A SURVEY OF ASSET LIABILITY MANAGEMENT AMONG DEFINED BENEFITS PENSION SCHEMES IN KENYA.

BY:

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DECLARATION

This management research project is my original work and has not been presented for a degree in another University.

Signed _____ Date 16/11/10.

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This management research project has been submitted for examination with my approval as University supervisor

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Last but not least, I acknowledge my wife Roselyne, daughters Tiffany, Kylie and Raissa, family, friends and colleagues for their encouragement , ideas and support, without which, I would not have gone this far.

DEDICATION

To my loving parents who brought me up to be whom I am today. Forever will be grateful.

ABSTRACT

This study sought to examine the strategic asset allocation and the asset/liability management in pension schemes in Kenya. The study specifically surveyed the asset liability management in defined benefits schemes in Kenya

The study sought to compare the asset liability structure of defined benefit schemes in the period January 2002 to December 2008, a period of 7 years. The population of the study consisted of all defined benefits pension funds in Kenya, registered with the retirement benefits authority (RBA), a number of 142. Preference was given to schemes that are at least five years old by the end of year 2008. The data collected was secondary data from the financial records of the pension schemes. For every pension fund, age structure data, solvency margin data and asset allocation information was collected. Correlation and regression analyses were carried out and their significance analyzed.

The majority of the pension funds under study held their assets were held in liquid assets as evidenced by the 40.12% average cash and cash equivalents holding. In the same period equity holdings and fixed income holdings averaged 21.04% and 10.66% respectively. The relationship between cash assets, fixed income and equity were all negatively correlated. The regression analysis indicates that there is a statistically significant positive relation between the proportional fixed income investment and the average age (significant at 5% level). One year's increase in the average age increases the proportion of fixed income investment by 1.2 percent. The relation between the proportional equity investment and the average age is negative, and it is statistically

significant at 5% level. One year's increase in the average age decreases the proportion of equity investment by 1.1 percent. The results indicate that there is a relationship between the liability structure and the asset allocation. While pension funds with younger participants have more equity exposure, more mature pension funds have more fixed income investments.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

The pension fund industry, in both developed and emerging market countries, has grown rapidly during the past decade. In developed countries, demographic changes are the main factors driving the growth of pension fund assets. The rapid aging of the populations in these countries has increased the fiscal burden of national pay-as-you-go systems since the support ratio, that is the ratio between those who have retired and those still working, has increased substantially (Chan-Lau, 2005).

There are numerous socio-economic factors explaining the rising popularity of pension and provident funds. Fabozzi et al (1998) argue that pension funds popularity is due to three main factors. First, they contend that income and wealth have grown steadily after the Second World War, leaving households with more money for long term savings. Secondly, they argue that the life span of people has increased leading to more expected financial needs for longer retirement periods. Lastly, they argue that pensions are a form of tax free pay to employees up to retirement when it ceases. With rising poverty levels and reduced life spans attributed to Aids scourge in developing countries, the first two factors seem to be entirely applicable to developed countries.

Investment performance of pension fund assets is regularly scrutinized by the management of the sponsoring firm for two basic reasons. First, for many firms, the value of their pension fund assets has grown to become significant when compared with the

firm's total assets. Second, most of the pension plans are of defined benefit type so that the performance of the fund directly affects the level of the firm's contribution to its pension fund. From the shareholders' viewpoint, therefore, the performance of the firm's pension fund directly affects the amount of contribution required to fulfill the promised benefits, and, thus, the shareholders' returns. If through active and skillful management the pension fund can achieve superior performance, shareholders will benefit due to the accompanying reduction in pension fund contribution levels. Because of the importance to the firm of managing the pension fund well, the pension's performance is often judged by the firm on a quarterly basis relative to other funds. (Jog, 1986)

Two of the most important tasks facing pension fund trustees are the appraising of past performance and the selection of fund managers. In both of these tasks performance measurement statistics play an important role. Within the pension fund industry trustees often act in the belief that there is consistency of performance from one quarter or year to another. The performance ranking of a fund within a league table of similar pension funds is considered to be of particular importance and significance [Brown, Davies, Draper and Pope (1994)].

