MODELLING THE GROWTH OF PENSION FUNDS USING GENERALIZED LINEAR MODEL (GAMMA REGRESSION)

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DECLARATION

I hereby declare that this research project is my original work and has not been presented in any other learning institution for academic award or otherwise.

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ACRONYM

NSE	-	Nairobi Stock Exchange
CMA	-	Capital Markets Authority
RBA	-	Retirement Benefits Authority
FKE	-	Federation of Kenya Employer
KBS	-	Kenya Bureau of Statistics

Etc…….

DEFINITIONS

"**Approved issuer"** means an insurer registered under the provisions of the Insurance Act or any other issuer approved in writing under the provisions of the Capital Markets Authority Act or under any other written law;

"**Defined benefit scheme"** means a scheme other than a defined contribution scheme;

"**Defined contribution scheme**" means a scheme in which members' and employers' contributions are fixed either as a percentage of pensionable earnings or as a shilling amount, and a member's retirement benefits has a value equal to those contributions, net of expenses including premiums paid for insurance of death or disability risks, accumulated in an individual account with investment return and any surpluses or deficits as determined by the trustees of the scheme;

"**Guaranteed fund":** means an asset class:-

(a) Issued by an approved issuer, whereby the approved issuer, inter ail, guarantees the accumulated capital of the scheme fund or pooled fund together with past investment income thereof in accordance with the terms of the guaranteed fund contract entered into between the approved issuer and the scheme or pooled fund, or

(b) Which shall be referred to as the Retirement Benefits Fund established as a statutory fund within the meaning of the provisions cap 487 of the Insurance Act in which the capital of the scheme fund or pooled fund together with past investment income thereof is guaranteed by the approved issuer in accordance with the terms of the policy of insurance issued to the scheme or pooled fund by the approved issuer;

"**Manager"** means a manager registered by the Authority;

"**Occupational retirement benefits scheme"** means a retirement benefits scheme established by employers for the benefit of the employees including schemes established under a written law;

Pooled fund" means a fund established by a limited liability company other than an approved issuer for purposes of pooling scheme funds for collective investment;

"**Provident fund"** means a scheme for the payment of lump sums and other similar benefits to employees when they leave employment or to the dependents' of employees on the death of those employees;

"**Scheme"** means an occupational retirement benefits scheme;

ABSTRACT

The current demographic shift of the Kenya ageing population, stress an increasing demand for pension schemes in all employment sectors. Unlike Kenya all over the world there have been pension reforms to arrest this population trend since it threatens the sustainability of the country's economy. Governments in many countries pay particular attention to pension scheme because of pension funds' enormous role in the development of the economy.

The laws in Kenya currently governing the pension industry do not encourage mandatory setting up of pension scheme by registered companies, small-scale enterprises and any other organisation in Kenya. Currently we have very many company and registered organisation that do not have retirement benefits plan or any other old age saving for the current employed workforce. This creates a risk of having future old age population that is dependant to the working population. If majority of the Kenyan working force where to have retirement benefit plan then we will have most of this fund be injected in Kenyan macroeconomic productions components, especially on investment in infrastructure development related projects. With this continued tread without any tangible solution there is future risk for majority of employed people retiring without any pension plan in place creating high dependency ratio.

Over the last decade and since the operational of Retirement Benefits Authority we have had the reform initiatives and the results achieved. Some of the positive effects of the legislation have started to be felt and thinking is now shifting to policy issues and the challenges of increasing coverage, benefit adequacy and the growth of retirement savings. Indeed over the past years in Kenya, there has been consensus on the need for further reform of the system. The achievements of the past decade, particularly with respect of voluntary employer sponsored occupational schemes, provides a good basis on which to implement further reforms to increase coverage and reduce post-retirement poverty levels.

For the purpose of this research I am cross examining at the various types of pension scheme in Kenya particularly the private pension scheme and the growth of the pension funds over a given period. This research project also examines the current private sector employee and expected future growth modelled based on generalized linear model. Lastly, an analysis is done to find out whether mandatory setting up of pension scheme will have a positive and exponential growth in

comparative to current non mandatory system, based on past fund value, private sector work force and risk free interest rate.

For the purpose of analysis, the research project uses a combination of data for which the main sources are; Retirement Benefits Authority, Kenya Bureau of statistics and Nairobi Stock Exchange scholarly literature review on the subject.

The growth of pension funds has positive relation with given variables. An increase in the population that contributes to pension scheme translate to more funds and hence the growth of pension funds. Likewise since the pension funds are invested in different asset class in the economy, and then at the end of valuation period interest is credited to the capital. High rate of return technical translate to high fund growth hence a positive increase in interest rate contributes to positive growth of the pension funds.

CHAPTER ONE

1.0. INTRODUCTION

1.1. Background

Pension funds may be defined as forms of institutional investor, which collect pool and invest funds contributed by sponsors and beneficiaries to provide for the future pension entitlements of beneficiaries (*Davis* 1995a). An employee or a member of defined contribution scheme makes fixed payments into pension scheme which is set up to provide an income when he or she goes on retirement. For defined benefits scheme it only the employer who set aside certain funds to the scheme. There is a series of risk one being inherent risk of inflation due to this time period. In simple terms, the real value of contributions may fall over the lengthy time period. To combat these problems, there must be prudent investment to compensate for these risks. The investments of pension funds play key role toward the growth of the Kenya economy. Multiplier effects generated by the government reinvestment of the funds into Kenya economy also ensure that more than adequate returns to make up for this longevity risk.

The economy is the realized social system of production, exchange, distribution and consumption of goods and services of a country or other areas. An economy can be said to be activities related to the production and distribution of goods and services in a particular geographic region. Every country in the world has its own individual economy particularly Kenya. The economic activities may include financial activities. The financial sector is responsible for the performance of these financial activities. Pension funds are invested in such activities in order to generate adequate revenue to fulfil pension obligations.

Current the total number of active contributor to registered scheme stands at less than 500,000 members and to NSSF stand at less than 1,500,000 members (*Source RBA*) and however the total private work force is a staggering huge figure that does not have any retirement plan or saving plan in place. With the coming in of county government the government will need more resource in term of fund to finance most of the infrastructure projects countrywide. If the population of non-contributor in the private sector is tapped this will create enough fund that could be invested

in infrastructure bond hence creating double edged gain for both economy growth and growth of the pension fund for retirees

In line with vision 2030 in laying the foundation for the economic pillar of the Vision, there is need to build an enabling environment for the private sector in order to fully unlock its potential and to become globally competitive. One of the key elements in the Medium Term Plan for this strategy is: If regulations of pension funds were to be relaxed to allow investments in private infrastructure projects and, in turn, these projects adapted their financial instruments to the needs of those pension funds, both parties would be able to reap significant tangible and intangible benefits

Financial markets have assumed increased significance and gained influence in the developed and emerging economies all around the world since the nineteen eighties. During that period, governments boosted the growth of financial markets; Private companies followed the movement towards raising finance through the financial markets to lower their dependency from the banking system. They started to use financial markets to obtain capital via the issuance of equity and credit through fixed income issuance. Equity markets were used to finance the bold strategic business expansions that the previous bank lending system could not have allowed in terms of financial risk considerations.

Investment banking has become a very lucrative place to be and then the government chose to build a retirement system based on the investment of the employee's savings on the financial markets in order to guarantee pensions for pensioners. This orientation has been progressively adopted by a large number of countries all around the world Kenya being one of them through the form of various public or private pension schemes managed by institutional investors on behalf of primary beneficiaries. Financial service providers such as asset managers and insurance companies (approved issuer) have assumed the task of investing citizens' savings in the financial markets. Consequently the collective weight of the institutional investors has started to become significant in the economy. Financial markets are not magical entities governed by their own rationality but prosaic bodies resulting from multiple actions and decisions of different players in the market. Innovative financial tools can also be used, for positive impact, to facilitate responsible economic growth. These innovative tools are more spread in developed economies but they are progressively taking root in emerging economies Kenya being front player.

1.2. Types of Pension Scheme in Existence

It's a fact the pensions and retirement benefits are inventions of the late nineteenth and early twentieth centuries in developed countries. However Before this, people in what are now developed economies did not retire; they continued working until a point of no return, often ending their lives as poor beggars it is believed the first state pension system started in Germany in the 1880s. During the twentieth century, state and occupational pension schemes developed in the other countries of Europe and in developed economies as far apart as the USA and Australia. However, in many parts of Africa, Asia and Latin America, even today the idea of retirement and pensions remains a dream particularly in Kenya the penetration rate is at the lowest point.

For those people living in developed countries and even emerging markets, it is conventional to talk of three major pillars of support in old age retirement.

The first pillar is provided by the state as part of its social security system. There are two main types of social security system, Beveridgean and Bismarckian. A Beveridgean system provides just sufficient support to keep people off the breadline; if people want to enjoy a higher standard of living, they are expected to make their own alternative arrangements. In Kenya mostly the teachers and civil servant have this kind of arrangement. The government of Kenya set a side each financial year budget amount for retirees. The UK and USA have also Beveridgean social security systems. A Bismarckian system provides much more generous support, often at a level that does not require individuals to make additional arrangements. Germany, Italy and France have Bismarckian social security systems. The first pillar is financed by collecting tax (part of the social security tax that the government raises) from workers and paying it out immediately to pensioners commonly referred to as Pay As You Go.

