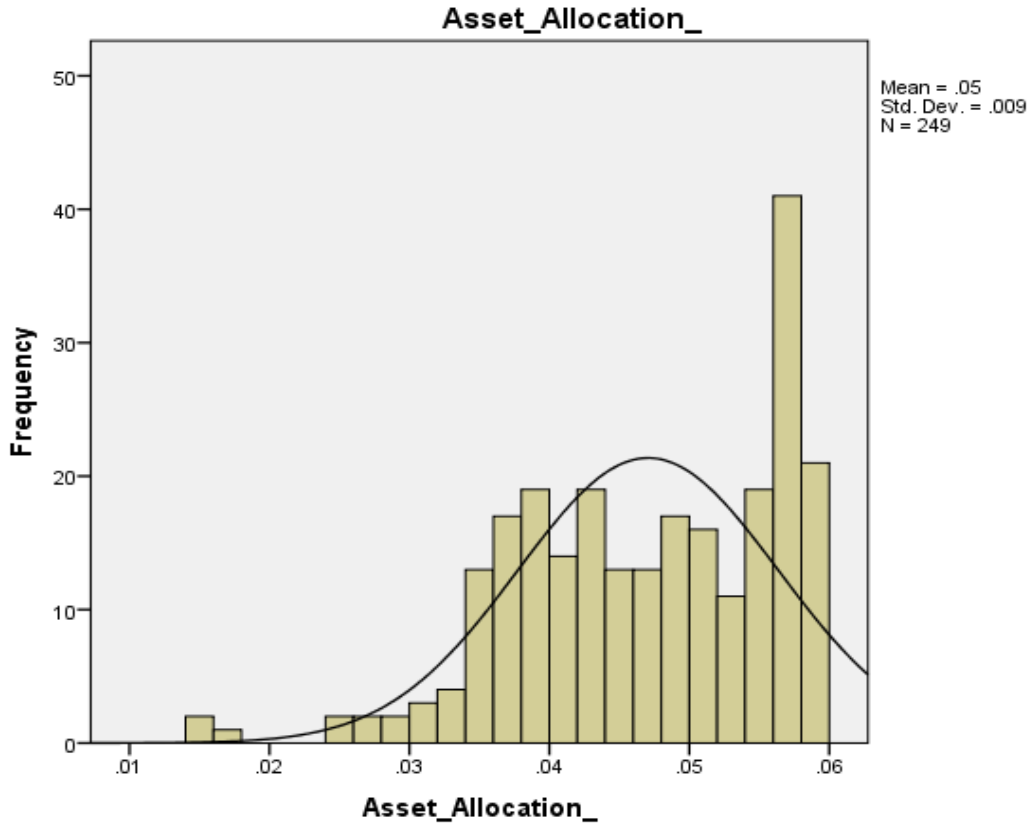

Figure 4.2 Histogram of Asset Allocation Score

Source: Research Data

The scores for total assets were distributed normally with a mean of 9.58 and a standard deviation of 0.547as indicated in figure 4.3 below. These scores confirm the data is appropriate for further examination.

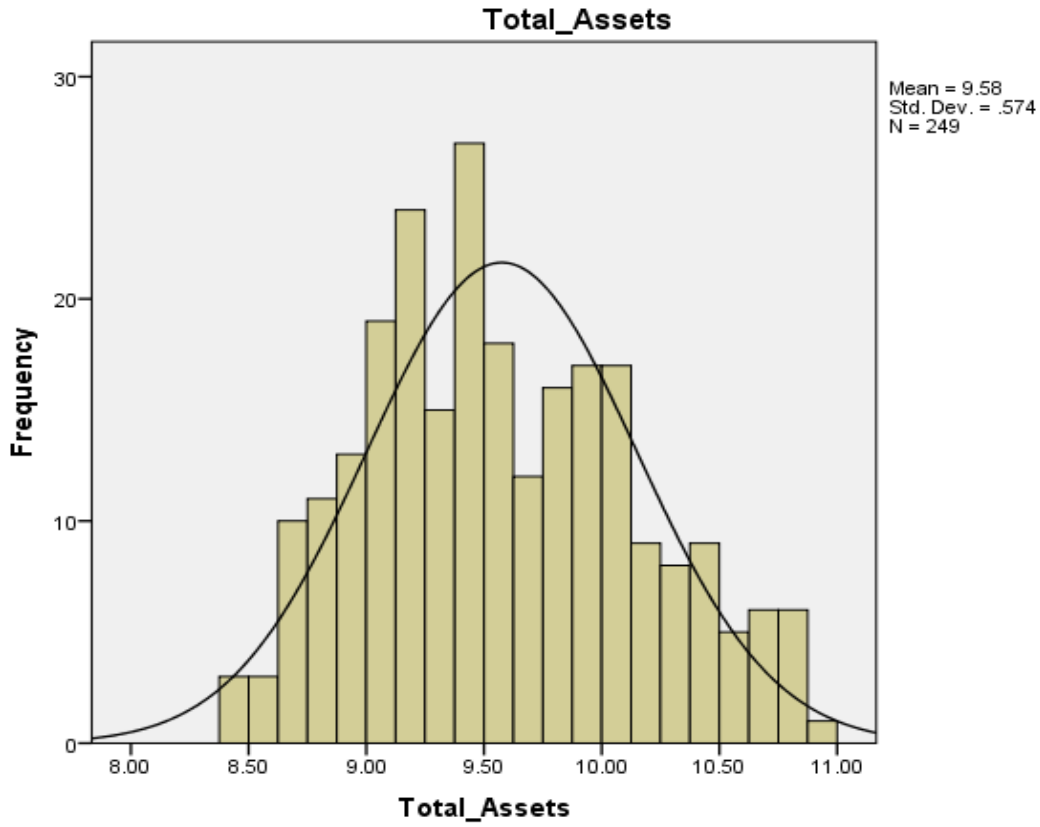

Figure 4.3 Histogram of Total Assets

Source: Research Data

The scores for gross written premiums assume a normal distribution with a mean of 9.16 and a standard deviation of 0.646 as indicated in figure 4.4 below. The histogram adopts a bell shaped curve indicating the data is normally distributed thus appropriate for further examination using parametric tests.

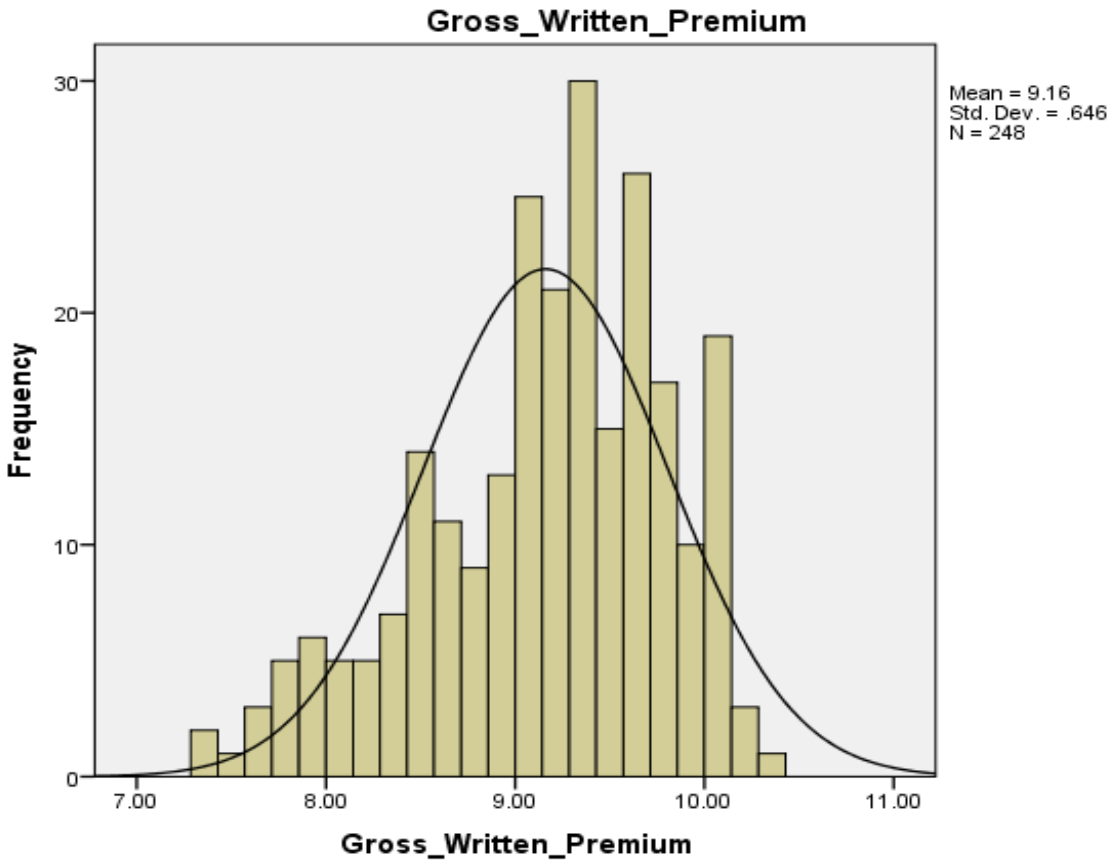

Figure 4.4 Histogram of Gross Written Premiums

Source: Research Data

Figure 4.5 below shows the scores for investment returns which is distributed normally with a mean of 0.83 and a standard deviation of 0.0678. The histogram adopts a bell shaped curve indicating the data is normally distributed thus appropriate for further examination using parametric tests.

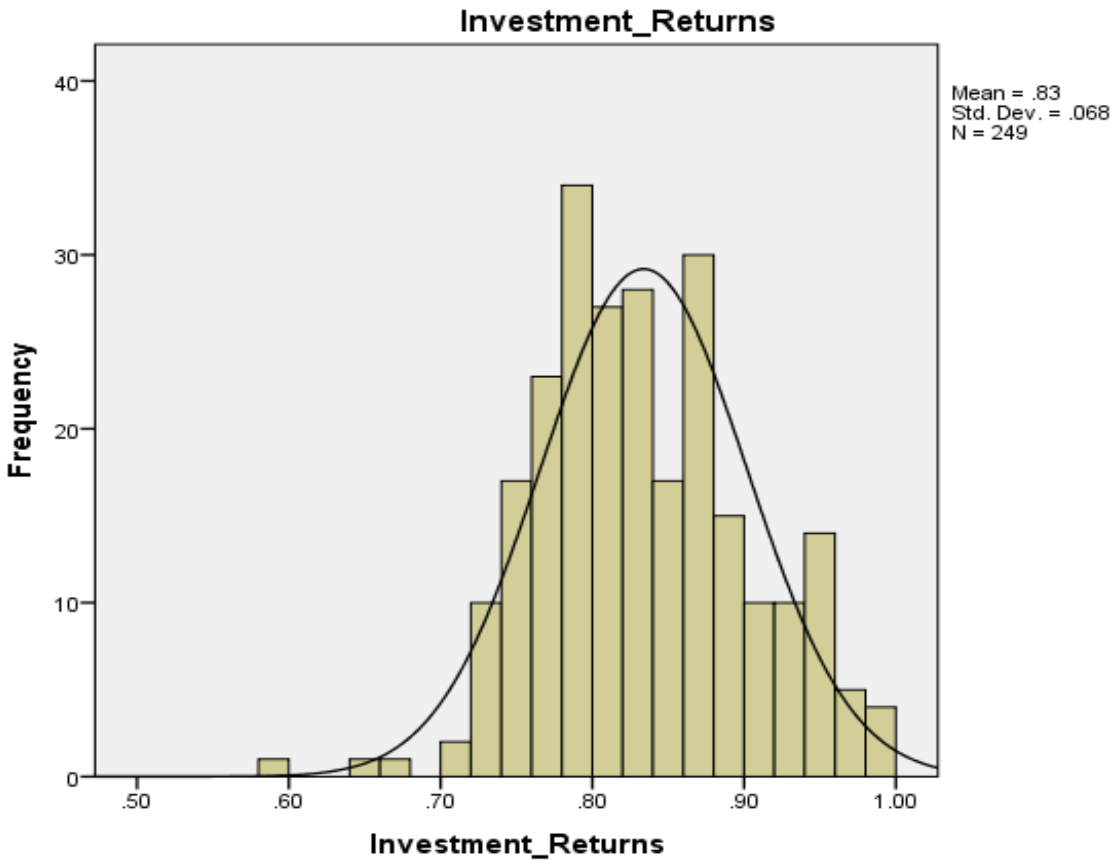

Figure 4.5 Histogram of Investment Returns
Source: Research Data

4.3.2 Linearity Test

To test for linearity in this study, both statistical (Ramsey's RESET test) and graphical methods (scatter plots) were used so as to confirm that the relationship amongst variables was linear and that the confidence levels generated by the regression analysis were not misleading or biased. The test shows a significant moderate relationship between the variables. This is an indication that linearity exists among the variables. The Ramsey's RESET test for linearity as highlighted in table 4.8 below shows that all the variables have a significance level > 0.05 thus indicating that linearity exists among the variables.

Table 4.8

Test for Linearity

Coefficients [a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	-1.734	1.594		-1.088	.278
	RBC	-.032	.217	-.017	-.148	.883
	Asset Allocation	9.147	12.459	.068	.734	.464
	Total Assets	-.091	.551	-.041	-.164	.870
	GWP	.268	.556	.138	.483	.630
	ram1	1.105	.614	.611	1.798	.073
	ram2	-.089	.258	-.096	-.347	.729

a. Dependent Variable: Investment Returns

Source: Research Data

The scatter plots of the relationship between variables are shown in figures 4.6 to 4.9 below.