In pension funds there are defined benefit schemes and defined contribution schemes. A defined contribution (DC) pension scheme provides an income for a pensioner after retirement from a fund built up from investing a series of contributions during the period of employment. The financial risk is taken by the member of the scheme since the fund is associated with an individual and there is no guarantee of a fixed benefit level at

retirement. The pension scheme is split into two phases. During the accumulation (or preretirement) phase, scheme members and/or their employer contribute to the pension fund, which is invested in a portfolio of assets with a particular risk profile. In the distribution (or postretirement) phase pensioners receive periodic income from the fund in order to provide support in old age. There are a number of mechanisms operating in different countries for distributing the pension fund (Lunnon, 2002)

In defined-benefit plans, the plan sponsor guarantees an agreed level of retirement benefits to the plan members. The plan sponsor, hence, bears the risk that the returns from the investment portfolio may not be enough to cover the pension fund liabilities, or funding gap risk. The plan sponsor can minimize this risk by choosing financial assets that match both the size and the volatility of the plan's liabilities. Matching the size of liabilities ensures that they would be appropriately covered by assets; matching the volatility of liabilities exactly implies that both assets and liabilities will be perfectly correlated and rules out the possibility that liabilities may exceed assets in the future. Perfect asset-liability matching both in size and volatility is not feasible. However, investments in domestic assets match better domestic liabilities than investments in foreign securities (Blake, 1999 and 2003, and Davis and Steil, 2001).

Stux (1995) divides pension fund portfolio management by using two steps. First, a pension fund needs to decide which broad asset classes to invest in. Typically, the asset classes include fixed income, equities, real estate, money market instruments, venture capital and private investments

This step is called strategic asset allocation and it is the most important part of a pension fund's asset management, as the strategic asset allocation decisions heavily affect the performance of a pension fund. The second step includes the actual implementation of the chosen strategic asset allocation by choosing internal or external fund managers and putting in practice the particular investment strategies and security selection process. This step is also important, but has less influence on pension fund's overall performance

A traditional view suggests that pension fund should only invest in a well-diversified fixed income portfolio, which can be duration-matched with the liability stream. The bond investment is also suggested due to the tax-advantages in some countries. Equity exposures are mainly for the higher expected rate of return on equity investments. This upside potential is especially needed in funds with younger participants, growing workforce and when salary inflation is expected. Real estate investments are considered to be an essential part of diversified investment portfolio, and therefore, pension funds also include real estate in their portfolio. Real estate is also considered to be a good hedge against the risk of inflation. Investments in a sponsor seem to make very little sense in terms of finance theory, due to their non-diversifying nature (Alestalo and Puttonen, 2006).

In order to meet the long-term future obligation, Chernoff (2003b) suggests that pension funds should return to basic asset liability management (ALM) practises. Ryan and Fabozzi (2002) also suggest that pension fund managers should avoid severe

underperformances and asset/liability mismatches every year, in order to follow an appropriate asset liability management (ALM).

According to Chernoff (2003a), a pension fund cannot just maximize its return by using traditional efficient frontier method. The correct way is to match pension assets against pension liabilities, and he simplifies: *"match the assets and the liabilities and go to bed"*. Ito (1995) argues that the aim of pension fund asset management is to provide funding for the pension liabilities, but a pension fund sponsor has also a secondary goal that is the achievement of an "earnings spread" (i.e. the positive gap between assets and liabilities). As these earnings spread can reduce the requirement for future contributions.

Asset-liability management (ALM) is a key method in strategic risk management. Asset-liability management (ALM) is a financial risk assessment and asset planning tool used by pension funds to help them choose the strategic pension policy under uncertainty in a coherent and consistent balance sheet approach (Blome, S. et al (2007).

In Kenya, Kenyan employers must pump Sh30 billion into company-sponsored pensions funds in the next 36 months to comply with new rules aimed at shielding contributors from risks associated with inadequate coverage of liabilities by financially troubled schemes. Industry regulator, the Retirement Benefits Authority (RBA's), data shows that 124 firms out of 78 defined benefit schemes, mostly State-owned corporations, are running pension schemes, whose liabilities exceed assets contrary to a directive that all schemes be fully funded. This means that the pension plans – especially those operating

under the defined benefit model that guarantees an income in retirement based on length of service and final salary — are likely to run into difficulties as members live longer upon retirement. (Omondi, M. (2010, August 12), Employers face Sh30bn top up bill in new pension rules. *Business Daily,* pp1).

1.2 Statement of the problem

The popularity of ALM in pension funds seems to have risen in recent years. Although asset and liability management (ALM) is a central issue in the pension fund management, empirical research within this topic appears to be fairly limited. Previous studies have either concentrated on presenting ALM theories and the optimal asset allocations for pension funds without any empirical research, or they have only described the pension funds' asset allocations without the use of a theoretical framework (Alestalo and Puttonen, 2006).

Feinberg (2002) reports that many pension funds are now conducting more asset/liability studies mainly due to the deterioration of their funded status. The demand for these asset/liability studies has occurred due to various reasons, including: market conditions; switching from defined benefit funds to defined contribution funds; additional contributions; increased liabilities due to the baby boomers retirement; and changes in the future benefits structure.