In other words, it is known as an unfunded system, since no fund of pension assets is accumulated. Clearly the level of social security tax collected will be lower in the former than the latter systems.

Most first pillar schemes are (non-financial) defined benefit in nature. Recently, countries such as Sweden and Poland have experimented with non-financial (or notional) defined contribution (NDC) schemes for their first pillar. These are unfunded schemes in which members have individual defined contribution (DC) accounts in which the returns that are credited to the contributions are not related to the returns on financial assets, but to some non-financial variable, such as the growth rate in the country's GDP or the growth rate in national average earnings

(denoted g below). The contribution rate is a fixed proportion of earnings. At retirement, the notional capital in the member's account is converted to a life annuity, using an annuity factor (An annuity factor shows the present value of one unit of pension payable annually for the life of the pensioner defined by

$$\bar{a}_x = \int_0^\infty \underbrace{v^t}_{\text{interest (or discounting) factor}} \underbrace{{}_tp_x}_{\text{probability of survival of } (x) \text{ for } t \text{ years}} dt$$

(1.21)

The discount rate for calculating this present value is related to return on the non-financial variable used by the scheme during the accrual stage, such as the growth rate in the country's GDP or the growth rate in national average earnings. The estimated length of life of the pensioner is set equal to the life expectancy of the member's birth cohort (i.e., all people born in the same year as the pensioner). The annuity factor is divided into the notional capital to get the total annual pension.) That reflects both the cohort life expectancy of the member and the rate of return on the scheme over the expected term of the annuity.

It's important that when DC member retires their DC accounts can provide a sufficient wage replacement income. We consider the worker's accumulated pension to be adequate once it exceeds two-thirds of their current salary.

We calculate the pension / purchasable by dividing the accumulated pension wealth, $W_{(t)}$, by a life annuity factor, $a_{x(t)}$.The pension income, divided by the individual's pre retirement salary, is referred to as the replacement-ratio, $RR_{(t)}$:

$$RR_{(t)} = \frac{W_{(t)} / a_{x(t)}}{Y_{(t)}}$$

(1.22)

Where

- ***t*:** current time in years;
- ***x*:** member's age at the current time *t*
- $a_{x(t)}$.: the annuity factor at time *t* for an individual aged *x*;
- $W_{(t)}$ the worker's accumulated DC pension wealth at time *t*
- $Y_{(t)}$: the worker's salary at time *t*.

The plan member retires as soon as the replacement-ratio exceeds two-thirds of current salary

The kind of system is kept in financial balance to ensure that the **Present Value of System Assets**{PV(A)), i.e., the accruing notional capital, always equals the present value of system liabilities (PV(L)}, i.e., the expected pension payments. Most recent among one of the legislative change affecting retirement benefits industries in Kenya its now mandatory for asset liability marching for all pension fund. This is achieved by using an adjusted rate of return $g + \rho$, where $\rho = [(PV(A)/PV(L)) - 1]$. The effects of demographic and economic shocks are therefore accommodated endogenously within the scheme and within each cohort, since the credited return on the scheme, $g + \rho$, adjusts the member's notional capital during both the accrual and payment stages and the annuity paid at retirement reflects changes in birth cohort life expectancy.

- To maintain a fixed contribution rate, total Non-Financial (Or Notional) Defined Contribution (NDC) system assets must equal or be greater than total liabilities.
- The NDC benefit is constructed as a life annuity, reflecting life expectancy at retirement.
- Financial balance requires the accounts be valued at the rate $g + \rho$.

NDC schemes can be interpreted as exhibiting intergenerational fairness, since each generation pays the same contribution rate as a proportion of earnings and receives a pension based on its own economic performance over its lifecycle and its own mortality prospects.

The second pillar is provided by the companies in the form of occupational pension schemes or plans. These are plan that are becoming more popular in the Kenya economy and companies are said to sponsor such schemes. Typically, occupational pension schemes are funded, i.e., a fund of pension assets accrues from the contributions paid by the employer (the scheme sponsor) and worker (the scheme member) and from the investment returns on these contributions. The

pension is paid from the accrued fund once the member retires. Sometimes (and this is more common in smaller companies than larger companies), the accrued fund is given to a life assurance company, which then provides a life annuity to the retiree.

There are three classes of pension scheme member: the active member, who still works for the company and is still making contributions; the retired member, who has retired from the company and is drawing a pension; and the deferred member, a worker who is no longer working for the company and has not yet retired, but has accrued rights to a pension on the basis of his previous service for the firm and associated membership of the scheme – the pension then becomes payable when the deferred member retires from his last job. However due to weak legislative laws member can access 100% of employee contributions and 50% of employers contributions.

Although most occupational pension schemes are funded, the calculation of the pension benefits can differ widely between different types of scheme. There are three main types of occupational scheme: defined benefit (DB), defined contribution (DC) and hybrid.

Until recently, the most common type of scheme was a DB scheme. In such a scheme it is the benefit that is defined and the scheme promises to pay a pension, based on this defined benefit, whatever the size of the fund backing this promise. The simplest DB scheme offers a fixed monetary pension at retirement, irrespective of earnings or subsequent inflation. Such schemes are common in Germany and the USA (where they are known as fixed benefit or fixed amount plans).

However, the most common type of DB scheme is a salary-related scheme. The most common of these is the final salary scheme, in which the pension paid is related to the salary earned in the final year of employment (or the average of the final three or five years of employment) of the scheme member. The actual pension is some fraction of the final salary, where the fraction is calculated as the product of the accrual rate (e.g., 1%) and the number of years of service.

Another type of DB scheme is the retirement balance scheme. The benefit is defined in terms of a lump sum rather than a pension and it is typically measured as the multiple of an accrual amount (a specified percentage of career average salary) and years of service. If final rather than average salary is used, such schemes are known as final salary lump sum or pension equity schemes. They are common in Japan and Australia.

They are not proper pension schemes, however, unless the lump sum is used to buy an annuity, and hence provide lifetime income security.

A DB scheme will show a surplus if the value of the assets in the pension fund exceeds the value of the liabilities, namely the present value of the future promised pension payments. A DB scheme will show a deficit if the value of the liabilities exceeds the assets. Pension regulators or supervisors (RBA) generally impose strict rules on the elimination of both surpluses and deficits. Surpluses are typically eliminated through sponsor contribution holidays, i.e., the sponsor stops making contributions to the fund until the surplus has been eliminated.

Deficits are eliminated through a series of deficiency payments, i.e., additional contributions from the sponsor, that extinguish the deficit within a specified recovery period, such as 5–10 years or the average remaining service life of the company's workforce (typically around 15 years).

Increasingly, DB schemes are being replaced with DC schemes. In such schemes, it is the rate of contributions into the scheme that is defined. The contributions might be a fixed annual amount or they might be a fixed percentage of salary. The pension will depend on the value of the fund accrued by the time of retirement. No particular level of pension is promised with a DC scheme. If the value of the fund is low, either as a result of low contributions or poor investment performance, then the pension will be low as well. If, on the other hand, the value of the pension is high, the pension will be correspondingly high. By definition, DC schemes show neither surpluses nor deficits.

The third pillar is any additional savings for retirement that the individual chooses above that provided by the state or the company for whom the individual works commonly known as gratuity. These savings will typically be held in deposit accounts or in mutual funds invested in equities or bonds. If the individual chooses to do this via a formal pension scheme, it will almost invariably be in the form of a DC scheme, known as a personal pension scheme or an individual retirement account. Other assets can also be used to provide income in retirement. An alternative is to borrow against the equity in the home and allow the interest to roll up. The initial loan and the rolled-up interest are repaid at the time of death of the occupant out of the proceeds from selling the home. This is called home equity release.

Increasingly there is a fourth pillar of support in old age, and that is post-retirement work. Sometimes this is by choice. Some individuals do not like the idea of being fully employed one

day and then having no work to do the next. Such individuals prefer a gradual entry into retirement. For other individuals, there might be no choice but to take a part-time job to make ends meet.

1.3. Statement of the Problem

Socio-economic conditions in developing countries Kenya amongst stress an increasing demand for social security for the aging population. There has been a growing international consensus on the rationality of using social protection mechanisms as complementary instruments for fighting old age poverty. Pension fund liabilities investments are long term in nature. This is because people make claims on the fund after retirement currently in Kenya people retire at an average age of 55 years. As a result of this, pension funds are invested in various assets such as stocks, infrastructure bonds and other securities on the financial market to generate sufficient funds for companies to meet their pension obligations. In order to sustain the scheme, the pension funds are also diversified in the other sectors of the economy. Examples are the use of pension funds for the provision of real estate housing, hospitals, road constructions and other infrastructure for the development of the economy.