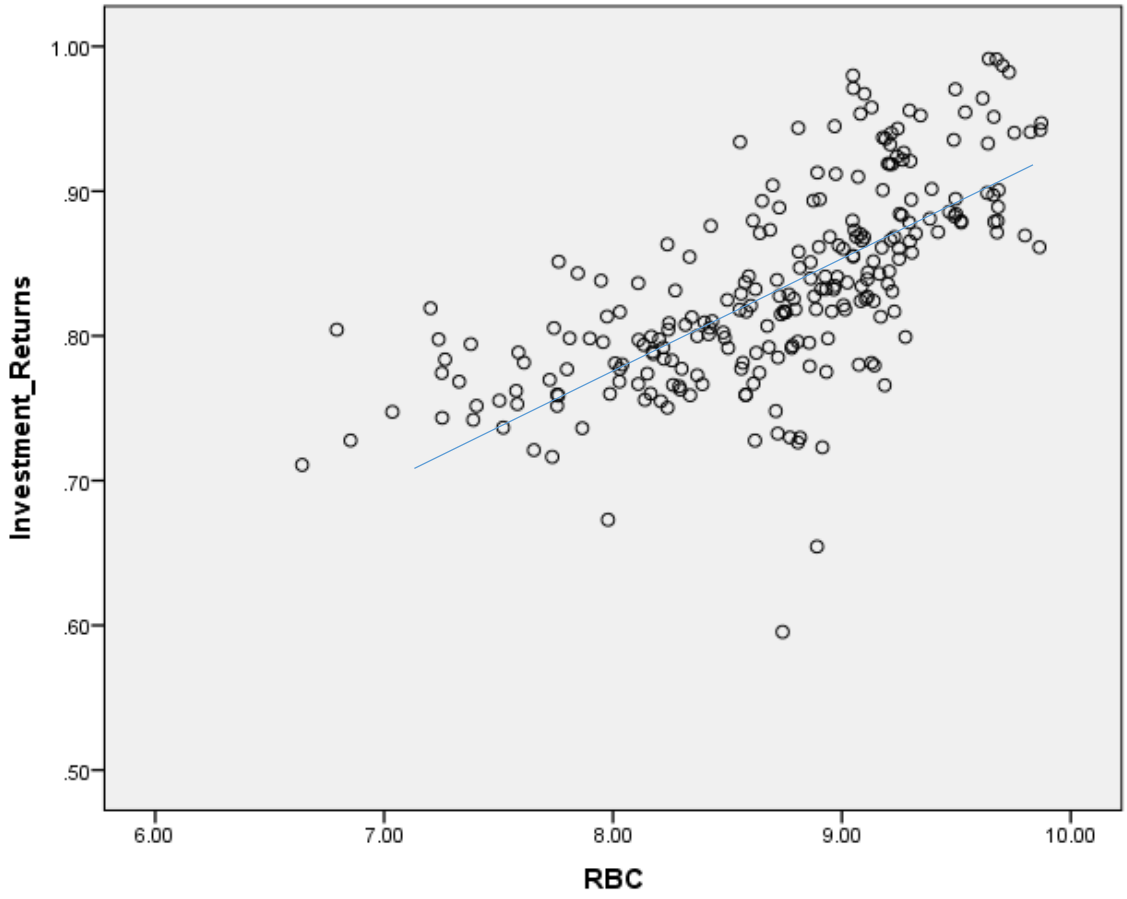

Figure 4.6 Scatter Plot of Risk Based Capital and Investment Returns

Source: Research Data

Figure 4.6 above shows the scatter plot for risk based capital and investment returns. The results of the test show significant moderate relationship between the two variables. This is an indication that linearity exists.

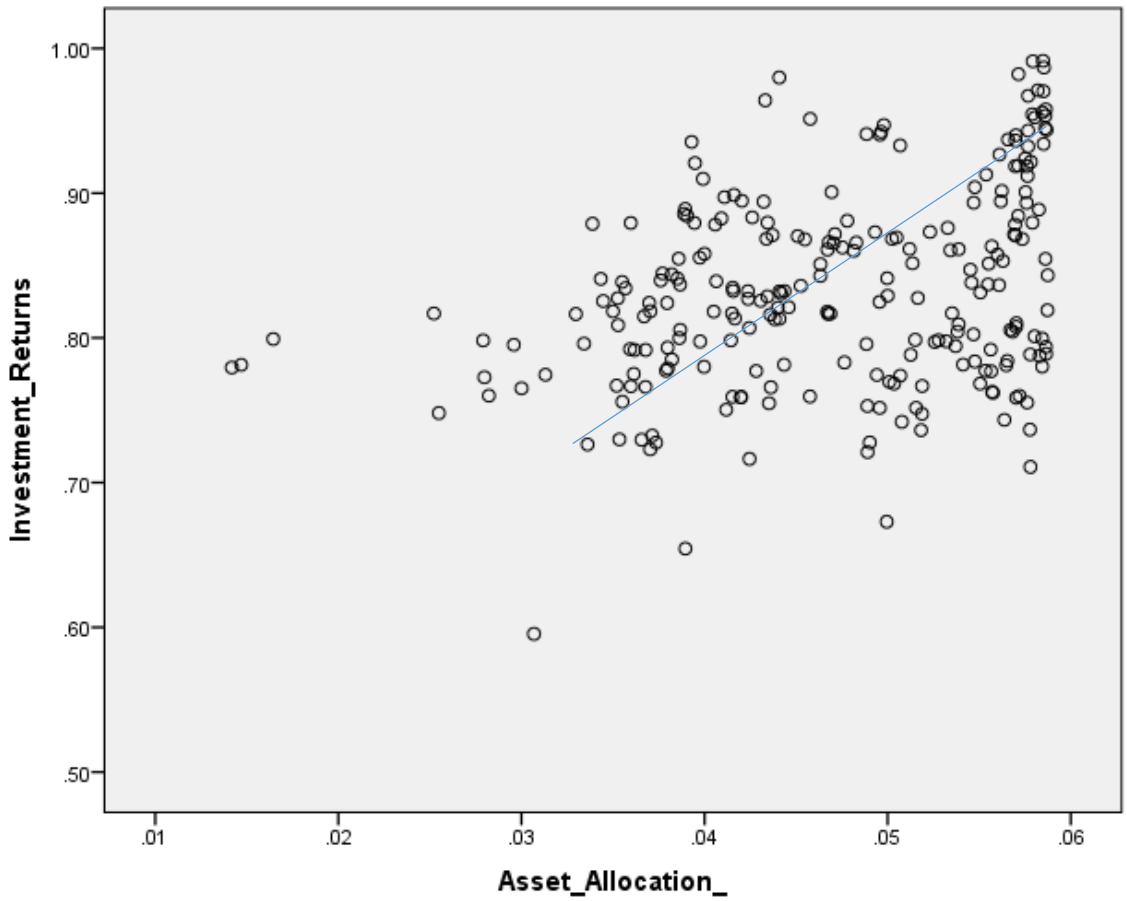

Figure 4.7 Scatter Plot of Asset Allocation and Investment Returns

Source: Research Data

Figure 4.7 above displays the scatter plot for asset allocation and investment returns. The results of the test show significant moderate relationship between the two variables. This is an indication that linearity exists.

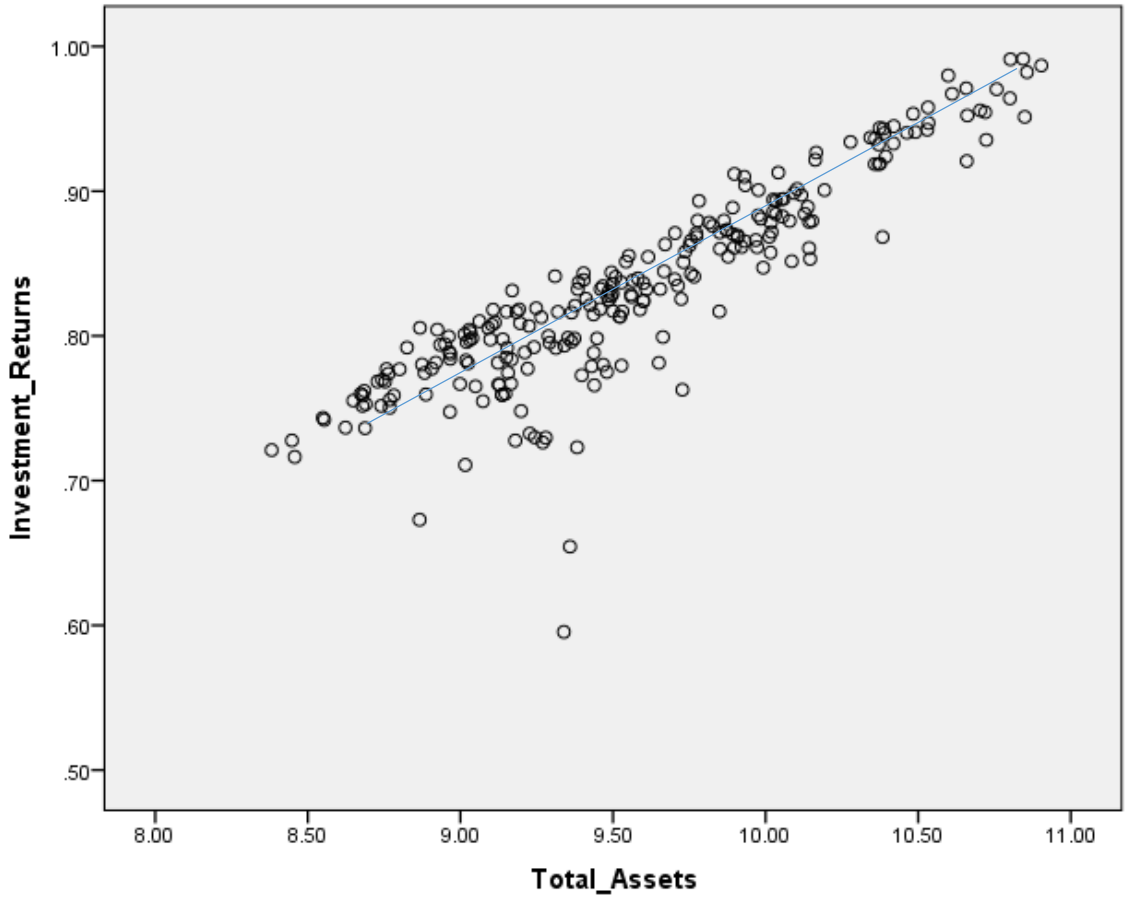

Figure 4.8 Scatter Plot of Total Assets and Investment Returns

Source: Research Data

The scatter plot for total assets and investment returns as shown in figure 4.8 above point out that there is a significant moderate relationship between the two variables. This is an indication that linearity exists.

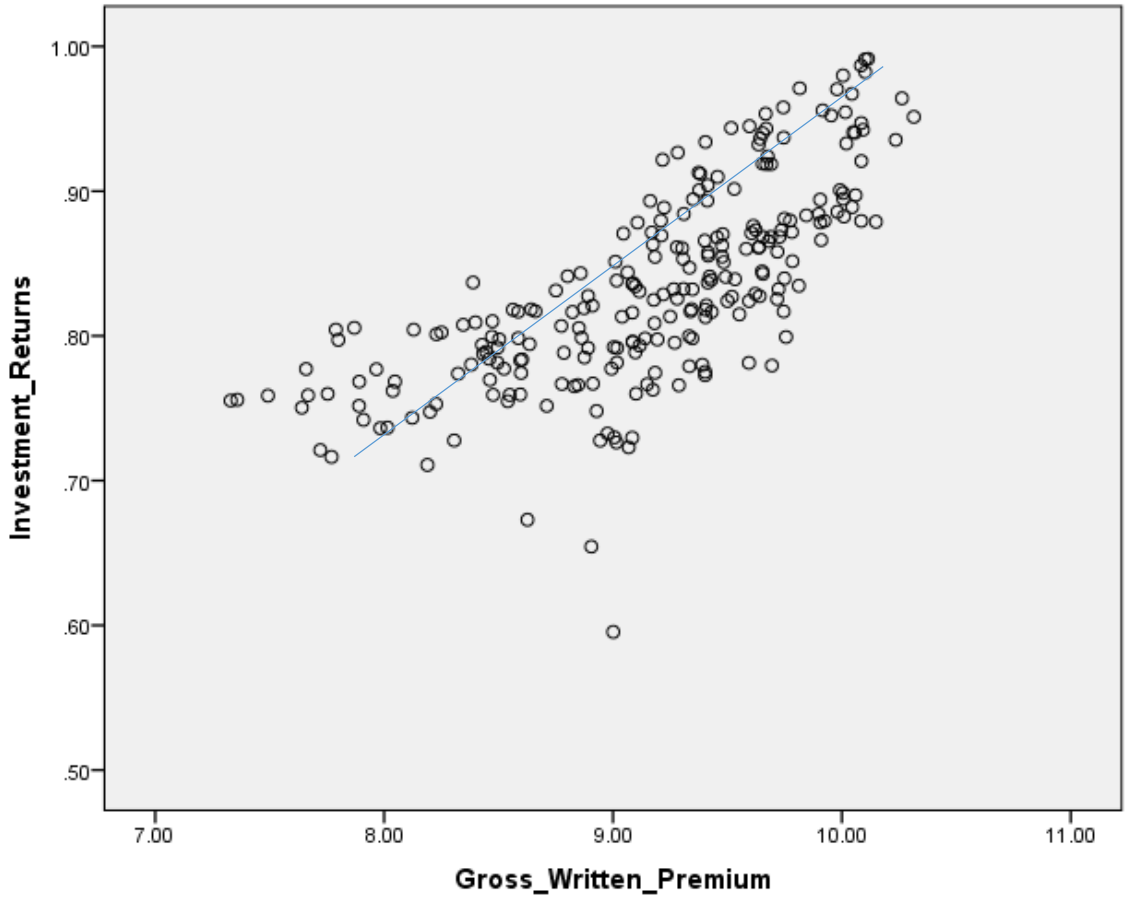

Figure 4.9 Scatter Plot Gross Written Premiums and Investment Returns

Source: Research Data

The scatter plot for gross written premiums and investment returns as shown in figure 4.9 above shows that there is a significant moderate relationship amongst the two variables, thus presence of linearity.

4.3.3 Homogeneity of Variance Test

This study adopted Levene's test to measure homogeneity of variance. This was critical for analysis since there is a likelihood of falsely rejecting the null hypotheses if the homoscedasticity is violated. If the p value of the Levene's test is less than 0.05, then it's an indication that the variance are not equal and other parametric tests such as ANOVA are not suited. Table 4.9 below demonstrates the Levene's test for homoscedasticity.

Table 4.9

Levene's test

Method		df	Value	Probability
Levene		(4, 1235)	31.21366	0.0000
Variable	Tally	Std. Dev.	Mean Abs. Mean Diff.	Mean Abs. Median Diff.
Asset Allocation	248	0.009298	0.007870	0.007854
GWP	248	0.645748	0.517189	0.511250
Investment Returns	248	1.254901	0.351641	0.290252
RBC	248	0.656647	0.523498	0.515870
Total Assets	248	0.574007	0.473253	0.469727
All	1240	4.451858	0.374690	0.358991

Bartlett weighted standard deviation: 0.741960

Source: Research Data

The p value as indicated above in table 4.8 is less than 0.05 thus indicting the variance are not equal. Variance stabilization transformation of the data was undertaken through obtaining reciprocals before further analysis.

4.3.4 Multicollinearity Test

This study implemented the variance inflation factor (VIF) to conclude whether multicollinearity is existent amongst the variables. Robinson and Schumacker (2009) indicate that if the VIF value is less than 10, then the level of multicollinearity can be tolerated. From table 4.10 below, the VIF for risk based capital is 3.970 with a tolerance level of 0.2518, for asset allocation is 2.101 with a tolerance level of 0.4759, for total assets is 9.118 with a tolerance level of 0.1096 and gross written premium is 6.659 with a tolerance level of 0.1502. All these figures are below 10 and a tolerance level of greater than 0.1, thus indicating that the level of multicollinearity can be tolerated.

Table 4.10

Multicollinearity test

Variables	Variance Inflation Factor (VIF)	1/VIF
Risk Based Capital	3.970	0.2518
Asset Allocation	2.101	0.4759
Total Assets	9.118	0.1096
Gross Written Premium	6.659	0.1502

a. Dependent Variable: Investment Returns

Source: Research Data

4.3.5 Serial Independence Test

This study adopted Durbin Watson test to confirm if the observations among the variables were independent. As per this test, the coefficient needs to be between 1.5 and 2.5 in order to confirm that the observations were independent. Table 4.11 below represents the independence test conducted in this study.

Table 4.11

Independence test

Model Summary				
Variable	R^2	Adjusted R^2	S.E of the Estimate	Durbin-Watson
RBC	0.474292	0.465494	0.625171	1.961820
Asset allocation score	0.396796	0.389288	0.007570	2.074575
Total Assets	0.506484	0.504470	0.576290	1.997517
Gross Written Premiums	0.497961	0.495912	0.647273	2.001893
Investment income ratio	0.507624	0.505614	1.259701	2.000623

a. Predictors: (Constant), Gross Written Premium, Asset Allocation, RBC, Total Assets
b. Dependent Variable: Investment Returns

Source: Research Data

From table 4.11 above, the coefficient observed as per the Durbin-Watson test for risk based capital was 1.961820, asset allocation score was 2.074575, firm size (total assets) was 1.997517, firm size (GWP) was 2.001893 and investment income ratio was 2. 000623. Since the coefficients lie between 1.5 and 2.5, it is an indication that the observations made were serially independent.

4.3.6 Panel Unit Root Test

This study adopted augmented Dickey-Fuller test in determining if the variables in the time series are non-stationary in nature. It tests if the autoregressive model has a unit root. For this study to reject the null hypothesis (the data has a unit root), the p value should be less than 0.05. Table 4.12 underneath displays the outcomes of the augmented Dickey Fuller test adopted in checking for unit root.

Table 4.12

Panel Unit Root Test

Variable	ADF Test	Prob.*	Remarks
RBC	-4.770575	0.0001	Stationery
Asset Allocation	-4.126420	0.0011	Stationery
Total Assets	-15.85680	0.0000	Stationery
GWP	-15.58876	0.0000	Stationery
Investment Income Ratio	-15.89299	0.0000	Stationery

*MacKinnon (1996) one-sided p-values.
Null Hypothesis: Variable has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=15)
Source: Research Data

Table 4.12 directly above indicates that all the P values for the augmented Dickey- Fuller test are less than 0.05, thus indicting that risk based capital, asset allocation, total assets, gross

written premium and investment income ratio have no unit root meeting the condition required for being stationery.

4.3.7 Cointegration Test

This study adopted Johansen test to check for cointegration. In this test, the p value is monitored in order to check the statistical significance level. P value of less than 0.05 implies the regression coefficients are statistically significant. Table 4.13 below displays the findings of Johansen's cointegration test.

Table 4.13

Cointegration Test

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.093409	23.82945	3.841466	0.0000
None *	0.047651	11.86414	3.841466	0.0006
None *	0.197284	53.40041	3.841466	0.0000
None *	0.126273	32.80197	3.841466	0.0000
None *	0.156718	41.42015	3.841466	0.0000

* signifies rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Basis: Research Data

For the regression coefficients to be termed as statistically significant, the p value ought to be less than 0.05. The results in table 4.12 above shows that all the p values are less than 0.05 thus confirming that the regression coefficients are statistically significant and rejecting the null hypothesis at 0.05 level of significance. The null hypothesis being rejected as per the cointegration rank test indicate that there is no cointegration.

4.4 Correlation Analysis

The nature and direction of the association among the variables was measured using Pearson Product Moment correlation coefficient (denoted by r) in line with previous studies like Mwangi (2014) and Angima (2017), with the value taking a range of +1 to -1. A perfect positive correlation would be represented by a positive 1, inferring that an escalation or reduction in one variable will lead to a proportionate rise or reduction in the other variable. A perfect negative correlation is depicted by a value of -1 which alludes, an increase in one variable leads to a reduction in another variable. A zero (0) value point towards no association exists between variables. A value more than zero point out a positive association while a value less than 0 shows a negative association.

The correlation analysis was done at a two tailed significance level of 0.05 and 0.01 as per previous studies. The study adopted the criterion used by Mwangi (2014) to measure the nature and direction of the relationship between variables where 0 and less than 0.4 depicted weak, 0.4 and less than 0.7 as moderate and above 0.7 as high. The correlation results are presented in table 4.14.

Table 4.14

Pearson Moment Correlations among the Dependent, Independent, Intervening and Moderating Variable

		Correlations				
		RBC	Asset Allocation	Total Assets	Gross Written Premium	Investment Returns
RBC	Pearson M. Correlation	1				
Asset Allocation	Pearson M. Correlation	-.186**	1			
Total Assets	Pearson M. Correlation	.806**	.153*	1		
Gross Written Premium	Pearson M. Correlation	.786**	-.160*	.871**	1	
Investment Returns	Pearson M. Correlation	.669**	.341**	.897**	.725**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

From the findings, a strong positive correlation (at 0.01 level of significance) was detected between the following variables: risk based capital and total assets (r = 0.806), risk based capital and gross written premium (r = 0.786), total assets and gross written premium (r = 0.871), total assets and investment returns (r = 0.897); and investment returns and gross written premium (r = 0.725). On the other hand, a moderate positive correlation (at 0.01 level of significance) was also observed between the following variables: risk based capital and investment returns (r = 0.669) and a weak positive correlation (at 0.01 level of significance) on the following variables: asset allocation and investment returns (r = 0.341).

A weak positive correlation existed amongst the following variables at 0.05 level of significance: asset allocation and total assets (r = 0.153). Other correlations, although weak positive or negative, are statistically insignificant for example: risk based capital and asset allocation (r = -0.186); and asset allocation and gross written premium (r = -0.160). From the

correlation analysis, it is revealed that there are significant relationships within the study variables and in line with the study hypotheses.

4.5 Chapter Summary

This chapter described the outcomes of descriptive statistics of the dependent, independent, intervening and moderating variables of the study. Secondary data was collected from insurance companies licenced by IRA. The resultant data was at 249 data points data points from the 63 insurance companies in Kenya. Risk based capital was evaluated using the calculated figure of RBC derived from the standard formula which incorporated the square root of the sum of squares of capital required for insurance risk, market risk and credit risk capital plus the capital required for operational risk. Investment returns was measured using the investment income ratio which incorporated investment income and the net earned premiums. Majority of the insurance companies reported a positive investment income ratio with one company posting a negative investment income ratio.

The arithmetic mean, standard deviation, coefficient of variation, maximum and minimum of each variable has also been presented. Diagnostic tests which include normality, which was tested using skewness and kurtosis and at the same time assessing graphical displays (histograms); linearity, which was measured using scatter plots; homogeneity of variance, which was conducted using Levene's test for homoscedasticity; multicollinearity, which was tested using variance inflation factor (VIF); independence, which was tried using Durbin Watson test, panel unit root test, which was done using Augmented Dickey Fuller test and cointegration, in which the study adopted Johansen's cointegration test, were conducted.

CHAPTER FIVE: HYPOTHESIS TESTING AND DISCUSSION OF FINDINGS

5.1 Introduction

This study sought to determine the relationships among risk based capital, asset allocation, firm size and investment returns of Insurance Companies in Kenya. The research sought to accomplish four objectives by testing four hypotheses. The first to be tested was the relationship between risk based capital and investment returns of insurance companies in Kenya; the second hypothesis tested the intervening effect of asset allocation on the relationship between risk based capital and investment returns; the third hypothesis tested the moderating effect of firm size on the relationship between risk based capital and investment returns; whilst the fourth hypothesis tested the combine effect of risk based capital, asset allocation and firm size on investment returns of insurance companies in Kenya. Tests of goodness of fit (analysis of variance- ANOVA), correlation coefficient (r), including coefficient of determination R^2, t test, F tests and standard error are presented.

5.2 Hypothesis Testing

To establish whether there was significant relationship between the variables, four hypotheses were formulated and tested. Regression models were run in order to test these hypotheses. The first model was to establish whether there was significant relationship between the dependent variable (investment returns; measured by investment income ratio) and the independent variable (risk based capital). Secondly, the intervening effect of asset allocation (measured by a composite score computed as the geometric mean of time horizon score and investment vehicle score) on the relationship between the investment returns and risk based capital was tested. Thirdly, the moderating effect of firm size (total assets and gross written premium) on the relationship between investment returns and risk based capital was tested and lastly the joint effect of risk based capital, asset allocation, firm size and investment returns of insurance

companies in Kenya was tested. The findings from regression analysis that was conducted at 95% confidence level (α of 0.05) are discussed below.

5.2.1 Risk Based Capital and Investment Returns

The study focused on the establishment of the effect of risk based capital on the returns on investments of insurance companies in Kenya. Panel data was used in establishing the investment returns which was measured by investment income ratio (computed as net investment income/net earned premiums or life fund). Risk based capital was calculated using the square root of the sum of squares of the for insurance risk required capital, market risk required capital, credit risk required capital and operational risk capital required and an adjustment which considered the loss-absorbing capacity of technical provisions and deferred taxes. The following hypothesis was developed:

Hypothesis 1: The effect of risk based capital on investment returns of insurance companies in Kenya is not significant.

With investment returns as the dependent variable and risk based capital as the independent variable, the results of the regression analysis are shown below in table 5.1.

Table 5.1

Regression Analysis on Risk Based Capital as the Independent Variable and Investment Returns as the Dependant Variable

Model	**R**	**R^2**	**Adj. R^2**	**S. E of the Estimate**	
a. Predictors: (Constant), RBC	.669a	0.447	0.445	0.05072	
Model	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Regression	0.514	1	0.514	199.646	.000b
Residual	0.635	247	0.003		
Total	1.149	248			
Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**T**	**Sig.**
	B	Std. Error	Beta		
(Constant)	0.231	0.043		5.383	0
RBC	0.069	0.005	0.669	14.13	0

a. Dependent Variable: Investment Returns
b. Predictors: (Constant), RBC

Table 5.1 above indicates an adjusted R^2 = 0.445 thus demonstrating that risk based capital explains 44.5 % of the variance in investment returns. From the model coefficients shown in table 5.1, the results indicate a statistically significant model since the p value is 0.000 which is less than 0.05 level of significance. This finding therefore rejected the null hypothesis which implied that the effect of risk based capital on investment returns of insurance companies in Kenya is insignificant. The regression model which explains the variation of the investment returns attributed to by risk based capital is shown below:

$$\mathbf{IR_{it} = 0.231 + 0.069RBC_{it} + \varepsilon_i}$$

Where:

IR is the investment returns

RBC is the risk based capital.