The recent trend in global demographic shift towards population ageing has led many countries to reform their pensions from unfunded schemes (pay-as-you-go) to funded schemes and also enforcing mandatory contributory. With the current demographic trend and the structure of funded schemes, it is certain that pension funds will increase remarkably in the coming decades. Hence the following questions arises

1. Whether pension funds at current level of market penetration is sufficient to generate the resources needed to meet the needs of the ageing population.
2. The question is whether pensions fund growth under the current non-mandatory contributions need to be substituted with mandatory contributions system for all employed workforce. This lead to derivation of a mathematical model showing pension funds growth under the two system non-mandatory and mandatory contributions.
3. There is an increase in the number of retired people being over dependant to working force and government grants

4. The shortage of fund by government to fund development of infrastructure will be highly be reduced since more fund will come from the pension industry and invested in government infrastructure bonds and other financial securities

1.4. Objectives

In regard to the study, a number of objectives need to be achieved in this project as highlighted below

The Objectives of the study are as follows:

Based on Generalized Linear Model (Gamma Regression) we estimate the effect of pension fund growth using private sector population and risk free interest as variable.

1.5. Justification

Currently in Kenya the coverage of existing pension system is very low compared to other developed and developing countries. At the moment below15%of active work force covered have pension saving plan leaving staggering 85% (*Source RBA)*of the working with no form of retirement saving.

The coverage is mostly in the formal sector leaving behind informal and agricultural sectors uncovered and the low coverage is mainly attributed to optional for employer to sponsor a pension scheme, which is not mandatory legal requirement. Other factor that have contributed to low coverage are individual retirement benefits pension plan are still in the infancy stage meaning not popular country wide, fast growing informal sector than the formal sector that have no understanding or appreciation for having retirement saving plan

All those factor put together contribute to the urgent legislative and government intervention to increase the level of pension penetration in the country to generate enough fund that can be of economic important to all sector of development

It’s from the low pension penetration level in the country that is justified to have Mandatory pension systems require that employees subscribe to supplementary pension schemes

However, the nature and structure of such systems in terms of design and delivery can differ very substantially, depending on the way in which a range of key issues are addressed. These key issues include coverage of the scheme, contribution levels, cost distribution, means of scheme introduction, and the establishment of ceilings and floors. The way in which each of these issues is addressed in designing and delivering a mandatory system will also result in potentially different economic impacts.

Mandatory or quasi-mandatory systems are already in place in a number of countries including Australia, Chile, Denmark, Switzerland, Sweden, the Netherlands, Hungary and Iceland. Practice and experience differs markedly between the countries that have adopted this approach. Systems developed include defined contribution and defined benefit models, compulsory contributions to private pension plans, state-run schemes, and initiatives operated by social partners. Some

The aging population is on the increase and if the government tries to finance the pension debts by public debts, then public savings would decrease, so the overall national saving rate might be unchanged or even fall, Focusing on emerging market economies, (*Walker and Lefort, 2002*) argue that pension funds can decrease the cost of capital via three channels. The first channel is more developed capital market resulting from pension reforms, thus making the issuing of securities cheaper. Secondly, even allowing for short-term performance evaluation (*Davis and Steil, 2001*), the expected investment time horizon of pension funds is longer than that of individuals and firms, thus reducing the 'term premium'. Third, the equity risk premium is reduced due to pension funds' pooling and professional management. Both the term premium and risk premium's reduction might lead to a decrease in the average cost of capital, which spurs investment. In addition, they give some evidence that pension funds reduce security price volatility, implying a lower risk premium for their panel of emerging market economies

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CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 The Concept of Pension Funds

Broader View of Pension Over the last several decades there has been a movement in retirement savings plans offered by employers from defined benefit (DB) to defined contribution (DC). In DB plans, the plan sponsor promises workers a specified annuity benefit for their retirement, is liable for such a promise, and is responsible for asset management of funds in the plan. With a DB scheme, it is the pension benefit that is specified by formula. In the UK, for example, the defined benefit formula for the annual pension would be of the form:

Annual Pension = k × (no of years of membership) × (earnings averaged over the h years before retirement)

Typical values of **k** (the accrual rate) would be 1/60 so that a maximum of 2/3 of final salary could be achieved after 40 years' membership. **h** is usually 1 or 3. The annual contribution formula would be of the form

Annual Contribution = c × (current pensionable earnings)

Where c is not specified in the scheme rules but is determined by the "funding method" used by the actuary at each valuation.

Valuation Principles

Only defined-benefit schemes shall be considered, and the mean present value of the future benefits and future contributions of an "active" member aged *x* will be calculated. (\Active" refers to a member who has not yet retired).

The reserve for each member is calculated prospectively. That is,

Reserve = mean present value of future benefits - mean present value of future contributions (of both employee and employer)

DC plans allow employees to decide in which assets their retirement investment will be allocated. Investment choice, within a menu ordered by the sponsor, and capital market risk is moved from the employer to the employee in this plan.

The introduction of DC plans to retirement savings has been of great concern lately as capital market volatility has affected the performance of many plan participants. Therefore, it is important to understand how investors will make investment decisions as their behaviour could significantly alter their retirement wealth.Defined contribution plans have tended to grow faster than defined benefit in recent years, as employers have sought to minimize the risk of their obligations, while employees seek funds that are readily transferable or portable between employers.

These investments ensure that the various entitlements are adequately provided for. These entitlements or benefits are in the form of old age, invalidity and survivors' lump sum benefits. The benefits may be paid either in the form of annuity or a lump sum. Pension funds are invested in companies, households as well as the government. Shares are also purchased in various companies in order to earn dividends. Governments also use pension funds to supplement their budgets. The governments borrow the amounts they need from the pension funds with the promise to repay at an agreed time. Drawing on the extensive existing literature on pension economics (*Bodie and Davis,*2000), it is self-evidence that pension funds' efficiency in this sense is an important factor underlying their rise to prominence.

Due to the long-term nature of pension funds, the funds can be invested in high yielding long-term instruments. Early withdrawals are restricted. The funds can thus be invested in corporate equities, government bonds and corporate debt, corporate equities are in the form of shares, government bonds include treasury bonds and corporate debts are loans granted to companies.
Employers may make contributions into the fund alone or by both the employer and the employee. Where only the employer makes contributions, we have a non-contributory scheme. Where both the employee and the employer make the contributions, we have a contributory scheme. The benefits received by eligible members can be either defined-benefit or defined-contribution. Under the defined-contribution, benefits are not based upon a predetermined formula; plan participants upon retirement get back their contributions plus their accumulated return with the pension benefit taking the form of a lump-sum payment or a series of lump-sum payment or an annuity

Defined-contribution plan is usually fully funded. The employee/retiree bears the risk of poor investment performance and inflation. The real value of benefits may fall during periods of inflation. The defined-benefit plan defines plan participants' benefits as a function of salary and work history. A formula is used in the calculation of this benefit. The risk of investment is borne by the employer who serves as the guarantor of the scheme. These schemes are not very mobile from one employer to another. There are also a lot more conditions attached to the benefits. Some of these conditions may include length of employment and position.A few empirical studies *(Holzmann, 1997; Davis and Hu, 2008)* indeed argue that funding of pensions is associated with an increase in economic growth rates. This increase should be caused by higher saving rates, capital market development and reduced labor market distortions.

In recent years defined contribution plans have grown faster than defined benefit plans. This is because employers now seek to minimize their risk of obligation whiles employees also seek funds readily transferable between employers.

2.2 Generalized Linear Models (GLM) – Gamma Regression

In GLM modelling, one specifies a mean and variance function for the observed raw scale variable y, conditional on x (*McCullagh and Nelder, 1989).* Because of the work by Blough, Madden, and Hornbook (1999), we will focus on the gamma regression model with a log link. Like the log normal, the gamma distribution has a variance function that is proportional to the square of theme an function, a property approximately characteristic of many health data sets.

Regression modelling deals with explaining the movements in one variable by movements in one or more other variables. The classical linear model, or normal linear model, forms the basis of generalized linear modelling. Many of the regression concepts found in GLMs have their genesis in the normal linear model. The original idea of least square by (*Gauss*) presents today generalized linear modelling.

Simple Linear Modelling (SLM)

This is of the form

$$Y \approx \beta_0 + \beta_1 X \qquad (2.1)$$

where β_0 and β_1 are parameters to be estimated. SLM is way of explaining an observed variable Y by a single other observed variable or covariates X. The variable y is called the response variable and x the explanatory variable. When x is categorical it is also called a factor.

Generalized Linear Modelling.

With multiple regression it is of the form;

$$Y \approx \beta_0 + \beta_1 X_1 + \ldots\ldots + \beta_p X_p \qquad (2.2)$$

Were $X_1, X_2, \ldots, X$ pare the explanatory variables with the interpretation as for every unit increase in X_j , Y increases by about β_j , holding all other variables X_k constant

The $g\{E(Y|X)\}$ is explained in terms of X. The variables X and Y variables play distinct roles. The Y variable is generally thought of as being caused or explained by X, not vice versa. This may seem overly prescriptive; however, if the direction of causation is from Y to X then it can be shown that some of the other assumptions that are usually invoked will definitely not hold. For this study we take the fund pension fund at time one to be the observed variable and the explanatory variable to the population and the interest

2.3 Pensions Funds as a Function of the Financial Sector

More generally, pension funds' increasing role in the financial sector plays a great role therefore forced pensions saving will tend to boost their overall saving particularly markedly *(Bernheim and Scholz, 1992)*. This activities include collecting saving, investing in securities, infrastructure investment and other financial assets, disbursing annuities, providing forms of insurance, acting as operators in securities markets. The reasons given for the growth of pensions plans do not emphasize the choice over investment destinations provided by these plans. This becomes especially important with the increase in superior returns that can be attained by exercising such a choice. The Nairobi Stock Exchange has played key role in the growth of the pension industry sector in Kenya.