5.2.2 Risk Based Capital, Asset Allocation and Investment Returns

The second purpose of the study was to establish the intervening effect of asset allocation on the relationship between risk based capital and investment returns. The developed hypothesis was:

Hypothesis 2: The relationship between risk based capital and investment returns of insurance companies in Kenya is not intervened by asset allocation.

Four steps were carried out to test the intervening effect of asset allocation on the relationship between risk based capital and investment returns as described by Baron and Kenny (1986). Step one of the intervening investigation involved a regression analysis on the relationship between RBC (independent variable) and investment returns (dependent variable), ignoring asset allocation (intervening variable) equivalent to hypothesis 1 above. The second step of the intervening analysis involved regressing asset allocation as the dependant variable and risk based capital as the independent variable ignoring investment returns.

Step three of the intervening analysis involved a regression on the relationship between asset allocation (as the independent variable) and investment returns (as the dependent variable) ignoring RBC. The final step (four) of the intervening analysis involved a regression analysis on the relationship between asset allocation (as an intervening variable), investment returns (as a dependent variable) and risk based capital (as an independent variable).

Table 5.2

Regression Results for the Relationship between Asset Allocation as the Dependent Variable and Risk Based Capital as the Independent Variable

Model	**R**	**R^2**	**Adj. R^2**	**S. E of the Estimate**
a. Predictors: (Constant), RBC	.186a	.035	.031	.00915

Model	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Regression	.001	1	.001	8.894	.003b
Residual	.021	247	.000		
Total	.021	248			

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta		
(Constant)	.070	.008		9.063	.000
RBC	-.003	.001	-.186	-2.982	.003

a. Dependent Variable: Asset Allocation
b. Predictors: (Constant), RBC

Table 5.2 show an adjusted R^2 of 0.031 indicating that risk based capital explains a 3.1 % variation of asset allocation. The results further illustrate that risk based capital is a significant predicting variable of asset allocation since the p value is 0.003 which is less than the 0.05 level of significance. The regression model of risk based capital as the independent variable and asset allocation as the dependent variable ignoring investment returns is shown below:

$$\mathbf{AA_{it} = 0.07 - 0.003RBC_{it}}$$

Where:

AA is asset allocation and;

RBC is the risk based capital.

The results showed that there was a significant relationship between risk based capital and asset allocation, and that risk based capital had a negative effect on asset allocation. The third step

was taken where investment returns was taken as the dependent variable and asset allocation as the independent variable.

Table 5.3

Regression Results for the Relationship between Investment Returns as the Dependent Variable and Asset Allocation as the Independent Variable.

Model	**R**	**R^2**	**Adj. R^2**	**S. E of the Estimate**
a. Predictors: (Constant), Asset Allocation	.341a	.117	.113	.06410

Model	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Regression	.134	1	.134	32.604	.000b
Residual	1.015	247	.004		
Total	1.149	248			

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta		
(Constant)	.716	.021		34.112	.000
Asset Allocation	2.499	.438	.341	5.710	.000

a. Dependent Variable: Investment Returns
b. Predictors: (Constant), Asset Allocation

Table 5.3 above show an adjusted R^2 of 0.113 which indicates that asset allocation explains 11.3% variation in investment returns. The findings as per table 5.3 further alludes that there is a significant relationship between asset allocation and investment returns since the p value is 0.000 which is below the 0.05 level of significance.

The regression model can be presented as follows:

$$\mathbf{IR_{it} = 0.716 + 2.499AA_{it}}$$

Where:

IR is the investment returns and;

AA is asset allocation.

The fourth step was to run a regression on investment returns as the dependent variable and asset allocation, risk based capital as the independent variables. The outcomes are shown as follows:

Table 5.4

Regression Results for the Relationship between Investment Returns as the Dependent Variable while Asset Allocation and RBC as the Independent Variable.

Model	**R**	**R^2**	**Adj. R^2**	**S. E of the Estimate**
a. Predictors: (Constant), Asset Allocation, RBC	.820a	.672	.669	.03913

Model	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Regression	.772	2	.386	252.093	.000b
Residual	.377	246	.002		
Total	1.149	248			

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta		
(Constant)	-.017	.038		-.447	.655
RBC	.079	.004	.759	20.413	.000
Asset Allocation	3.535	.272	.483	12.995	.000

a. Dependent Variable: Investment Returns
b. Predictors: (Constant), Asset Allocation, RBC

Table 5.4 above show an adjusted R^2 of 0. 679 which indicates that risk based capital and asset allocation explains a 67.9% variation in investment returns. It further shows a p value of 0.000 which is less than 0.05 significance level thus deeming a significant relationship among the variables.

Risk based capital also showed a significant relationship with investment returns with a p value of 0.000 as shown in table 5.1 b above, which is less than the 0.05 level of significance. Table 5.1 showed an adjusted R^2 of 0. 445 which indicated that risk based capital explained a 44.5% variation in investment returns. The percentage increase from 44.5% to 67.9% shows that the

introduction of asset allocation increases the variation between risk based capital and investment returns. The conclusion therefore is that asset allocation has a positive significant intervening effect on the relationship between RBC and investment returns. The null hypothesis that the relationship between risk based capital and investment returns of insurance companies in Kenya is not intervened by asset allocation is therefore rejected. The resultant regression model is shown below:

$$\mathbf{IR_{it} = -0.017 + 0.079RBC_{it} + 3.535AA_{it}}$$

Where:

IR is the investment returns,

RBC is the risk based capital and;

AA is asset allocation.

5.2.3 Risk Based Capital, Firm Size and Investment Returns

The third intention of the study was to establish the moderating effect of firm size on the relationship between risk based capital and investment returns. Firm size comprised of total assets and gross written premium. The developed hypothesis was:

Hypothesis 3: The relationship between risk based capital and investment returns of insurance companies is not moderated by firm size.

The moderating effect was evaluated using the approach recommended by Baron and Kenny (1986). The first step entailed a regression analysis of RBC (independent variable) and the moderating variable (firm size measured by total assets) against investment returns (the dependent variable).

The first sub hypothesis for firm size was;

Hypothesis 3a: The relationship between risk based capital and investment returns of insurance companies is not moderated by total assets.

The results were as follows;

Table 5.5

Regression Results for the Relationship between Investment Returns as the Dependent Variable Firm Size (Total Assets) as the Moderator and RBC as the Independent Variable

Model	**R**	**R^2**	**Adj. R^2**	**S. E of the Estimate**
a. Predictors: (Constant), Total Assets, RBC	.902a	.814	.812	.02951

Model	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Regression	.935	2	.467	536.706	.000b
Residual	.214	246	.001		
Total	1.149	248			

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta		
(Constant)	-.187	.031		-5.973	.000
RBC	-.016	.005	-.157	-3.364	.001
Total Assets	.121	.006	1.023	21.992	.000

a. Dependent Variable: Investment Returns
b. Predictors: (Constant), Total Assets, RBC

The outcomes in table 5.5 above show an adjusted R^2 of 0. 812 which indicates that risk based capital and total assets explains 81.2% variation in investment returns. It further indicates that the p value is 0.000 which is statistically significant at a 5% level of significance. The p value for risk based capital and total assets is 0.001 and 0.000 respectively which are statistically significant since they are less than the 0.05 level of significance.

The next step entailed testing the effect of RBC (the independent variable), total assets as the first measure of moderating variable and the interaction term between RBC and total assets (RBC*TA) on investment returns (independent variable). RBC and total assets were centred and multiplied together in order to create a single item indicator (RBC * TA). The regression results where the interaction term is introduced is shown below:

Table 5.6

Regression Results for the Relationship between Investment Returns as the Dependent Variable, Firm Size (Total Assets) and RBC as the Independent Variable, Centred Approach.

Model	**R**	**R^2**	**Adj. R^2**	**S. E of the Estimate**
a. Predictors: (Constant), RBC*TA, Total Assets, RBC	.904a	.817	.815	.02929

Model	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Regression	.939	3	.313	364.771	.000b
Residual	.210	245	.001		
Total	1.149	248			

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta		
(Constant)	.783	.448		1.748	.082
RBC	-.123	.050	-1.190	-2.488	.014
Total Assets	.015	.049	.129	.312	.755
RBC* TA	.012	.005	1.833	2.170	.031

a. Dependent Variable: Investment Returns
b. Predictors: (Constant), RBC*TA, Total Assets, RBC

Results from the above table 5.6 show a change in 0.003 change in R^2 from 0. 814 to 0.817 and adjusted R^2 from 0. 812 to 0.815 which is also a 0.003 increase occasioned by the interaction term. The p values of risk based capital and the centered value is less than 0.05 thus depicting a statistical significance at 0.05 level of significance.

From the results, firm size (total assets) moderates the relationship between risk based capital (the independent variable) and investment returns (the dependent variable). The resultant regression model is shown below:

$$\mathbf{IR_{it} = 0.783 - 0.123RBC_{it} + 0.012((RBC_{it}) * (TA_{it}))}$$

Where:

IR is the investment returns,

RBC is the risk based capital and;

TA is Total Assets.

The regression model above indicates that risk based capital had a statistically significant but a negative effect on investment returns.

The second step involved a regression analysis of RBC (independent variable) and the moderating variable (firm size measured by GWP) against investment returns (the dependent variable). The second sub hypothesis for firm size was;

Hypothesis 3b: The relationship between risk based capital and investment returns of insurance companies is not moderated by gross written premiums.

The results were as follows;

Table 5.7

Regression Results for the Relationship between Investment Returns as the Dependent Variable Firm Size (Gross Written Premium) as the Moderator and RBC as the Independent Variable

Model	**R**	**R^2**	**Adj. R^2**	**S. E of the Estimate**
a. Predictors: (Constant), Gross Written Premium, RBC	.742a	.550	.547	.04587

Model	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Regression	.631	2	.315	149.902	.000b
Residual	.515	245	.002		
Total	1.146	247			

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta		
(Constant)	.097	.043		2.267	.024
RBC	.027	.007	.256	3.700	.000
Gross Written Premium	.055	.007	.523	7.550	.000

a. Dependent Variable: Investment Returns
b. Predictors: (Constant), Gross Written Premium, RBC

The results in table 5.7 above show an adjusted R^2 of 0. 547 which indicates that risk based capital and gross written premiums explains 54.7% variation in investment returns. The table further illustrates that the p value is 0.000 which is statistically significant at a 5% level of significance. The p value for risk based capital and gross written premium is 0.000 respectively which are statistically significant since they are less than the 0.05 level of significance.

The final method was to use the gross written premium as a measure of firm size. This entailed testing the effect of RBC (the independent variable), gross written as the second measure of moderating variable and the interaction term between RBC and gross written premium (RBC*GWP) on investment returns (independent variable). RBC and gross written premium were centred and multiplied together in order to create a single item indicator (RBC * GWP).

Table 5.8

Regression Results for the Relationship between Investment Returns as the Dependent Variable, Firm Size (GWP) and RBC as the Independent Variable, Centred Approach.

Model	**R**	**R^2**	**Adj. R^2**	**S. E of the Estimate**
a. Predictors: (Constant), RBC*GWP, Gross Written Premium, RBC	.767a	.589	.583	.04396

Model	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Regression	.675	3	.225	116.345	.000b
Residual	.472	244	.002		
Total	1.146	247			

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta		
(Constant)	2.564	.520		4.935	.000
RBC	-.262	.061	-2.521	-4.296	.000
Gross Written Premium	-.219	.058	-2.081	-3.778	.000
RBC*GWP	.032	.007	5.089	4.763	.000

a. Dependent Variable: Investment Returns

b. Predictors: (Constant), RBC*GP, Gross Written Premium, RBC

Results from the above table 5.8 above show an adjusted R^2 of 0.583 which is a 0.036 (3.6%) increase from the one in table 5.7 of 0. 547. The adjusted R^2 is 0.583 from the previous one of 0.547 which is a 0.036 increase. Table 5.8 above further indicates the p values of risk based capital and the centered value is 0.000 which portrays a statistical significance at 0.05 level of significance.

From the results, firm size (gross written premium) moderates the relationship between RBC (the independent variable) and investment returns (the dependent variable), thus rejecting the null hypothesis which stated the relationship between risk based capital and investment returns of insurance companies is not moderated by firm size. The resultant regression model is shown below:

$$\mathbf{IR_{it} = 2.564 - 0.262RBC_{it} - 0.219GWP_{it} + 0.012((RBC_{it}) * (GWP_{it}))}$$

Where:

IR is the investment returns,

RBC is the risk based capital and;

GWP is Gross Written Premium.

From the regression model above, risk based capital and gross written premiums have a statistically significant but a negative effect on investment returns.

5.2.4 Risk Based Capital, Asset Allocation, Firm Size and Investment Returns

The fourth objective as per the study was to establish the joint effect of risk based capital, asset allocation, and firm size on investment returns of insurance companies in Kenya. The developed hypothesis was:

Hypothesis 4: The joint effect of risk based capital, asset allocation, and firm size on investment returns of insurance companies in Kenya is not significant.