(Scholtens and Wensveen,1999) suggest in addition that dynamic aspects of financial innovation and adaptation of institutions to gain competitive advantage should play a central role.We contend that a suitable framework for assessing the role of pension funds as key asset and the boost they give to capital markets is via consideration of the overall functions of the financial system. It also provides a basis for judging the extent to which pension funds are acting as agents of financial change by fulfilling the functions of financial systems more efficiently than the alternatives financial institutions.

In effect, whereas the institutional form taken by financial systems is subject to evolution through time, the functions fulfilled by the financial system are relatively fixed. The evolution of institutional forms and of financial structure such as the growth of pension funds may thus be seen as a form of adaptation and improvement in the ways these functions are fulfilled, under pressure from competitive forces. Various paradigms have been proposed. Here we highlight and utilise that proposed by (*Merton and Bodie, 1995)***.** They focus on six functions, as follows:

- The provision of a mechanism for pooling of funds from individual households so as to facilitate large-scale indivisible undertakings, and the subdivision of shares in enterprises to facilitate diversification.
- Provision of means to transfer economic resources over time, across geographic regions, countries or among industries.
- Provisions of means to manage uncertainty and control risk.

Pension funds may also boost economic growth via improved corporate governance *(Clark and Hebb 2003; Myners, 2001)2. (Clark and Hebb, 2003)* identify four drivers, which facilitate pension funds' corporate engagement, which they see as foreshadowing the so-called "Fifth Stage of Capitalism". The first driver is the widespread use of indexation techniques in the pension funds industry, which hinders "exit" via sale of shares in underperforming companies, which are in the index. The second driver is the increasing demand by owners for more transparency and accountability. Third, there is pension funds' pressure to undertake socially responsible investing (SRI). Fourth, pressures to "humanize" capital with social, moral and political objectives extend pension funds' simple concerns for rate of return

2.4 Population Growths and Life Expectancy

There is little published methodological literature addressing this common practical concern to integrate estimates and targets in a population projection, beyond a concern to make consistent sub-regional and regional projections *(Smith et al., 2001; King, 1990). Keilman (1985: 1482)* usefully describes a three stage strategy that is used here for the general case: "(1) formulate initial values of model parameters; (2) check and adjust for consistency; (3) translate consistent model variables into adjusted parameter values". He distinguishes between internal and external constraints.

In this study the techniques of projection we shall consider the estimation of the future population of a given country private sector working force, P(t) at time t years from the present.

Worldwide life expectancy at birth (the average number of years a new-born infant would live if prevailing patterns of mortality at the time of birth were to stay throughout the child's life) has been increasing due to declining death rates, reflecting success in combating mortality and morbidity. Future population are expected to live longer than the past and current population hence need to plan for proper structure of pension as a pillar of future income

Life Expectancy is given by $\mathbf{e_x = \frac{T_x}{l_x}}$ (2.4)

where T_x is the total years lived after age X

l_x Is number of person living at age X

Pensions has adverse effect on the development of the economy that has positive repercussions since pension fund are mostly invested for long term hence Increasing the generation of long-term savings normal since pension have locking in policy meaning that member of pension scheme cannot access the benefit s while in the service of employer;

2.5 Interest Rate Effect on Pension Funds

Finally, the growth in defined contribution assets may be related to the levels of interest rates, though the theoretical explanation for interest rate effect is ambiguous. In theory, higher interest rates increase returns from savings and investment, thus increasing both the flows and the overall levels of saving. However, rise in interest rates may also have a counter-effect on savings, since higher interest rates imply the need for lower amounts of saving to generate a required future level of assets.

In a previous study, *(Feldstein and Seligman,1981)* warned that the heterogeneity of interest rate assumptions was the source of a potentially serious problem in measuring the key variable in their study of the effect of unfunded pension liabilities on share prices.

The effect of pension obligations on share prices is of intrinsic interest to anyone concerned with the efficiency of capital markets and the nature of corporate financial decisions. More generally, however, the ability of share prices to reflect unfunded pension obligations is an important link in the effect of private pensions on national saving *(Feldstein, 1978~)*

Often benefits are related to an average of the last several years' salary rates of the employee. Increases in the inflation rate matched by equal increases in salary will reduce the ratio of benefits (based on an average salary) to final pay, below what was expected. For example, if benefits are based on an average of the last five years' pay, this base will likely be close to the actual final salary in a period of no inflation, where it may be significantly below final salary in a period of high inflation. Such effects are not trivial *(Winklevoss,1977)* has estimated that a five percentage point increase in both salary growth rates and interest rates would reduce the present

value of the benefits of a typical worker by about 13%. However, these "mechanical" effects (derived from assuming that the worker's future real salary is unaffected by the inflation rate) represent only a small part of the effect of inflation on the value of workers' benefits. (*Pablo A, Sebastian and Juan Y, 2011)*In conclusion, lower interest rates will impact pension funds and insurance companies on both the asset and the liability side of their balance sheets. While lower interest rates increase the value of fixed-income securities, they increase the liabilities of pension funds and insurance companies, with the extent of the impact depending on:

1. Whether future cash flows are fixed;
2. To what extent benefits to be paid in the future are being adjusted to reflect the new economic environment.

Protracted low interest rates reflective of a lower-growth economic environment will reduce the returns on portfolio investments. Thus, lower long-term interest rates could lead to pressure to adjust pension promises or guarantees downwards, or to adjust contributions and premiums upwards in order to pay for the pension and insurance promises that become more expensive to provide in a protracted low-interest-rate environment.

CHAPTER THREE

3.0. METHODOLOGY

3.1 Model Selection

Firstly from two recent papers I explored the performance of some of the alternatives found in the literature. In (*Manning and Mullahy,2001*), they compared models for estimating the exponential conditional mean – how the log of the expected value of y varied with observed covariates x. That analysis compared a range of GLM alternatives with log links under a variety of data conditions that researchers often encounter in health care cost data. In (*Basu, Manning, and Mullahy, 2003*), they compared the gamma with a log link, and an alternative from the survival model literature, the Cox proportional hazard regression. In both papers, they proposed a set of tests that can be employed to select among the competing estimators, because they found no single estimator dominates the other alternatives or is a close second best.

The set of models to be selected is that they assume independent (or at least uncorrelated) observations. The observations are assumed to be independent in blocks of fixed or known sizes. As a consequence, data exhibiting the auto correlations of time series and spatial processes are expressly excluded. This assumption of independence is characteristic of the linear models of the classical regression analysis, which is imported without modification to the wider class of generalized linear models. The models also assume explicit one single error term structure. The choice of scale for analysis is also important, for example a choice between analyses of Y– (Pension Fund at time t) of the original scale, or log Y? Under GLM, normality and constancy of variance are no longer required, although the way in which variance depends on the mean must be known. Additivity of effects can be specified to hold on a transformed scale if necessary. Another problem involves the choice of the covariates (x-variables) to be included in the systematic part of the model. Mostly, we have a given number of candidate covariates $x_1, x_2, \bullet\bullet\bullet, x_p$ and we are required to find a subset of these that in some sense are best for constructing the fitted values

$$\hat{\mu} = \sum_j x_j \hat{\beta}_j \qquad (3.1)$$

3.2 Components of a Generalized Linear Model

Generalized linear models are an extension of classical linear models. A vector of an n-turple observations y is assumed to be a realization of a random variable Y whose components are independently distributed with means $\boldsymbol{\mu}$ The systematic part of the model is a specification of the vector p, in terms of a small number of unknown parameters 3_1, $_i32$, • • • , $_i3_p$,thus the specification takes the form

$$\mu = \sum_{j=1}^{p} (X_j \beta_j) \tag{3.2}$$

Where β_j are parameters whose values are usually unknown and have to be estimated from the data. If we let the index *j* denote observation, the systematic part of the model can be written as

$$\mathrm{E}(Yi) = \mu_i + \sum_{j=1}^{p} \left(X_{ij}\beta_j\right)$$

$$i = 1, \cdots, n \tag{3.3}$$

Where X_{ij} is the value of the *j*th covariate for observations *I*, in matrix notation (where μ, is *n* x 1, X is *n* x *p* and β is a *p* x 1)

For the random part, we assume independence and constant variance of errors. The assumptions are strong and require checking (diagnostics). Similarly, the structure of the systematic part assumes we know the covariates that influence the mean and can measure them effectively without error; this assumption needs checking also. Generally we have the three specifications for the GLM models as:

1. The *random component:* the components of Y have independent normal distributions with *E(Y)* = μ , and constant variance σ^2
2. The *systematic component:* covariates x_l, *x2,* • • • , x_p produce a linear predictor *n*

given by

$$\eta = \sum_{j=1}^{p} (X_j \beta_j) \tag{3.4}$$

3. The link between the random and the systematic components:

$$\mu = \eta$$

3.3 Goodness of fit

3.3.1 The analysis of deviance

The parameters of a GLM are usually estimated using maximum likelihood estimation. The log-likelihood function $l(y;\theta,\varphi)=\log(f_Y(y;\theta,\varphi))$ depends on the parameters in the linear predictor through the link function, thus maximum likelihood estimates of the parameters maybe obtained by maximizing l with respect to the parameters in the linear predictor. Likewise the approximations of standard errors of the parameters are based on using asymptotic maximum likelihood theory. The process of choosing a model also uses methods, which are approximations, based on maximum likelihood theory. The analysis of variance is highly a useful technique for screening the effects of factors and their interactions. We usually rely on the χ^2approximation for the differences between deviances for most nested models.

A saturated model is defined to be a model in which there areas many parameters as observations so that the fitted values are equal to the observed values. In such cases, to assess the adequacy of a model for describing a set of the data, we can compare the likelihood under any model with the likelihood under a saturated model. The saturated model uses the same link function and distribution as the chosen model but has more parameters, as there are data points; as such it fits the data perfectly. Suppose that L_S and L_M denote the likelihood functions of the saturated and the current models evaluated at their optimal parameter values, the likelihood ratio statistic is given by L_S/L_M. If the current model describes data well, then the value of L_M should be close to the value of L_S, otherwise if the model is poor, then the value of L_M is much smaller than the value of L_S and the

likelihood ratio statistic will be large. We could also examine the natural log of the likelihood ratio statistic

$$\log \frac{L_S}{L_M} = l_S - l_M \tag{3.5}$$

Where $l_S = \log L_S$ and $l_M = \log L_M$. The scaled deviance is defined as twice the difference between the log-likelihood of the model under consideration and the saturated model. The decision on which model to use usually begins with a consideration of the deviances for a range of models. The smaller the deviance, the better the model

3.4 Gamma Regression

Continuous responses of interest to Pension funds involve an application to growth of pension funds. The funds are non-negative and right skewed. The options often available for modeling such data involve use of transformation to normality of the fund values then use a linear model on the transformed response variables. Thus $g(y) \sim N(\mu, \sigma^2)$where $g(\cdot)$ is the transformation and $\mu = X\beta$. For the Gamma distribution, the link function is the inverse function, but since interpretation of parameters from a model with inverse link is difficult to interpret, the log link is usually regarded more useful.

The generalized gamma distribution has one scale parameter and two shape parameters. This form is also referred to as the family of generalized gamma distributions because the standard gamma, Weibull, exponential and the lognormal are all special cases of this distribution. Hence, it provides a convenient form to identify the data generating mechanism of the dependent variable and in turn helps to select the best estimator by applying maximum likelihood methods to estimate a regression model based on the generalized gamma distribution.

The probability density function for the generalized gamma is parameterized as a function of κ, μ, and σ:

$$f(y;\kappa,\mu,\sigma)=\frac{\gamma^{\gamma}}{\sigma y\sqrt{\gamma}\Gamma(\gamma)}\exp\left[z\sqrt{\gamma}-w\right] \quad y\geq 0$$

(3.6)

The gamma has a pdf that can be either monotonically declining throughout the range of support or bell shaped. The gamma is often a reasonable fit for variables such as claim size and annual income. Gamma random variables are continuous, non-negative and skewed to the right, with the possibility of large values in the upper tail.

3.5 Designs and Evaluation.

The primary estimates of interest in this study are:

(1) The mean, standard error and 95% interval of the simulation estimates of the slope β1 of ln(E(y)) with respect to x. The mean provides evidence on the consistency of the estimator, while the standard error indicates the precision of the estimate.

(2) The mean residual, to see if there is any overall bias in the prediction of y. The mean provides evidence on the consistency of the overall level of the response.

Finally we also employ all the tests for identifying distributions based on the generalized gamma regression we performed Wald tests on the parameter and variance estimates of the ancillary parameter.

CHAPTER FOUR

4.0 DATA ANALYSIS AND RESULTS

4.1 Sources of Data

Secondary data was sourced and used for the purpose of addressing the main research objectives of this project.

Data in regard to employments trend in the private sector of Kenya economy is sourced from Kenya Bureau of Statistics. The appendix 3 shows employment statistics in Kenya for the period 2005 to 2010 per sector. This data is sourced from Kenya bureau of statistic. The population data is the key variable for modelling pension fund growth.

On the other hand data relating to the net worth of pension fund since 2000, performance of the pension fund over a given period and growth of active contributor and retires is sourced from RBA. Appendix 2 and 4 gives pension funds asset classes in Kenya for the period 2000 to 2011 and the fund value per each asset class is in million Kenya shilling. This data is sourced from the retirement benefits authority

Expected future riskless interest rate is modelled from the past rate and this data is sourced from central bank of Kenya and Nairobi stock exchange. Appendix 5 shows key interest rate from Central Bank of Kenya key Interests Rates for the period from year 2002 to 2012. Appendix 1 give declared rate of return by different insurance companies in Kenya for the period 2000 to 2010 which is sourced from the Retirement Benefits Authority for comparison purpose.

4.2 Data Analysis and Results

Based on equation (3.4) the data analysis and result is based on the following key variable that are; the private sector population, risk free interest and pension fund value from time t1

4.3 Analysis of Parameter Estimates Results

Call:
GLM(formula = Fundt ~ fundt1 * Interest * Population, family = Gamma(log),

data = nai)

Table (4.31)

The table below shows the deviance residuals (Min - Max)

Deviance Residuals:				
Min	**1Q**	**Median**	**3Q**	**Max**
-0.117281	-0.030133	-0.007214	0.036008	0.107784

Table (4.32)

The table below shows interaction of the estimates variables

Coefficients:			
	Estimate	**Std. Error**	**t value Pr(>|t|)**
(Intercept)	3.382e+01	5.038e+00	6.713 1.04e-07 ***
Fund t1	6.816e-05	2.861e-05	-2.382 0.022945 *
Interest	1.569e+00	6.277e-01	-2.499 0.017447 *
Population	7.796e-05	1.785e-05	-4.367 0.000112 ***
Fund t1: Interest	3.890e-06	3.360e-06	1.158 0.255050
Fund t1: Population	2.532e-10	1.046e-10	2.420 0.020997 *
Interest: Population	5.362e-06	2.201e-06	2.436 0.020230 *
Fund t1: Interest: Population	1.331e-11	1.229e-11	-1.083 0.286641

Signif.codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 ' ' 0.1 ' ' 1

(Dispersion parameter for Gamma family taken to be 0.003864153)

Null deviance: 7.26736 on 41 degrees of freedom
Residual deviance: 0.13146 on 34 degrees of freedom
AIC: 927.86

Number of Fisher Scoring iterations: 4

Explanation of the Parameter Estimates Analysis

The fitted generalized linear model fitted for the data above in results (4.3) is based on Gamma Family of distributions. The Gamma regression is special since it models continuous response variables given a set of covariates. In the Table (4.32) it's clear that the constant coefficient (with a value 3.382e+01) is very significant to the model.

The lagged value of the fund has important contribution to the model for its p-value is less than 0.05 (level of significance) with a value (6.81e-05) meaning the value has a positive relationship to the growth of the fund. Interest is also an important factor having a coefficient value (1.569e+00), which implies as interest increases; the value of the fund tends to increase. The population under cover also affects the growth of the fund positively.

We also investigated the interactions, where an interaction between the lagged funds amount and population size happened to be significant with its p-value is less than 0.05 (level of significance) with a value (2.532e-10) meaning the value has a positive relationship to the growth of the fund. So the interaction between interest rate and the population also happens to be significant

4.4 Analysis of Deviance

Anova(GLM.2, type="II", test="F")

Analysis of Deviance Table (Type II tests)

Table (4.41) the table below gives analysis of deviance

Response: Fund				
	SS	**Df**	**F**	**Pr(>F)**
Fund t1	1.16777	1	302.2059	< 2.2e-16 ***
Interest	0.00990	1	2.5609	0.11879
Population	0.00074	1	0.1921	0.66398
fundt1: Interest	0.02606	1	6.7431	0.01380 *
fundt1: Population	0.25980	1	67.2340	1.447e-09 ***
Interest: Population	0.02428	1	6.2834	0.01713 *
Fund t1: Interest: Population	0.00462	1	1.1946	0.28209
Residuals	0.13138	34		

Signif.codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Explanation of the Deviance

From the above results the ANOVA for the covariates, the lagged fund is important interaction between lagged fund and population, lagged fund and interest rates and finally interest and population as being important.