Multiple linear regression (MLR) was undertaken to assess the relationship among risk based capital (the independent variable) asset allocation (the intervening variable) firm size (the

moderating variable and investment returns (the dependant variable). The multiple regression analysis results are shown as follows:

Table 5.9

Regression Results for Risk Based Capital, Asset Allocation, and Firm Size on Investment Returns of Insurance Companies in Kenya

Model	**R**	**R^2**	**Adj. R^2**	**S. E of the Estimate**
a. Predictors: (Constant), Gross Written Premium, Asset Allocation, RBC, Total Assets	.921a	.848	.845	.02678

Model	**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
Regression	.972	4	.243	338.658	.000b
Residual	.174	243	.001		
Total	1.146	247			

Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta		
(Constant)	-.223	.029		-7.703	.000
RBC	.004	.005	.041	.831	.407
Asset Allocation	1.723	.266	.235	6.487	.000
Total Assets	.094	.009	.790	9.993	.000
Gross Written Premium	.004	.007	.042	.649	.517

a. Dependent Variable: Investment Returns
b. Predictors: (Constant), Gross Written Premium, Asset Allocation, RBC, Total Assets

The adjusted R^2 as per table 5.9 above is 0.845, which indicates that 84.5% of the variation in investment returns are attributed to by the joint effect of risk based capital, asset allocation and firm size (total assets and gross written premiums). The analysis results as per table 5.9 show that the intercept is negative 0.223 with a p value of 0.000 which is statistically substantial. Risk based capital had a coefficient value of 0.004 with a p value of 0.407 which is statistically insignificant. Asset allocation had a coefficient value of 1.723 with a statistically significant p

value of 0.000. Total assets had a coefficient value of 0.094 and a statistically significant p value of 0.000 at 5% level of significance. Gross written premium had a coefficient value of 0.004 with a p value of 0.517 which is statistically insignificant at 5% level of significance.

There is a positive significant relationship on the joint effect of risk based capital, asset allocation and firm size (total assets) on the investment returns of insurance companies in Kenya. The null hypothesis indicating that the joint effect of risk based capital, asset allocation, and firm size on investment returns of insurance companies in Kenya is not significant and is therefore rejected. The regression model explains the variation in investment returns as a result of the joint effect of risk based capital, asset allocation and firm size is shown below:

$$\mathbf{IR_{it} = -0.223 + 1.723AA_{it} + 0.094TA_{it}}$$

Where:

IR is the investment returns,

RBC is the risk based capital,

AA is the asset allocation,

TA is the total asset score,

5.3 Discussion of Findings

The overall objective of the study was to explain the relationship among risk based capital, asset allocation, firm size and investment returns of Insurance Companies in Kenya. This section discusses the findings with summary results in line with the formulated hypotheses.

5.3.1 The Effect of Risk Based Capital on Investment Returns

The first objective of the study was to determine the effect of risk based capital on investment returns of insurance companies in Kenya. The study hypothesis was that the relationship between risk based capital and investment returns was insignificant. The relationship between risk based capital and investment returns was found to be significant thus leading to the

rejection of the null hypothesis (H_1). The concept of risk based capital is to ensure that all insurance companies are well capitalized in order to endure any severe economic circumstances. This means that insurers should continuously invest in assets which can maximize their overall returns.

When determining the risk based capital, risk factors/capital charges are imposed on investments which are deemed risky while others attract a zero percent capital charge. Any insurer whose risk based capital is substantial indicates that the firm is investing in highly volatile investments such as trading in the securities exchange or transacting high volumes of insurance business leading to more premiums. If an underwriter invests in a high risk environment, it is expected that the return on investment would be high. At the same instant, if a company underwrites more premium, it means it is highly liquid thus having more cash at hand for investments before committing to payment of materialized claims. This explains why the relationship between risk based capital and investment returns was found to be significant.

The above results are found to be consistent with preceding empirical studies such as; Marlina and Puyarti (2013) study which focused on how risk based capital affect the profitability of some insurance companies in Asia by adopting a linear regression model with a Pearson correlation of 95% confidence level. The study findings alluded that RBC explained the variations on return on equity and return on assets. Bett and Wepukhulu (2019) analysed how the risk based supervision model affects financial performance of insurance companies in Kenya whose choice of indicators were capital adequacy, actuarial valuation and growth in investment under the quantitative pillar of RBS. The capital adequacy ratio was derived as a component of total capital available and the risk based capital or minimum capital requirement.

The calculation of risk based capital entailed operational risk charge, market risk charge, insurance risk charge, credit risk charge and an amendment which considered the loss-

absorbing capability of technical provisions and any taxes that will become due. The study finding was that the capital adequacy had a positive significant effect on financial performance which is similar to the study findings. Waweru and Kisaka (2012) established that effective risk management had a positive influence on the value of the firm. These findings are in line with the current study findings which established that RBC has a positive influence on investment returns, which is a component of firms' value. However, the study findings were also contradictory to that of Koshanski (2010), which established that some of the risks, for example, mortality risk and expense risk, were considered negligible when looking at how risk based capital affects performance of German unit linked products.

5.3.2 The Effect of Asset Allocation on the Relationship between Risk Based Capital and Investment Returns

The second objective of the study was to establish the effect of asset allocation on the relationship between risk based capital and investment returns of insurance companies in Kenya. The study hypothesised that the relationship between risk based capital and investment returns of insurance companies in Kenya is not intervened by asset allocation. Since there was a significant relationship between risk based capital and investment returns, the null hypothesis (H_1) was rejected. The results of the study findings after introduction of asset allocation established that it has a positive significant intervening effect the relationship between risk based capital and investment returns thus rejecting the null hypothesis (H_2). This implied that risk based capital, which is the independent variable, influences asset allocation, which in turn influences the investment returns of insurance companies in Kenya. Therefore, an increase in asset allocation would result to an increase in investment returns.

These findings are in line with those of Ibbotson and Kaplan (2000) who established that 100% of the returns in the mutual funds under study was attributed to asset allocation. Idzorek (2010) further alluded that asset allocation is an important factor in explaining the variations in

investment returns. Xiong et al. (2010) findings established that a portfolios total return was based on market return, asset allocation policy return and active portfolio management. The findings of this study and other studies may not be directly comparable since most of the studies used asset allocation as the independent variable in relation to investment returns, while this study considers asset allocation as an intervening variable on the relationship between risk based capital and investment returns. Despite this, the intervening effect of asset allocation on the relationship between risk based capital and investment returns has been confirmed in the current study. However, this result is not comparable to Brown et al. (2009), whose findings alluded that asset allocation is not interrelated to portfolio returns in cross sections but appears to affect the risk adjusted performance of firms.

5.3.3 The Effect of Firm Size on the Relationship between Risk Based Capital and Investment Returns

The third objective of the study was to examine the effect of firm size on the relationship between risk based capital and investment returns of insurance companies in Kenya. The study hypothesised that the relationship between risk based capital and investment returns of insurance companies is not moderated by firm size. The results of the regression models revealed that there is a significant relationship between RBC and firm size (total assets and gross written premium) and investment returns. This means that the firms that are bigger in terms of total assets base or underwrite high volumes of premiums, would generate more investment returns, owing to the fact that the Companies would have more resources at their disposal for investments before any claim arises. The findings also established that firm size (total assets and gross written premium) has a moderating effect on the relationship between risk based capital and investment returns of insurance companies in Kenya, thus rejecting the null hypothesis (H_3).

These findings are in line with those of Mwangi (2014) where firm size was used as one of the indicators of the moderating variable (institutional characteristics). The size of the firm was measured by the total assets which had a significance influence in performance. Mwangi and Angima (2016) also looked at the size of the firm both in total assets and gross written premium. Their findings also established that firm size (gross written premiums) is statistically significant to firm's performance. Lee (2009) sought to examine the effect of firm size on profitability of public firms listed in the United States. His study findings were that firm size played a dominant role in determining the profitability of these firms, thus having a positive significant effect. Dorgan (2013) analysed the effect of firm size on profitability of listed firms in Instanbul stock exchange. The indicators for firm size in the study were, total assets, total sales and the number of employees. The study findings were that, firm size had a positive significant effect on the profitability of the firms. The findings of these studies are comparable to the current study since they indicate a positive significant effect of firm size on the relationship between risk based capital and investment returns.

Despite the comparable results of the various studies to the current study findings, the results are inconsistent with Niresh and Velnampy (2014), whose study focused on the relationship between firm size and profitability of manufacturing firms in Sri Lanka, and the findings was that there was no relationship between firm size and profitability of the firm. Abdullahi et al. (2011) study findings on how firm size, through a sectorial approach, can affect risk and return was that sectorial size had no significant effect on the sectorial returns of the listed firms. These study findings are inconsistent with the current study findings, which indicate that there is a positive significant effect of firm size on the relationship between risk based capital and investment returns.

5.3.4 The Joint Effect of Risk Based Capital, Asset Allocation, and Firm Size on Investment Returns

The final study objective was to establish the joint effect of risk based capital, asset allocation, and firm size on investment returns of insurance companies in Kenya. The study hypothesised that the joint effect of risk based capital, asset allocation, and firm size on investment returns of insurance companies in Kenya is not significant. The findings show a statistically significance on the joint effect of risk based capital, asset allocation and firm size on investment returns of insurance companies in Kenya explaining 84.8% of variation in investment returns. The findings therefor led to the rejection of the null hypothesis (H_4).

The influence of all the study variables on investment returns of insurance companies has previously not been considered together in a single study. The results of risk based capital, asset allocation, firm size (total assets and gross written premium) and investment returns has been discussed in section 5.3.1 to 5.4.4 above. Although previous studies from Doff (2008), Kochanski (2010), Eling and Pankoke (2014) looked at the concept of risk based capital, the focus was on the effectiveness of risk based supervision model and not solely on risk based capital as a quantitative measure in the first pillar of risk based supervision model, and its influence on the investment returns. This study combined the influence of all the study variables on investment returns of insurance companies in Kenya.

Table 5.10 below shows a summary of the results of hypothesis testing.

Table 5.10

Summary of Results of Hypotheses Testing

Study Objective	Hypothesis	Results	Implications
Objective 1 To determine the effect of risk based capital on investment returns of insurance companies in Kenya	**Hypothesis 1:** The effect of risk based capital on investment returns of insurance companies in Kenya is not significant.	R^2 = 0.447, p≤0.05, F=199.646 Significant relationship exists as risk based capital explains 44.7 % of the variance in investment returns	The null hypothesis is rejected, and alternate hypothesis is confirmed. The resultant equation is $\mathbf{IR} = \mathbf{0.231} + \mathbf{0.069RBC_{it}}$
Objective 2 To establish the effect of asset allocation on the relationship between risk based capital and investment returns of insurance companies in Kenya;	**Hypothesis 2**: The relationship between risk based capital and investment returns of insurance companies in Kenya is not intervened by asset allocation.	R^2 of 0. 672, p≤0.05 F=252.093 Percentage increase from 44.7% to 67.2% shows that the introduction of asset allocation increases the variation between risk based capital and investment returns. Asset allocation has a positive significant intervening effect on the relationship between RBC and investment returns.	The null hypothesis is rejected and the alternative confirmed. The resultant equation is: $\mathbf{IR} = -\mathbf{0.017} + \mathbf{0.079RBC_{it}} + \mathbf{3.535AA_{it}}$
Objective 3 To examine the effect of firm size on the relationship between risk based capital and investment returns of insurance companies in Kenya; and	**Hypothesis 3**: The relationship between risk based capital and investment returns of insurance companies is not moderated by firm size.	R^2 = 0. 814, p≤0.05, F=536.706 which indicates that risk based capital and total assets explains 81.4% variation in investment returns. R^2 from 0. 812 to 0.815 which is also a 0.003 increase occasioned by the interaction term. Firm size (total assets) moderates the relationship between risk based capital (the independent variable) and investment returns	The null hypothesis is rejected and the alternative confirmed. The resultant regression model is shown below: $\mathbf{IR} = \mathbf{0.783} - \mathbf{0.123RBC_{it}} + \mathbf{0.012}((\mathbf{RBC_{it}}) * (\mathbf{TA_{it}}))$

Study Objective	Hypothesis	Results	Implications
		(the dependent variable).	
		R^2 of 0. 550, p≤0.05, F=149.902 After introduction of the interacting term, the adjusted R^2 is 0.583 from the previous one of 0.547 which is a 0.036 increase. Firm size (GWP) moderates the relationship between risk based capital (the independent variable) and investment returns (the dependent variable).	The null hypothesis is rejected and the alternative confirmed. The resultant regression model is shown below: $\mathbf{IR} = \mathbf{2.564} - \mathbf{0.262RBC_{it}} - \mathbf{0.219GWP_{it}} + \mathbf{0.012}((\mathbf{RBC_{it}}) * (\mathbf{GWP_{it}}))$
Objective 4 To establish the joint effect of risk based capital, asset allocation, and firm size on investment returns of insurance companies in Kenya.	**Hypothesis 4**: The joint effect of risk based capital, asset allocation, and firm size on investment returns of insurance companies in Kenya is not significant.	R^2 =0.848, p≤0.05, F=338.658 There is a positive significant relationship on the joint effect of risk based capital, asset allocation and firm size on the investment returns of insurance companies in Kenya.	The null hypothesis is rejected and the alternative confirmed. The resultant regression model is shown below: $\mathbf{IR} = -\mathbf{0.223} + \mathbf{1.723AA_{it}} + \mathbf{0.094TA_{it}}$

CHAPTER SIX: SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This study intended to establish the relationship amongst risk based capital, asset allocation, firm size and investment returns of insurance companies in Kenya. This chapter gives a summary of the study findings, conclusions, contributions to both theory and knowledge; and policy and practice; limitations that the study encountered and suggested areas research in the future.

6.2 Summary of Findings

The study's key objective was to determine the relationship among risk based capital, asset allocation, firm size and investment returns of Insurance Companies in Kenya. Descriptive statistics was conducted of all the variables incorporated in the study. The average risk based capital was 1.15 billion with a minimum of 11.4 million and a maximum of 6.2 billion on the 5-year period. From the asset allocation score, 41.8% of the insurance companies had a score of above 0.05 which showed that most of the investment had a longer maturity period and similar investment vehicles. The industry mean during the period was 7.9 billion worth of assets with the least being of 272 million and a maximum of 60.6 billion. The industry average gross written premium during the period of study was of 3.2 billion with a minimum of 46 million and a maximum of 15.6 billion. Most of the insurance companies' investment income ratio ranges from 0.01 to 0.1 which accounts for 30% of the total firms under study. About 15% of insurance company under study have an investment income ratio of over 0.5 with the highest having an average of 3.92 during the study period.

The study further conducted diagnostic tests to evaluate the assumptions that should be met when performing a linear regression. The first test was normality test, whose findings were that; the scores for risk based capital were distributed normally, having a mean score of 8.71

and 0.675 as the standard deviation. Asset allocation scores was not distributed normally, recording a mean score of 0.05 and 0.009 as the standard deviation, thus data transformation was required. The log of the asset allocation score was used as a treatment measure. The scores for total assets was distributed normally, recording a mean of 9.58 and 0.547 as the standard deviation, and that of gross written premiums was normally distributed, having a mean score of 9.16 and 0.646 as the standard deviation. Investment returns scores was also normally distributed, recording a mean of 0.83 and 0.0678 as the standard deviation.

Scatter plots were used for confirmation that the association between variables was linear, and that the confidence levels generated by the regression analysis were not misleading or biased. The test disclosed a substantial moderate relationship between the variables. This was an indication that linearity existed among the variables. The study adopted Levene's test to measure homogeneity of variance where p value was less than 0.05, thus demonstrating the variance are not equal.

In determining the existence of multicollinearity amongst the variables, variance inflation factor (VIF) was used. The VIF for risk based capital is 3.970, for asset allocation is 2.101, for total assets is 9.983 and gross written premium is 6.659. All these figures are below 10, thus indicating that the level of multicollinearity can be tolerated. Serial independence test was done using Durbin Watson test. Durbin-Watson test for risk based capital was1.961820, asset allocation score was 2.074575, firm size (total assets) was 1.997517, firm size (GWP) was 2.001893 and investment income ratio was 2.000623. Since the coefficients lie between 1.5 and 2.5, it is an indication that the observations made were serially independent.

Augmented Dickey-Fuller test was used in finding out whether variables in the time series are not stationary in nature. All the P values for the augmented Dickey- Fuller test were less than 0.05, indicating that the variables had no unit root, thus non stationery. Johansen test was used

to check for cointegration. The findings revealed that all the p values were less than 0.05, thus confirming that the regression coefficients were significant statistically. Pearson moment correlations among the dependent, independent, intervening and moderating variables was conducted. It was done at a two tailed significance level of 0.05 and 0.01. From the correlation analysis, it was revealed that the relationships within the study variables were significant and in line with the study hypotheses.

Objective one of the study was to determine the effect of risk based capital on investment returns of insurance companies in Kenya. Hypothesis 1 tested the significance of the effect of risk based capital on investment returns of insurance companies. Multiple linear regression analysis rejected the null hypothesis which was stating that the relationship between risk based capital and investment returns ($p \leq 0.05$) is not significant. The findings were supported by R^2 = 0.447 thus demonstrating that risk based capital explains 44.7 % variation in investment returns. It is therefore concluded that there is a significant relationship between risk based capital and investment returns of insurance companies.

The study's subsequent goal was to establish the effect of asset allocation on the association between risk based capital and investment returns of insurance companies in Kenya. The second hypothesis explored the significance of the intervening effect of asset allocation on the association between risk based capital and investment returns of insurance corporations in Kenya. The results showed that asset allocation has a significant intervening effect ($p \leq 0.05$) on the relationship between risk based capital and investment returns. The null hypothesis H_2 was therefore rejected and the alternate confirmed.

The third study's objective was to examine how firm size affects the relationship between risk based capital and investment returns of insurance firms in Kenya. The third hypothesis explored the option that the mediating influence of firm size on the association amongst risk

based capital and investment returns was not significant. From the findings, it was noted that firm size mediates the association among risk based capital and investment returns with size (total assets and gross written premiums) influencing direction of performance. The null hypothesis H_3 was therefore rejected and the alternate confirmed.

The study's fourth objective was to establish the joint influence of risk based capital, asset allocation, and firm size on investment returns of insurance corporations in Kenya. The fourth hypothesis was that the joint effect of risk based capital, asset allocation, and firm size on investment returns of insurance companies in Kenya is not significant. The results show that the overall model was statistically significant at $p \leq 0.05$. Furthermore, 84.8% of the variation in investment returns are attributed to by the joint effect of risk based capital, asset allocation and firm size (total assets and gross written premiums). The null hypothesis H_4 was therefore rejected and the alternate confirmed.

6.3 Conclusions

The study's purpose was to examine the relationship among risk based capital, asset allocation, firm size and investment returns of insurance companies in Kenya. The study was anchored on extreme value theory and modern portfolio theory; and used longitudinal (panel) design testing four formulated hypotheses.

The first study specific objective was to determine the effect of risk based capital on investment returns of insurance firms in Kenya. The null hypothesis to be tested (H_1), was that the effect of risk based capital on investment returns of insurance companies in Kenya is not significant. The rejection of the first hypothesis H_1as per the study findings established that there is significant relationship between risk based capital and investment returns of insurance companies in Kenya. This implied that the greater the risk based capital, the higher the investment returns. This is a reflection that firms which invest in assets which are deemed high

risk by the regulator, tend to maximize their investment returns in comparison to the conservative firms who invest in zero or low capital charge investments (government securities) in order to hold a lower risk based capital.

The second specific study objective was to establish how asset allocation affects the association between risk based capital and investment returns of insurance companies in Kenya. The null hypothesis tested (H_2) was that the relationship between risk based capital and investment returns of insurance corporations in Kenya is not intervened by asset allocation. From the study findings, H_2 , as the second hypothesis was also rejected signifying that the relationship between risk based capital and investment returns of insurance companies in Kenya is intervened by asset allocation. Portfolio managers of insurance companies are keen on the investment vehicle they use in order to maximize their returns. The type of investment vehicle determines the percentage of capital charge thus determining the amount of risk based capital an insurance company will hold. This clearly explains a causal link between risk based capital and investment returns of insurance companies.

The study's third specific objective was to examine the effect of firm size on the relationship between risk based capital and investment returns of insurance companies in Kenya. The null hypothesis to be tested (H_3) was that firm size does not moderate the relationship amongst risk based capital and investment returns of insurance companies. As per the study findings, the third hypothesis (H_3) was also rejected indicating that the relationship between risk based capital and investment returns of insurance companies is moderated by firm size. Insurance companies who are keen in holding a capital buffer by imposing risk factors to their technical provisions and investment portfolio mix in order to avert instability in any financial crisis should consider their size either by increasing their asset base or the gross premium written. Companies can purpose to increase their sales by underwriting more insurance business and

consider upscaling their asset base as a precautionary measure in case they face a one in two-hundred-year crisis and concurrently capitalize on their returns on investment.

The fourth specific study objective was to establish the joint effect of risk based capital, asset allocation, and firm size on investment returns of insurance companies in Kenya. The null hypothesis to be tested (H_4) was that the joint effect of risk based capital, asset allocation, and firm size on investment returns of insurance companies in Kenya is not significant. The findings of the study established that the fourth hypothesis H_4 was also rejected, inferring that there is a significant relationship among the variables; risk based capital, asset allocation, firm size and investment returns of insurance companies in Kenya. It implies that all variables should be considered when looking at the risk based capital and investment returns of insurance companies.

6.4 Contributions of the Study Findings

This study outcomes add-on to the body of knowledge in the area of risk based capital, asset allocation, firm size and investment returns of insurance companies. This section highlights the findings of the study's contribution to theory and knowledge; and contribution to policy and practice.

6.4.1 Contribution to Theory and Knowledge

This study has generally contributed to the field of finance and risk management (particularly risk based capital) and the influence of asset allocation, firm size on insurance companies' investment returns. The study supports Redington immunization theory which defines asset liability matching. Asset liability matching is a critical component in determining the amount of capital a company is expected to hold after taking the total balance sheet approach, which involves reviewing the asset and liabilities; and imposing a capital buffer that will ensure continuity of the company in times of financial crisis. It has further revealed that the applicability of extreme value theory is not fully reliant on data obtained from extreme events,

but rather insurance companies can use available data on capitalization and investments and still apply the concept to determine their survival in adverse operating environment or scenarios.

The study also supports Markowitz portfolio selection theory in the sense that a Company is expected to allocate its assets in a manner that it receives maximum returns from the investment, but at the same time be cautious on the investment vehicles, since the capital charges imposed are pegged on how risky an investment vehicle is deemed. This will eventually influence the amount of risk based capital an insurer is expected to hold and determine its investment returns. It has further revealed that the association amongst risk based capital and investment returns is not purely direct, but it's intervened by asset allocation. The effect of risk based capital can be fully understood by looking at where insurers have placed their assets since it will determine the capital charge they will impose to create a capital buffer that will sustain them in adverse scenarios, and at the same time, the placement of these investments as per the defined investment vehicles will determine the investment returns that the companies expect. Overall, the study established that the combined effect risk based capital, asset allocation and firm size; has a positive effect on investment returns of insurance firms.

Studies of risk based supervision model and precisely risk based capital have mostly been done in industrialized countries. Since this concept has been understudied in Kenya, this study has made a contextual contribution to the existing knowledge on capitalizing a company in readiness for adverse scenarios even though a lot is yet to be exploited. The knowledge is useful to the insurance sector in Kenya and across Africa and can also be used in comparison to African nations such as South Africa who have adopted the same supervision model. Researchers may also use this study as their basis of research since it has contributed to research interest in the area of risk capitalization.

6.4.2 Contribution to Policy and Practice

Due to a progressively complex financial service industry, all financial institutions are keen in managing their risks and holding enough capital in order to survive such crisis in the future. Most regulators in the insurance industry and banking sector across the globe have adopted risk based supervision models, moving away from compliance based capital requirements and concentrating on a risk based capital which is grounded on the size and complexity in operations of the financial institutions. This approach looks at both sides of the balance sheet (asset and liability) and impose a percentage of capital charge to any investment or business operations as per a defined risk rating. The effect of risk based capital on investment returns as illustrated in this study would help insurance companies' portfolio managers when defining investment policies which will determine on where to invest and the amount of risk based capital the company will be obligatory to hold.

The study will also help portfolio managers diversify their investment to maximize their returns without being concerned on the amount of capital to hold. This is supported by the study findings which indicate a positive relationship between risk based capital and investment returns, thus allowing the managers to justify their investments in high risk areas which attract a high capital charge. However, the duration of such investments also needs to be considered, since the study findings indicate that asset allocation has a positive effect on the amount of capital to hold in order to cushion it from unforeseen circumstances and its effect on investment returns. Duration of the investment and investment vehicle were used to determine the asset allocation score, thus deeming investment duration important.

The study also shows that size is positively linked to investment returns of insurance companies. Regulators can encourage insurance firms to merge, acquire or be acquired with other sector players, which will lead to well capitalized companies that can withstand any harsh economic conditions (a one in two-hundred-year crisis as per the risk based capital model). The

current insurance penetration rate in Kenya is quite low, thus requiring the regulator to devise ways to increase the penetration. Initiatives such as educating the general public on the importance of insurance might assist in increasing the penetration rate. This may lead to a growth in insurance uptake which might lead to an increase in gross written premiums, thus growing the size of insurance companies.

6.5 Limitations of the Study

Despite the study having some limitations, efforts were made to make sure that these shortcomings did not significantly affect the results of the study. This research study opted for longitudinal (panel) design where secondary data was collected over a period of 5 years. The use of secondary data, which is historical in nature may not have represented the current situation, and not incorporated any management comments especially on factors that may have influenced asset allocation.

Other variables that may have influenced the investment returns of insurance companies were not considered in this study. The results of the study are therefore based on the indicators used thus giving the interrelationship between variables that affect investment returns of insurers. The lack of management studies in the Kenyan context, and risk based supervision model meant that comparative analysis in the local context was not possible. However, the results of the study findings were comparable with related studies done internationally. Despite these limitations, the quality of the study wasn't compromised.

6.6 Suggestion for Further Research

Future research may arise from the outcomes of this study and some of the limitations. Since the study adopted longitudinal (panel) design, future studies can consider using a descriptive cross sectional research design which may incorporate management comments especially on factors that may have influenced asset allocation and investment decisions, which may have an effect on the returns on investment.

Risk based capital was computed using the standardized methodology as described by the regulator. Further research can also focus on the self-determined solvency assessment described as own risk solvency assessment (ORSA) and how it may affect investment returns of insurance companies. Since RBC is a quantitative pillar in the risk based supervision model, researchers can opt for other qualitative aspects such as governance framework and how it affects investment returns. This study also focused on investment returns of insurance firms and not the overall performance of insurance companies. Additional exploration can be done on how risk based capital affects the overall performance of insurance companies. Performance can incorporate both investments returns and underwriting profit/loss of insurance companies.