4.5The Wald Test

Table (4.51) below are results for simultaneous parameter test

Simultaneous parameter test(wald test)			
Confint(GLM.2, level=0.95, type="Wald")			
	Estimate	**2.5 %**	**97.5 %**
(Intercept)	3.381545e+01	2.394197e+01	4.368893e+01
Fund t1	6.816299e-05	-1.242435e-04	-1.208251e-05
Interest	1.568642e+00	-2.798922e+00	-3.383628e-01
Population	7.796485e-05	-1.129540e-04	-4.297573e-05
Fund t1: Interest	3.889978e-06	-2.695617e-06	1.047557e-05
Fund t1: Population	2.532187e-10	4.816719e-11	4.582703e-10
Interest: Population	5.362288e-06	1.048362e-06	9.676215e-06
Fund t1: Interest: Population	1.330598e-11	-3.739726e-11	1.078531e-11

Explanation of the Simultaneous Parameter Test

Wald test here is used to test the joint significance of a subset of coefficients, which are interest rate and the population. These two variables are individually significant based on t-tests with low p values

4.6 Hypothesis Testing

Based on the objective of the study we formulate a hypothesis as below

The Population and interest rate have tremendous positive effect on the growth of the pension funds

H_0: (p value <0.05)

H_1: (p value >0.05)

Based on the result on table (4.32) the interaction of the fund amount and the variables is significant since (P<0.05) hence we accept the hypothesis H_0

CHAPTER FIVE

5.0. CONLUSION AND RECOMMENDATIONS

5.1 CONLUSION

In this study we explored the performance of alternative generalized linear model estimators for the response of the expected value of y based on result on table (4.32) the p-value of interaction of fund value and the variables i.e. population with a value (2.532e-10) and interest with a value of (5.362288e-06) is less than 0.05 (level of significance) hence a prove of a positive relationship. However no single estimator was dominant or nearly dominant under all circumstances. But one pattern was clear. The GLM models would be unbiased but could be quite imprecise if the log-scale error was symmetric but heavy-tailed or if the log scale error variance is large (>1).

The Generalized Gamma Model (GGM) is not a full substitute for a careful examination of the model to see if the data exhibit the pattern we would expect of this class of models. Nor is it a substitute for a careful examination of linearity, functional form, and the link function as per results of table (4.41) on analysis of deviance. In a related paper, *(Basu and Rathouz, 2003*) extend the formulation of GLM models to select the power for the link and variance functions (distribution) simultaneously. They show the nature in the bias from selecting the wrong link function.

Moreover it's clearly evident that the population and interest rate have direct relationship with the growth of the pension. Based on the results above it's evident that the key variable determining pensions funds growths are population size and interest rate. From the result on table (4.32) we realize that the interaction between the lagged funds amount and population size is significant and also the interaction between the lagged funds amount and interest is also significant. The hypothesis test (4.5) where we accept H_0: (p value <0.05) confirms that the Population and interest rate have tremendous effect on the growth of the pension funds.

5.2. RECOMMENDATIONS

Based on the on the first conclusion in (5.0)and the result of table (4.32) where an increase in contributing population and higher interest rate has a positive effects of fund growth, and currently in the republic if Kenya the level of active participant in the pension schemes compared to the working labor force as at lowest level. For the government to avoid future risk of old age poverty mandatory pension scheme should be established with minimum contribution rate that will ensure income replacement ratio after retirement is more than 60% of income at retirement. Individuals should be encouraged to supplement their social security pension through adequately regulated and supervised occupational and personal pension scheme. There should be strengthening of the financial sector by the Capital Market Authority and availability of appropriate investments to absorb the increasing pension funds. Since it has been observed that the relationship between pension fund and interest and population is very strong, attention must be paid to the investment of the funds so as to ensure the sustainable growth of the economy particularly infrastructure development. There must be continuous monitoring of investment portfolio by the Retirement Benefits Authority so as to generate more returns to sustain the investment of the funds.

As per conclusion three in (5.0) and the result of (4.32) where the interaction between the lagged funds amount and population size and interest yield a positive growth of fund size then as a result the enormous fund generated from pension contribution can be channeled to the development of the infrastructure in the country. Pension funds have been expanding and will continue such a trend in coming decades given the population growth and proper investment of the funds

Since high interest rate have a positive effects growth of pension funds based on the first conclusion in (5.0) and acceptance of the hypothesis testing (4.5) where we accept H_0: (p value <0.05)and driven by the high rate of return arising from the investment firms responsible for investment of pension funds. Pension funds will tend to grow and this will be advantageous for the central and county governments that need funds for infrastructure development.

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APPENDIX 1

Below is table of declared rate of return by different insurance companies in Kenya for the period 2000 to 2010

INSURANCE COMPANY NET RATES OF RETURNS TO RETIREMENT BENEFITS SCHEMES 2000 - 2010											
Company	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Apollo Insurance	10.00%	10.50%	10.00%	10.00%	8.00%	11.00%	12.50%	11.00%	4.00%	10.00%	11.00%
British American	10.00%	9.60%	8.60%	10.00%	7.50%	10.25%	18.00%	10.50%	6.00%	9.00%	15.00%
CFC Life	11.50%	11.50%	9.00%	8.00%	7.50%	8.50%	11.00%	9.50%	5.00%	6.00%	10.00%
Corporate Insurance	10.00%	5.00%	5.70%	10.50%	5.00%	5.00%	10.00%	8.00%	8.00%	8.00%	8.00%
Heritage Insurance	11.00%	10.50%	8.50%	8.00%	8.00%	8.75%	15.00%	13.00%	8.00%	6.00%	10.00%
ICEA	10.00%	10.00%	6.50%	7.25%	6.00%	7.62%	9.00%	9.25%	8.10%	8.15%	11.50%
Jubilee Insurance	12.00%	11.75%	10.75%	10.25%	9.50%	10.50%	12.75%	12.00%	8.00%	8.20%	12.75%
Kenindia Insurance	11.50%	11.50%	10.50%	9.25%	8.50%	10.00%	11.00%	11.00%	9.50%	11.00%	12.00%
KenyaAlliance	7.50%	7.50%	8.50%	8.00%	5.00%	10.00%	10.00%	11.00%	6.00%	7.00%	10.00%
Madison Insurance	5.00%	7.50%	6.00%	6.00%	6.00%	7.00%	10.00%	9.00%	5.00%	8.25%	10.00%
The Monarch	10.00%	10.90%	10.79%	5.60%	6.00%	9.00%	10.00%	10.00%	12.00%	12.00%	10.00%
UAP Insurance	10.00%	10.50%	8.00%	15.00%	12.50%	12.50%	16.00%	10.00%	7.50%	5.00%	10.00%
Pan Africa Insurance	7.00%	10.00%	9.00%	9.00%	9.00%	11.00%	12.50%	11.00%	10.00%	10.00%	12.50%
Mercantile Insurance	8.00%	8.00%	7.00%								
Average Declared Rate	**9.65%**	**9.75%**	**8.60%**	**8.99%**	**7.58%**	**9.32%**	**12.13%**	**10.40%**	**7.51%**	**8.33%**	**10.70%**

(*Source Retirement Benefits Authority*)

APPENDIX 2

Pension Funds Asset Classes in Kenya for the period 2000 to 2011 and the fund value per each asset class is in million Kenya shilling