When determining the composite score for asset allocation, the study focused on time horizon and investment vehicle as the indicators of the intervening variable. This could be done using other indicators of asset allocation and test its mediating effect on the association between risk based capital and investment returns. The study focused on the investment income ratio as an indicator of investment returns on insurance companies. Future studies can consider using other measures as indicators for the investment income for insurers.

A replica of the study can be carried out by including additional intervening and moderating variables that may affect the association amongst risk based capital and returns on investment which may enhance validity of the study. Future studies could also focus on just one line of business (general insurance or life insurance), to assess any similarities or differences to this relationship. Studies can be done in other jurisdictions within Africa and across the world to find out if there are similarities in the relationship among the variables. This study can also be replicated across other areas e.g. the banking sector and capital markets since most regulators are adopting risk based supervision models which will require the industry players to adequately assess their risks in order to avert any financial crisis.

REFERENCE

Abdullahi, I., Muhtar, E., & Lawal, W. A. (2011). The effects of firm size on risk and return in the Nigerian stock market: A sectoral analysis. *British Journal of Economics, Finance and Management Sciences, 1*(2), 1-10.

Afande, F. O., & Maina, P. M. (2015). Capital requirements for Kenyan life insurance companies. *International Journal of African and Asian Studies, 8*(2), 26-49.

Andonov, A., Bauer, R., & Cremers, M. (2012). *Can large pension funds beat the market? asset allocation, market timing, security selection, and the limits of liquidity.* Cass Business School. London: CEM Benchmarking Inc.

Angima, C. (2017). Actuarial risk management practices, underwriting risk, firm characteristics and performance of property and casualty insurance firms in East Africa. *Unpublished PhD Thesis, School of Business, University of Nairobi.*

Barik, B., & Patra, R. (2014). Emerging trends in Insurance – A study in Indian life insurance industry. *Abhinav National Monthly Refereed Journal of Research in Commerce & Management , 3*(6), 7-12.

Baron, R., & Kenny, D. (1986). The moderator-mediator variable distinction in social psychological. *Journal of Personality and Social Psychology, 51*(6), 1173-1182.

Basak, S., Pavlova, A., & Shapiro, A. (2007). Optimal asset allocation and risk shifting in money management. *Review of Financial Studies, 20*(5), 1583-1621.

Battocchio, P., Menoncin, F., & Scaillet, O. (2006). Optimal asset allocation for pension funds under mortality risk during the accumulation and decumulation phases. *Annals of Operations Research, 152*(1), 141-165.

Beath, A. (2014). *Asset allocation and fund performance of defined benefit pension funds in the United States between 1998-2011*. Toronto: CEM Benchmarking Inc.

Beers, R., & Elshof , W. (2012). *Evaluating the solvency capital requirement of interest rate risk in solvency II.* Amsterdam: Milliman.

Bendrich , D., & Bergström , J. (2015). Impact of asset allocation on insurance companies performance ; a study of the European economic area. *Unpublished Masters Thesis, Umeå School of Business and Economics*.

Bett, L. K., & Wepukhulu, J. M. (2019). Effect of adoption of risk based supervision methodology on the performance of insurance companies in Kenya. *International Journal of Business Management and Finance, 3*(2), 139-165.

Black, F. (1972). Capital markets equilibrium with restricted borrowing. *The Journal of Business, 45*(3), 444-445.

Bragt, D., Steehouwer, H., Waalwijik , B., & Possen, T. (2010). *Impact of the solvency II guidelines on asset liability matching for life insurers.* Amsterdam: Ortec Finance Research Center.

Brennan , M., & Xia, Y. (2002). Dynamic asset allocation under inflation. *The Journal of Finance, 57*(3), 1201-1238.

Brennan, M., Schwartz, E., & Lagnado, R. (1997). Stategic asset allocation. *Journal of Economic Dynamics and Control, 21*(8-9), 1377-1403.

Brinson, G., Hood, R., & Beebower, G. (1986). Determinants of portfolio performance. *Financial Analysts Journal, 42*(4), 39-44.

Brown , K., Garlappi, L., & Tiu, C. (2009). *Asset allocation and portfolio performance: Evidence from university endowment funds.* Austin: Institute for quantitative research in finance.

Burns, N., & Grove, S. (2003). *Understanding nursing research* (3rd ed.). Philadephia: Saunders.

Castries, H. d. (2005). Capital adequacy and risk management in insurance. *The Geneva Papers on Risk and Insurance, 30*(1), 47-51.

Cheng, J., & Weiss, M. (2013). Risk based capital and firm risk taking in property-Liability insurance. *The Geneva Papers on Risk and Insurance - Issues and Practice, 38*(2), 274-307.

Dang, C., Frank Li, Z., & Yang, C. (2017). Measuring firm size in empirical corporate finance. *Journal of Banking and Finance, 86*(1), 159-176.

Dickinson, G. (1997). Some Issues in risk-based capital. *The Geneva Papers on Risk and Insurance, 22*(82), 76-85.

Diebold, F., Schuermann, T., & Stroughair, J. (2000). Pitfalls and opportunities in the use of Extreme Value Theory in risk management. *The Journal of Risk Finance, 1*(2), 30-35.

Djayadi, H., Adrianto, H., & Arifian, D. (2018). The model of insurance companies risk based capital. *International Journal of Economics and Financial Issues, 8*(6), 61-64.

Doff, R. (2008). A critical analysis of the solvency II proposals. *The Geneva papers, 33*(1), 193-206.

Doğan, M. (2013). Does firm size affect the firm profitability? Evidence from Turkey. *Research Journal of Finance and Accounting, 4*(4), 53-59.

Durante, F., Sánchez, J. F., & Sempi, C. (2013). A topological proof of Sklar's theorem. *Applied Mathematics Letters, 26*(9), 945-948.

Durante, F., Sanchez, J., & Sempi, C. (2012). Sklar's theorem obtained via regularization techniques. *Nonlinear Analysis: Theory, Methods & Applications, 75*(2), 769-774.

Economic Intelligence Unit. (2012). *The effect of solvency II on asset allocation and investment strategy.* London: Black Rock.

EIOPA. (2014). *The underlying assumptions in the standard formula for the solvency capital requirement calculation.* Frankfurt – Germany.

EIOPA. (2018). Review of solvency II implementing measures. Brussels- Belgium.

Eling , M., & Pankoke , D. (2014 a). Systemic risk in the insurance sector: review and directions for future research. *Risk Management and Insurance Review, 19*(1), 249-284.

Eling , M., & Pankoke, D. (2014 b). Basis risk, procyclicality, and systemic risk. *Journal of Insurance Regulation, 33*(1), 1-39.

Eling , M., Schmeiser , H., & Schmit, J. (2007). The solvency II process:Overview and critical analysis. *Risk Management and Insurance Review, 10*(1), 69-85.

Embrechts, P. (2000). *Extreme Value Theory: Potential and limitations as an integrated risk management.* Department of Mathematics, Working paper. Zurich: ETH.

Embretch, P., & Hofert, M. (2011). *Statistics and quantitative risk management for banking and insurance.* Zurich: Swiss federal institute of technology.

Engle, R., & Granger, C. (1987). Co-integration and error correction: representation, estimation, and testing. *Journal of The Econometric Society, 55*(2), 251-276.

Erjavec, N. (2011). Tests for Homogeneity. *International Encyclopedia of Statistical Science, 30*(5), 1595-1596.

Faber, M. (2007). A quantitative approach to tactical asset allocation. *The Journal of Wealth Management, 9*(4), 69-79.

Fare, R., Grosskopf, S., & Weber, W. (2004). The effect of risk-based capital requirements on profit efficiency in banking. *Applied Economics, 36*(15), 1731-1743.

Faugeras, O. (2013). Sklar's theorem derived using probabilistic continuation and two consistency results. *Journal of Multivariate Analysis, 122*(13), 271-277.

Fiala, R., & Hedija, V. (2015). The relationship between firm size and firm growth:The case of the Czech Republic. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 63*(5), 1639-1644.

Fisher, L., & Weil, R. L. (1971). Coping with the risk of interest-rate fluctuations: Returns to bondholders from naive and optimal strategies. *The Journal of Business, 44*(4), 408-431.

Fombellida, R. J., & Rincon-Zapatero, J. P. (2010). Optimal asset allocation for aggregated defined benefit pension. *European Journal of Operational Research, 201*(1), 211-221.

Ghasemi, A., & Zahediasl, S. (2012). Normality tests for statistical analysis: A guide for non-Statisticians. *International Journal for Endocrinology and Metabolism, 10*(2), 486-489.

Gilli, M., & Kellezi, E. (2006). An application of Extreme Value Theory for measuring financial risks. *Computational Economics, 27*(1), 1-23.

Gkillas, K., & Katsiampa, P. (2018). An application of extreme value theory to cryptocurrencies. *Economic Letters, 164*(1), 108-111.

Granger, C. (1981). Properties of time series data. *Journal of Econometrics, 16*(1), 121-130.

Green, P. E., Tull , D., & Albaum, G. (1988). *Research for market decisions* (5th edition ed.). New Jersey: Prentice Hall, Inc.

Grenadier, S., & Hall, B. (1996). Risk based capital standards and the riskiness of Bank portfolios: credit and factor risks. *Regional Science and Urban Economics, 6*(3-4), 433-464.

Habiboellah , F. (2007). *Modeling dependencies in financial risk management.* Amsterdam: Vrije Universiteit .

Hall, M., & Weiss, L. (1967). Firm size and profitability. *The Review of Economics and Statistics, 49*(3), 319-331.

Hasan , I., Kobeissi, N., Liu, L., & Wang, H. (2016). Corporate social responsibility and firm financial performance: The mediating role of productivity. *Journal of Business Management, 1*(2), 1-18.

Herranz, E. (2017). Unit root tests. *Wiley Interdisciplinary Reviews: Computational Statistics, 9*(3), 1-20.

Hoevenaars, R., Molenaarb, R., Schotman, P., & Steenkamp, T. (2008). Strategic asset allocation with liabilities: beyons stock and bonds. *Journal of Economic Dynamics and Control, 32*(9), 2939-2970.

Hogan, T., Meredith, N., & Pan, X. (2015). Risk based capital regulation. *Journal of financial regulation and compliance, 23*(2), 115-134.

Hoque, Z., & James, W. (2000). Linking balanced scorecard measures to size and market factors: impact on organizational performance. *Journal of Management Accounting Research, 12*(1), 1-17.

Ibbotson, R., & Kaplan, P. (2000). Does asset allocation policy explain 40, 90, or 100 percent of performance? *Financial Analysts Journal, 56*(1), 26-33.

Idzorek, T. (2010). *Asset allocation is king.* Chicago: Morningstar Advisor .

Ingersoll Jr., J. E. (1983). Is immunization feasible? Evidence from the CRSP data. In: G.G Kaufman, G.O Bierwag, and A Toevs, eds.,. *Innovations in Bond Portfolio Management: Duration Analysis and Immunization*, 163-182, JAI Press,Greenwich, CT.

Insurance Regulatory Authority. (2016). *Guideline on Risk Based Capital.* Nairobi.

Insurance Regulatory Authority. (2017). *Insurance industry annual report.* Nairobi.

Jacques, K., & Nigro, P. (1994). *Risk-based capital, portfolio risk, and bank capital: a simultaneous approach.* Office of the Comptroller of the currency. E&PA.

Jensen, G., Johnson, R., & Mercer, J. (2002). Tactical asset allocation and commodity futures. *The Journal of Portfolio Management, 28*(4), 100-111.

Johansen , T. K. (2011). A critical analysis of solvency II from a regulatory perspective. *Unpublished PhD Thesis, Aarhus School of Business and Social Sciences*.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control, 12*(2-3), 231-254.

Kaya , E. Ö. (2015). The effects of firm-specific factors on the profitability of non-life insurance companies in Turkey. *International Journal of Financial Studies, 3*(4), 510-529.

Kim, D. (1997). A re-examination of firm size, book-to-market, and earnings price in the cross-section of expected stock returns. *The Journal of Financial and Quantitative Analysis, 32*(4), 463-489.

Kochanski, M. (2010). Solvency capital requirement for German unit linked insurance products. *German Risk and Insurance Review, 6*(2), 33-70.

Lamont, O. (2010). Investment plans and stock returns. *The Journal of Finance, 55*(6), 2719-2745.

Lappe, J. (2000). Taking the mystery out of research- descriptive correlational design. *Orthopaedic nursing, 9*(2), 81.

Lastra, R. M. (2004). Risk-based capital requirements and their impact upon the banking industry: Basel II and CAD III. *Journal of financial regulation and compliance, 12*(3), 225-239.

Lee, J. (2009). Does size matter in firm performance? Evidence from US public firms. *International Journal of the Economics of Business, 16*(2), 189-203.

Lenoir, G., & Tuchschmid, N. (2001). Investment time horizon and asset allocation models. *Financial Markets and Portfolio Management, 15*(1), 76-93.

Liebwein, P. (2006). Risk models for capital adequacy: applications in the context of solvency II and beyond. *The International Association for the Study of Insurance Economics, 31*(3), 528-550.

Liu, J., Longstaff, F., & Pan, J. (2003). Dynamic asset allocation with event risk. *The Journal of Finance, 58*(1), 231-259.

Long Vu, D. (2015). Optimizing on investment portfolio under solvency II. *Network for Studies on Pensions, Aging and Retirement, 49*(2), 3-44.

Majtanova, A., & Marcinech, P. (2017). Rebalancing of investment portfolios of insurers under solvency II. *Economic Review, 46*(1), 25-44.

Markowitz, H. (1952). Portfolio selection theory. *Journal of Finance, 7*(1), 77-91.

Marlina, R., & Puryati, D. (2013). The influence of risk based capital to profitability in Jansindo Insurance Company. *South East Asia Journal of Contemporary Business, Economics and Law, 2*(1), 8-16.

McNeil, A. (1999). Extreme Value Theory for Risk Managers. *Proceedings of the 29th International ASTIN Colloquium* (pp. 1-22). Zurich: ETH Zentrum.

McNeil, A., & Saladin, T. (1997). The Peaks over Thresholds method for estimating high quantiles of loss distributions. *Proceedings of the 28th International ASTIN Colloquium* (pp. 1-21). Zurich: ETH Zentrum.

Michael, S. (1989). Investment returns and yields to holders of insurance. *The Journal of Business, 62*(1), 81-98.

Miller, D., & Salkind, N. (2002). Handbook of research design & social measurement. (6th ed.). Thousand Oaks, CA: Sage.

Mossin, J. (1966). Equilibrium in a capital asset market. *Econometrica, 34*(4), 768-783.

Mutunga, D., & Owino, E. (2017). Moderating role of firm size on the relationship between micro factors and financial performance of manufacturing firms in Kenya. *Journal of Finance and Accounting, 1*(2), 14-27.

Mwangi, C. I. (2014). Socially responsible investment, portfolio management,institutional characteristics and performance of mutual funds in Kenya. *Unpublished PhD Thesis, School of Business,University of Nairobi.*

Mwangi, M., & Angima, C. (2016). Actuarial risk management practices and financial performance of property and casualty insurance firms: identification of a moderating variable. *International Journal of Humanities and Social Science, 6*(2), 126-132.

Nelson, R. (2003). Properties and applications of copulas: A brief survey. *Proceedings of the first Brazilian conference on statistical modeling in insurance and finance;* (pp. 10-48). Sao Paulo: University Press USP.

Niresh, A., & Velnampy, T. (2014). Firm size and profitability: A study of listed manufacturing firms in Sri Lanka. *International Journal of Business and Management, 9*(4), 57-64.

Nyamute, W. (2016). Investor behaviour,investor demographic characteristics, investment style, and individual investor portfolio performance at the Nairobi Securities exchange. *Unpublished PhD Thesis, Jomo Kenyatta University of Agriculture and Technology, School of Business.*

Planchet, F., & Tomas, J. (2014). Uncertainty on survival probabilities and solvency capital requirement: application to long-term care insurance. *Scandinavian Actuarial Journal, 1*(4), 1-14.

Porta, D. D. (2014). *Methodological practices in social business research.* New York: Oxford press.

Preuss, M. (2016). Return on investment and grants: A review of present understandings and recommendations for change. *Research Management Review, 21*(1), 1-26.

Putra, N. D. (2018). The influence of growth of income, assets, ratio of claim and risk based capital on profitability of life insurance companies in Indonesia. *International Journal of Business and Commerce , 6*(9), 24-42.

Reitano, R. (1991). Multivariate immunization theory. *Society of actuaries transactions, XLIII*, 393-428.

Robinson, C., & Schumacker, R. (2009). Interaction effects: centering, variance infaltion factor and interpretation issue. *Multiple Linear Regression Viewpoints, 35*(1), 6-11.

Rocco, M. (2014). Extreme Value Theory in Finance: a survey. *Journal of Economic Surveys, 28*(1), 82-108.

Ruschendorf, L. (2009). On the distributional transform, Sklar's theorem, and the empirical copula process. *Journal of Statistical Planning and Inference, 139*(11), 3921-3927.

Schmelzer, B. (2015). Sklar's theorem for minitive belief functions. *International Journal of Approximate Reasoning, 63*(1), 48-61.

Schwarz, G., Meier, D., & Acunto , R. (2011). *Solvency II rewrites the rules for insurers.* Berlin: Bain & Company Global Editorial.

Scor. (2015). *Gaining a strategic edge through capital management.* Paris: SCOR Global P&C Strategy & Development.

Sekaran, U. (1992). *Research Methods for Business: A Skill-building Approach.* Wiley.

Shalit , S., & Sankar, U. (1977). The measurement of firm size. *The Review of Economics and Statistics, 59*(3), 290-298.

Sharpe , W., & Harrison, M. (1983). *Optimal funding and asset allocation rules for defined-benefit pension plans.* Chicago: University of Chicago Press.

Sharpe, W. F. (1964). Capital Asset Prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance, 19*(3), 425-442.

Sharpe, W. F. (1987). Integrated asset allocation. *Financial Analysts Journal, 43*(5), 25-32.

Shiu, E. (1990). On Redington's theory of immunization. *Insurance: Mathemetics and Economics, 9*(2-3), 171-175.

Shiu, E. S. (1987). On the Fisher-Weil immunization theorem. *Insurance: Mathematics and Economics, 6*(4), 259-266.

Siu, T. K. (2015). A Stochastic flows approach for asset allocation with hidden economic environment. *International Journal of Stochastic Analysis, 15*(1), 1-11.

Sklar, A. (1959). Distribution functions with n dimensions and their margins. *Publications of the Institute of Statistics of the University of Paris, 9*(1), 229-231.

Smith, M. (1989). Investment returns and yields to holders of insurance. *The Journal of Business, University of Chicago Press, 62*(1), 81-98.

Society of Actuaries. (2015). *Own risk solvency assessment process implementation for internal stakeholders.* Washington: Milliman.

Stanwick, P., & Stanwick, S. (1998). The relationship between corporate social performance and organizational size,financial performance and environmental performance: an empirical examination. *Journal of Business Ethics, 17*(2), 195-204.

Sweet, S., & Grace-Martin, K. (2012). *Data Analysis with SPSS: A First Course in Applied Statistics* (4th ed.). Boston: Pearson Allyn & Bacon.

Tang, A., & Valdez, E. (2006). *Economic capital and the aggregation of risks using copulas.* Sidney: University of South Wales.

Thoren, E. (2015). *Introduction to solvency II SCR standard formula for market risk.* London: Earnst and Young.

Tippet, C. (1928). Limiting forms of the frequency distribution of the largest or smallest member of a sample. *Proceedings of the Cambridge Philosophical Society, 24*(5), 180-290.

Treynor, J. (1962). Toward a theory of market value of risky assets. *Journal of Investment Management, 1*(2), 15-22.

Tutuncu, R., & Koenig, M. (2004). Robust asset allocation. *Annals of Operations Research, 132*(1), 157-187.

Twycross, A., & Heale, R. (2015). Validity and reliability in quantitative studies. *Evidence-Based Nursing , 18*(3), 66-67.

Van Hulle, K. (2015). *Insurance regulatory update on solvency II.* Frankfurt: Viena Insurance Group.

Vyas, M. (2015). A study of recent trends in insurance industry. *Indian Journal of Applied Research, 5*(9), 348-350.

Wang, J. L., Huang, H., Yang, S. S., & Tsai, J. T. (2010). An optimal product mix for hedging longetivity risk in life insurance comapies: The immunization theory approach. *The journal of risk and insurance, 77*(2), 473-497.

Waweru, N., & Kisaka , E. (2012). The effect of enterprise risk management implementation on the value of companies listed in the Nairobi stock exchange. *International journal of business and commerce, 3*(6), 1-17.

Weber , J. E., & Monarchi, D. E. (1982). Performance of the Durbin-Watson test and WLS estimation when the disturbance term includes serial dependence in addition to first-order autocorrelation. *Journal of the American Statistical Association, 77*(377), 117-128.

Wen, Z., Peng, X., Liu, X., Bai, X., & Sun, X. (2013). Asset allocation under the basel accord risk measures. *Chinese Academy of Sciences, 1*(1), 1-36.

Woltman, H., Feldstain, A., MacKay, C., & Rocchi , M. (2012). An introduction to hierarchical linear modeling. *Tutorials in Quantitative Methods for Psychology, 8*(1), 52-69.

Wyman, O. (2005). *Solvency assessment models compared-essential groundwork for the solvency II project.* Copyright © 2005 Comité Européen des Assurances.

Xiong, J., Ibbotson, R., Idzorek, T., & Chen, P. (2010, April). The equal importance of asset allocation and active management. *Financial Analysts Journal , 66*(2), 1-9.

Yegon, C., Gekara, J., & Wanjau , K. (2014). Effects of firm size on enterprise risk management of listed firms in Kenya. *Journal of Business and Management, 15*(5), 86-95.

Yow, S., & Sherris, M. (2008). Enterprise risk management, insurer value maximization and market frictions. *Asian Bulletin, 38*(1), 293-339.

APPENDICES

Appendix I: Data Collection Form

Part A: Risk Based Capital

Years	Market Risk Capital	Insurance Risk Capital	Credit Risk Capital	Operational Risk Capital	RBC
2014					
2015					
2016					
2017					
2018					

Part B: Asset Allocation

Part B 1: Investment vehicle

Asset	% of total assets Years				
	2014	**2015**	**2016**	**2017**	**2018**
Government Securities					
Listed Ordinary Shares on the NSE					
Listed Ordinary Shares on other recognized stock exchanges					
Listed Preference Shares on the NSE					
Listed Preference Shares on other recognized stock exchanges					
Unlisted Shares and/or private equity (including venture capital)					
Land and Self-occupied properties (Buildings)					
Investment property and property-related investments					

Asset	**% of total assets Years**				
	2014	**2015**	**2016**	**2017**	**2018**
Real Estate Investment Trusts (REITS)					
Foreign Government Bonds					
Local Authorities Bonds					
Corporations and other organisations bonds					
Term deposits and Cash					
Assets under management					
Others					

Part B 2: Duration of investment portfolio (years)

Asset	**< 1**	**1-2**	**2-3**	**3-4**	**4-5**	**>5**
Government T -Bills						
Government Bonds						
Shares on the NSE						
Shares on other recognized stock exchanges						
Unlisted Shares and/or private equity (including venture capital)						
Land and Self-occupied properties (Buildings)						
Investment property and property-related investments						
Real Estate Investment Trusts (REITS)						
Foreign Government Bonds						
Corporations and other organisations bonds						
Term deposits and Cash						
Assets under management						
Others						

Part C: Firm Size

Years	Total Assets	Gross Premium Written
2014		
2015		
2016		
2017		
2018		

Part D: Investment Returns

Years	Investment Income	Net Earned Premiums/ Life Fund
2014		
2015		
2016		
2017		
2018		

Appendix II: List of Insurance Companies

1. AAR Insurance Kenya Limited	33. The Kenyan Alliance Insurance Company Limited-General
2. African Merchant Assurance Company Limited	34. The Monarch Insurance Company Limited-General
3. AIG Insurance Company Limited	35. Trident Insurance Company Limited
4. Allianz Insurance Company of Kenya Limited	36. UAP Insurance Company Limited
5. APA Insurance Company Limited	37. Xplico Insurance Company Limited
6. BRITAM General Insurance Company (K) Ltd	38. APA Life Assurance Company Limited
7. CIC General Insurance Company Limited	39. Barclays Life Assurance Kenya Limited
8. Corporate Insurance Company Limited-General	40. BRITAM Life Insurance Company Limited
9. Directline Assurance Company Ltd	41. Capex Life Assurance Company Limited
10. Fidelity Shield Insurance Company Limited	42. CIC Life Assurance Company Limited
11. First Assurance Company Limited-General	43. Corporate Insurance Company Limited-Life
12. GA Insurance Limited	44. First Assurance Company Limited-Life
13. Geminia Insurance Company Limited-General	45. GA Life Assurance Limited
14. Heritage Insurance Company Limited	46. Geminia Insurance Company Limited-Life
15. ICEA Lion General Insurance Company Ltd	47. ICEA Lion Life Assurance Company Ltd
16. Intra-Africa Assurance Company Limited	48. Jubilee Insurance Company Limited-Life
17. Invesco Assurance Company Limited	49. Kenindia Assurance Company Limited-Life
18. Jubilee Insurance Company Limited-General	50. Kenya Orient Life Assurance Company Limited
19. Kenindia Assurance Company Limited-General	51. KUSCCO Mutual Assurance Limited
	52. Liberty Life Assurance Kenya Limited

20. Kenya Orient Insurance Company Limited 21. Madison General Insurance Company Limited 22. Mayfair Insurance Company Limited 23. Metropolitan Cannon General Insurance Limited 24. MUA Insurance (Kenya) Limited 25. Occidental Insurance Company Limited 26. Pacis Insurance Company Limited 27. Pioneer General Insurance Limited 28. Resolution Insurance Company Limited 29. Saham Insurance Company Limited-General 30. Sanlam General Insurance Limited. 31. Takaful Insurance of Africa Limited-General 32. Tausi Assurance Company Limited	53. Madison Insurance Company Limited-Life 54. Metropolitan Cannon Life Assurance Limited 55. Old Mutual Assurance Company Limited 56. Pioneer Assurance Company Limited 57. Prudential Life Assurance Kenya Limited 58. Saham Insurance Company Limited-Life 59. Sanlam Life Insurance Limited 60. Takaful Insurance of Africa Limited-Life 61. The Kenyan Alliance Insurance Company Limited-Life 62. The Monarch Insurance Company Limited-Life 63. UAP Life Assurance Company Limited

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