		ASSET CLASSES In Millions										
Year	2011	Cash & Demand Deposits	Fixed Deposits	Fixed Income	Government Securities	Quoted Equity	Unquoted Equity	Offshore	Immovable Property	Guaranteed Funds	Other	Totals
	4	6,829.30	21,925.00	20,969.00	145,739.00	93,015.17	3,662.00	5,248.00	57,758.00	48,031.00		403,176.47
	2	5,385.55	20,039.47	19,500.76	158,697.82	123,170.64	3,265.65	15,963.11	54,248.57	40,105.37	58.43	440,435.38
Year	2010											
	4	7,296.61	16,797.81	21,044.78	143,334.51	130,296.33	2,501.83	15,346.54	50,010.89	33,257.04	982.23	420,868.57
	2	7,845.03	16,829.19	14,542.43	144,249.62	111,089.51	1,962.93	13,338.58	49,852.40	36,821.81	124.65	396,656.15
Year	2009											
Quarter	4	5,118.05	7,805.08	14,501.21	113,601.38	83,439.34	1,974.78	10,700.27	46,095.81	30,632.38	-	313,868.30
	3											
	2	4,430.06	9,604.69	6,877.99	106,722.34	83,140.07	1,796.26	5,913.11	42,694.97	26,534.01		287,713.50
	1	4,243.05	11,624.44	7,023.67	94,379.23	69,155.24	999.4	5,885.04	36,520.25	25,125.84	4,413.18	259,369.34
Year	2008											
Quarter	4	4,192.12	14,163.77	7,493.46	87,560.37	85,161.74	1,775.49	6,124.08	34,933.56	26,418.28	4,460.88	272,283.75
	3	4,428.26	11,197.54	6,301.54	81,234.79	92,676.06	1,667.03	7,917.97	32,458.85	25,679.20	4,467.13	268,028.37
	2	6,086.03	11,121.72	5,242.58	83,847.24	111,325.41	1,683.69	10,195.29	33,632.57	23,378.76	4,748.06	291,261.35
	1	10,153.40	8,526.74	4,604.10	79,601.07	88,995.14	1,705.69	8,925.70	38,268.51	22,389.87	531.86	263,702.08
Year	2007											
Quarter	4	6,677.09	7,022.05	4,556.28	78,536.26	95,242.10	1,648.46	9,699.55	38,389.27	21,529.91	394.86	263,695.83
	3	3,496.22	7,272.45	3,703.37	79,369.80	96,271.23	2,102.28	10,541.10	41,727.98	17,883.00	286.88	262,654.31
	2	5,239.72	5,525.90	3,848.75	73,179.81	87,497.56	1,977.34	10,495.03	36,376.52	17,679.17	2,818.46	244,638.26
	1	6,926.00	3,886.72	2,644.00	70,670.48	86,449.93	2,146.27	11,709.00	36,780.95	19,318.00	585	241,116.35
Year	2006											
Quarter	4	2,831.03	4,043.58	5,370.91	65,854.56	76,191.45	2,203.21	8,885.87	40,873.11	17,517.19	248.04	224,018.95
	3	2,397.25	5,045.48	5,473.56	63,279.38	69,254.18	2,154.13	8,330.94	39,734.45	16,320.56	313.71	212,303.64
	2	2,564.76	3,564.46	5,496.15	64,035.27	53,602.65	2,167.90	7,759.33	39,797.05	15,782.09	205.36	195,004.96
	1	3,906.08	3,566.26	5,387.77	57,503.11	46,474.00	2,385.79	7,886.99	35,793.81	15,296.96	99.07	178,299.84
Year	2005											
Quarter	4	1,743.10	4,213.10	5,904.90	56,802.40	44,869.50	2,375.90	6,818.20	39,306.10	14,743.80	17.9	176,794.90
	3	2,282.10	4,638.20	4,348.20	57,253.60	45,150.70	2,576.10	6,230.00	38,236.10	14,452.00	43.1	175,210.10
	2	2,940.80	5,644.40	4,969.20	51,941.10	29,411.30	595.6	5,163.70	35,012.20	13,918.10	4,082.70	153,679.10
	1	3,072.10	6,382.90	5,267.10	48,522.90	23,633.30	580.9	4,321.50	35,303.30	12,814.00	3,739.20	143,637.20
Year	2004											
Quarter	4	1,611.90	6,404.60	4,969.60	46,859.90	22,899.50	447	4,667.00	35,234.70	12,846.20	3,670.40	139,610.80
	3	1,881.80	4,630.50	4,023.30	45,845.40	22,598.70	351.2	4,847.80	35,267.80	11,553.60	3,622.00	134,622.10
	2	1,711.90	3,592.40	4,313.30	44,074.60	22,159.40	473.7	4,833.20	35,091.80	11,830.80	3,715.30	131,796.40
	1	1,866.10	3,266.20	4,605.50	42,383.60	24,040.30	696.9	4,918.30	35,112.30	11,773.80	3,669.70	132,332.70
Year	2003											
Quarter	4	1,223.30	4,444.40	4,827.80	39,881.30	25,770.50	591.5	4,739.20	36,191.90	11,332.20	3,757.30	132,759.40
	3	2,124.50	2,727.80	4,950.10	41,046.80	19,460.20	721.4	3,825.90	35,190.90	10,231.00	3,667.50	123,946.10
	2	4,878.20	1,794.30	5,195.90	37,634.30	14,812.30	710.7	2,926.70	35,873.00	10,029.10	3,207.80	117,062.30
	1	5,464.90	3,800.60	4,946.70	35,885.48	12,577.00	470.1	2,339.60	35,205.10	9,638.40	3,759.00	114,086.88
Year	2002											
Quarter	4	5,995.40	3,811.10	6,973.40	35,238.70	10,860.00	1,276.50	2,875.30	41,292.90	9,152.90	4.6	117,480.80

(Source Retirement Benefits Authority)

APPENDIX 3

Employment statistics in Kenya for the period 2005 to 2010 per sector

	2005	2006	2007	2008	2009	2010*
Private agriculture and forestry	272,400.00	280,300.00	289,000.00	289,700.00	288,000.00	291,800.00
Rest of private sector	885,000.00	927,400.00	992,700.00	1,016,200.00	1,058,500.00	1,105,200.00
Public service	654,200.00	649,900.00	628,100.00	638,000.00	653,500.00	663,400.00
Total	1,811,600.00	1,857,600.00	1,909,800.00	1,943,900.00	2,000,100.00	2,060,400.00
Source: Kenya National Bureau of Statistics.						
* Provisional						
WAGE EMPLOYMENT BY SECTOR, 2005 - 2010						
Sector	2005	2006	2007	2008	2009	2010*
Private						
Minority shareholding by the public sector..	80,800.00	84,300.00	89,500.00	91,100.00	93,900.00	97,500.00
Incorporated Companies						
Local public..	112,100.00	117,000.00	124,200.00	126,400.00	130,500.00	135,400.00
Local private	435,300.00	454,300.00	482,200.00	491,500.00	506,600.00	525,600.00
Foreign public	97,700.00	101,900.00	108,200.00	110,200.00	113,700.00	117,900.00
Foreign private	115,500.00	120,500.00	127,900.00	130,300.00	134,400.00	139,400.00
Co-operatives	84,100.00	87,700.00	93,100.00	94,800.00	97,800.00	101,400.00
Other private sector	231,900.00	242,000.00	256,600.00	261,500.00	269,700.00	279,900.00
Total	1,157,400.00	1,207,700.00	1,281,700.00	1,305,900.00	1,346,500.00	1,397,000.00

(Source;Kenya Bureau of Statistic)

APPENDIX 4

Pension Scheme Statistic in Kenya for period 2008 from retirement benefits authority data

	Occupational & Individual		
2008	**Schemes**	**NSSF**	**TOTAL**
Number of Schemes	1003	1	1004
Pensioners	32,079		32079
New Entrants	32,991		32991
Leavers	17,895		17895
Deferred Members	8,885		8885
Contributing Members	298,742	1,115,241	1413983
CONTRIBUTIONS			
2008	**Schemes**	**NSSF**	**TOTAL**
Total Employee Contributions	11,799,043,501	3,125,461,000	14,924,504,501
Total Employee Contributions	7,672,721,976	2,544,892,000	10,217,613,976
Not specified	3,151,600,278	0	3,151,600,278
Total Contributions	**22,623,365,755**	**5,670,353,000**	**28,293,718,754.85**
BENEFITS			
2008	**Schemes**	**NSSF**	**TOTAL**
Emigration grant	-	16,506,000	16,506,000.00
Funeral grant	-	3,395,000	3,395,000.00
Deferred Benefits	367,872,974	-	367,872,974.03
Retirees/Lumpsum Benefits	5,760,986,194	1,028,019,000	6,789,005,194.31
Death Benefits	152,306,517	265,502,000	417,808,517.00
Withdrawals(others)	6,629,569,032	1,061,931,000	7,691,500,031.64
Not specified	3,082,300,164	-	3,082,300,163.50
Total Benefits	15,993,034,880	2,375,353,000	18,368,387,880.48
Underpaid to leavers	1,942,875,385	-	1,942,875,385.00
Overpaid to leavers	998,765	-	998,765.00
Transfer In	1,604,793,918	-	1,604,793,918.05
Transfer Out	5,526,655,914	-	5,526,655,914.00
INVESTMENT INCOME			
2008	**Schemes**	**NSSF**	**TOTAL**
Investment Income - Dividends	1,560,605,695	1,191,268,000	2,751,873,694.55
Investment Income - Interest	9,583,149,283	1,022,504,000	10,605,653,282.91
Other Income	1,439,098,183	2,206,736,000	3,645,834,183.36
Rental income	2,007,698,829	615,176,000	2,622,874,829.00
Not specified	375,696,695	-	375,696,695.25
Total Investment Income	14,966,248,685	5,035,684,000	20,001,932,685.07
NET ASSET			
2008	**Schemes**	**NSSF**	**TOTAL**
Net Assets	214,618,552,745	90,508,481,000	305,127,033,744.96

(Source Retirement Benefits Authority)

APPENDIX 5

Central of Kenya key Interests Rates for the period from year 2002 to 2012

COMMERCIAL BANKS' WEIGHTED AVERAGE INTEREST RATES (%) 1/				CENTRAL BANK RATES				
YEAR	MONTH	**Lending**	**Overdraft**	**Repo**	**Interbank**	**91-Day Tbill**	**182-days Tbill**	**364-days Tbill**
2002	JAN	19.30	19.31	10.81	10.29	10.85		
	FEB	19.18	19.19	10.51	9.79	10.61	11.12	
	MAR	18.86	18.78	10.19	10.05	10.14	10.60	
	APR	18.69	18.88	10.07	9.64	10.01	10.47	
	MAY	18.54	18.73	9.12	8.54	9.04	9.98	
	JUN	18.38	18.46	8.11	8.19	7.34	8.80	
	JUL	18.12	18.32	8.20	7.63	8.63	9.36	
	AUG	18.12	18.56	8.20	8.25	8.34	9.49	
	SEP	18.14	18.52	7.56	7.29	7.60	8.62	
	OCT	18.34	18.89	7.84	8.30	8.07	8.54	
	NOV	18.05	18.56	7.91	8.12	8.30	8.76	
	DEC	18.34	18.56	8.14	8.69	8.38	8.79	
2003	JAN	19.02	18.52	8.17	9.04	8.38	8.73	
	FEB	18.83	17.81	7.17	7.06	7.77	8.14	
	MAR	18.49	17.26	6.23	6.22	6.24	6.64	
	APR	18.57	17.27	5.94	5.88	6.25	6.83	
	MAY	18.52	17.18	5.50	5.67	5.84	6.68	
	JUN	15.73	14.93	0.84	1.62	3.00	4.12	
	JUL	15.30	14.43	0.78	0.45	1.54	2.95	
	AUG	14.81	14.96	0.48	0.43	1.18	2.12	
	SEP	14.82	14.31	0.47	0.54	0.83	1.35	
	OCT	14.75	14.13	0.56	0.69	1.00	1.61	
	NOV	14.07	14.02	0.64	0.73	1.28	1.88	
	DEC	13.47	13.74	0.78	0.81	1.46	2.09	
2004	JAN	13.48	13.30	1.06	0.82	1.58	2.35	
	FEB	13.01	12.30	1.13	0.90	1.57	2.33	
	MAR	13.12	11.65	1.27	1.27	1.59	2.53	
	APR	12.67	11.08	1.56	1.72	2.11	3.12	
	MAY	12.55	10.79	1.56	2.05	2.87	3.61	
	JUN	12.17	10.72	1.29	1.29	2.01	3.15	
	JUL	12.31	11.10	1.49	1.52	1.71	2.98	
	AUG	12.19	10.81	1.94	2.10	2.27	3.49	
	SEP	12.27	10.95	2.50	2.95	2.75	4.03	
	OCT	12.39	11.85	2.76	3.56	3.95	5.16	
	NOV	11.97	12.21	4.95	4.66	5.06	6.03	
	DEC	12.25	12.69	8.97	9.41	8.04	8.19	
2005	JAN	12.12	13.14	7.25	8.72	8.26	8.76	
	FEB	12.35	13.82	7.23	8.14	8.59	8.96	
	MAR	12.84	14.03	7.26	8.13	8.63	8.91	
	APR	13.12	14.00	7.28	8.28	8.68	8.92	

	MAY	13.11	13.94	7.26	8.30	8.66	9.02	
	JUN	13.09	13.83	7.34	7.37	8.50	8.96	
	JUL	13.09	13.54	7.43	7.51	8.59	9.08	
	AUG	13.03	13.81	7.67	7.77	8.66	9.09	
	SEP	12.83	13.50	7.77	8.03	8.58	8.90	
	OCT	12.97	13.56	7.80	7.98	8.19	8.52	
	NOV	12.93	13.33	7.72	7.64	7.84	8.37	
	DEC	13.16	13.67	7.74	7.79	8.07	8.49	
2006	JAN	13.20	13.81	7.81	7.78	8.23	8.84	
	FEB	13.27	13.34	7.78	7.73	8.02	8.85	
	MAR	13.33	13.26	7.50	7.52	7.60	8.52	
	APR	13.51	13.81	6.78	6.97	7.02	7.36	
	MAY	13.95	14.02	6.68	8.11	7.01	7.48	
	JUN	13.79	13.78	6.39	6.41	6.60	7.32	
	JUL	13.72	13.48	5.73	5.74	5.89	6.42	
	AUG	13.64	13.43	5.94	5.66	5.96	6.47	
	SEP	13.54	13.42	6.16	6.02	6.45	7.45	
	OCT	14.01	13.94	6.23	6.08	6.83	8.31	
	NOV	13.93	13.96	6.33	6.18	6.41	7.99	
	DEC	13.74	13.91	6.34	6.34	5.73	7.32	
2007	JAN	13.78	14.11	6.43	6.43	6.00	8.28	
	FEB	13.64	14.05	6.75	6.52	6.22	8.56	
	MAR	13.56	13.95	6.70	6.55	6.32	7.97	
	APR	13.33	13.26	6.84	6.81	6.65	7.93	
	MAY	13.38	13.35	7.03	7.11	6.77	7.98	
	JUN	13.14	13.20	7.07	6.98	6.53	7.19	
	JUL	13.29	13.34	7.19	7.07	6.52	7.17	
	AUG	13.04	13.39	7.49	7.38	7.30	7.99	
	SEP	12.87	13.26	7.81	7.59	7.35	7.82	
	OCT	13.24	13.29	7.44	7.65	7.55	7.84	
	NOV	13.39	13.43	6.42	6.50	7.52	8.04	
	DEC	13.32	12.96	7.13	7.05	6.87	7.87	
2008	JAN	13.78	13.41	7.75	7.66	6.95	8.09	
	FEB	13.84	13.26	6.90	7.18	7.28	8.30	
	MAR	14.06	13.48	6.46	6.35	6.90	7.82	
	APR	13.91	13.46	6.67	6.59	7.35	8.30	
	MAY	14.01	13.53	7.42	7.72	7.76	8.75	
	JUN	14.06	13.30	7.61	7.79	7.73	8.84	
	JUL	13.90	13.46	7.41	8.07	8.03	9.09	
	AUG	13.66	13.11	6.35	6.92	8.02	8.75	
	SEP	13.66	13.43	6.06	6.70	7.69	8.08	
	OCT	14.12	13.91	6.03	6.81	7.75	8.32	
	NOV	14.33	13.85	6.27	6.83	8.39	8.86	
	DEC	14.87	14.39	6.36	6.67	8.59	9.08	
2009	JAN	14.78	13.84	5.10	5.95	8.46	8.93	
	FEB	14.67	13.46	5.08	5.49	7.55	7.89	
	MAR	14.87	13.78	4.62	5.57	7.31	7.91	
	APR	14.71	13.66	4.05	5.81	7.34	8.34	

	MAY	14.85	14.13	6.18	5.55	7.45	8.77	
	JUN	15.09	14.41	-	3.08	7.33	8.28	
	JUL	14.79	13.94	-	2.69	7.24	8.14	
	AUG	14.76	13.90	-	3.68	7.25	8.12	8.71
	SEP	14.74	13.76	-	3.38	7.29	8.09	
	OCT	14.78	14.03	-	2.57	7.26	7.98	8.44
	NOV	14.85	14.24	-	3.11	7.22	8.02	
	DEC	14.76	14.13	-	2.95	6.82	7.38	8.01
2010	JAN	14.98	14.25	-	3.69	6.56	7.02	
	FEB	14.98	14.25	-	2.39	6.21	6.61	7.38
	MAR	14.80	13.59	-	2.21	5.98	6.34	
	APR	14.58	14.50	-	2.46	5.17	5.58	6.01
	MAY	14.46	14.38	-	2.16	4.21	4.41	-
	JUN	14.39	14.23	-	1.15	2.98	2.86	4.14
	JUL	14.29	14.03	-	1.35	1.60	1.72	-
	AUG	14.18	13.97	-	1.66	1.83	2.03	2.96
	SEP	13.98	13.81	-	1.18	2.04	2.14	-
	OCT	13.85	13.64	-	0.98	2.12	2.10	3.06
	NOV	13.95	13.77	-	1.01	2.21	2.28	-
	DEC	13.87	13.69	-	1.18	2.28	2.59	3.36
2011	JAN	14.03	13.93	-	1.24	2.46	2.70	3.69
	FEB	13.92	13.65	-	1.13	2.59	2.76	3.72
	MAR	13.92	13.60	1.66	1.24	2.77	3.06	4.00
	APR	13.92	13.68	4.50	3.97	3.26	3.51	5.00
	MAY	13.88	13.72	5.72	5.54	5.35	4.57	6.77
	JUN	13.91	13.59	5.73	6.36	8.95	9.93	-
	JULY	14.14	13.89	-	8.61	8.99	9.85	10.22
	AUG	14.32	14.28	-	14.29	9.23	10.15	11.07
	SEP	14.79	14.64	-	7.46	11.93	11.28	12.54
	OCT	15.21	14.87	18.89	14.95	14.80	14.68	14.50
	NOV	18.51	18.67	-	28.90	16.14	15.90	16.62
	DEC	20.04	20.20	17.75	21.75	18.30	18.30	20.96
2012	JAN	19.54	20.38	17.88	19.27	20.56	20.69	21.96
	FEB	20.28	20.53	13.78	18.15	19.70	19.88	20.96
	MAR	20.34	20.53	-	24.02	17.80	18.24	17.04
	APR	20.22	20.27	15.47	16.15	16.01	16.92	16.92
	MAY	20.12	20.41	16.97	17.16	11.18	12.71	12.43
	JUN	20.30	20.36	17.60	17.09	10.09	10.67	12.43
	JULY			14.31	13.71	11.95	12.21	13.00

1/ The weights correspond to each bank's market share in either deposit liability in the case of deposit interest rates or loans and advances in the case of lending rates.

Source: Central Bank of Kenya