For both defined benefit and defined contribution funds, the portfolio distribution and the corresponding return and risk on the assets seek to match or preferably exceed the growth

of average labour earnings. This will maximize the replacement ratio (pension as a proportion of final earnings) obtainable by purchase of an annuity at retirement financed via an occupational or personal defined contribution fund, and reduce the cost to a company of providing a given pension in a defined benefit plan. This link of liabilities to labour earnings points to a crucial difference with insurance companies, in that pension funds face the risk of increasing nominal liabilities (for example, due to wage increases), as well as the risk of holding assets, and hence need to trade volatility with return (Davis 2002).

Notably, the nature of the liabilities is the key to understanding how institutional investors differ in their operations. A liability is a cash outlay made at a specific time to meet the contractual terms of an obligation issued by an institutional investor. Such liabilities differ in certainty and timing, from known outlay and timing to uncertain outlay and uncertain timing. Thus the nature of liabilities determines the institutions' liquidity needs (Davis 2000).

Pension funds are exposed to many sources of risks, particularly risks regarding the asset portfolio and actuarial risks. As a result, one of the greatest concerns of the board of a pension fund (and also of the sponsor) is the risk of underfunding: the risk that the value of the liabilities is higher than the value of the assets (Drijver, 2005).

Strategic asset allocation by pension funds has been the focus of most studies. Omonyo (2003) did a survey on investment practises of pension fund managers in Kenya. He

found that there was no significant difference in asset allocation strategies of different fund managers. He observed that risk and returns are key considerations in investment. Further, he identified market illiquidity as the main problem facing portfolio management, and that the regulations of the sector were general and not specific to the extent that fund managers could easily manipulate them to meet personal whims.

Gitu (2004) did a study on the factors affecting the equity allocation decisions made by trustees and fund managers of pension schemes in Kenya. He found out that there was much fear, diffidence, caution and general aversion by trustees and fund managers towards equities. This was due to high volatility in the Nairobi Stock Exchange, as a result of factors beyond the market per se. Investment performance was based on company profitability, history of dividend payout ratio and level of industry maturity.

Mwangangi (2006) did a survey of the applicability of Markowitz portfolio optimization model in the overall asset allocation decisions by pension fund managers in Kenya. The study found the main contributor to overall portfolio performance is the overall static weights across asset categories. It concluded that there was little applicability of Markowitz model due to lack of appropriate database/foundation to generate the necessary data. Study showed that risk and return as the main factors considered in asset allocation by fund managers.

The Retirement Benefits Authority (RBA's), data shows that 124 firms out of 78 defined benefit schemes, mostly State-owned corporations, are running pension schemes, whose

liabilities exceed assets contrary to a directive that all schemes be fully funded. This means that the pension plans – especially those operating under the defined benefit model that guarantees an income in retirement based on length of service and final salary — are likely to run into difficulties as members live longer upon retirement (Omondi, M. (2010, August 12), Employers face Sh30bn top up bill in new pension rules. *Business Daily,* pp1).

This study set out to investigate if the structure of pension liabilities is reflected in the investment horizon of defined benefits pension funds and the asset liability management practises employed by pension funds.

1.3 Objective of the study

To identify asset liability management being employed by the defined benefits pension funds.

1.4 Importance of the study

Investment Analysts:

To have an understanding on the influence of asset/ liability management in the portfolio selection of defined benefit schemes.

Academicians:

This study will open doors for further research and will lead to further improvements in this field of finance as well as a point of reference for both academicians and researchers

since it will prove further insight into asset/ liability management of Defined Benefit Schemes.

Investors/Pensioners:

The research will provide an understanding in the performance of Defined Benefits pension schemes and asset/ liability management of Defined Benefit Schemes.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

Pension funds have to decide periodically how to allocate the investments over different asset classes and what the contribution rate should be in order to fund its liabilities. Because of its long term obligations, Pension Funds' planning horizon is large. The solvency of the fund must be guaranteed by acceptable investment and contribution policies. The process requires a great amount of information about the organization, its operations and market performance (Davis, 2002).

This chapter examines the strategic asset allocation, choice of assets and asset liability management in defined benefits pension funds.

2.2 Retirement benefits schemes

Retirement benefit schemes are commonly known as pension schemes. Pension schemes have been defined in various ways but with the same general meaning. In the Britannica Concise Encyclopaedia, a pension is series of periodic money payments made to a person who retires from employment because of age, disability, or the completion of an agreed span of service. The payments generally continue for the rest of the recipient's natural life, and they are sometimes extended to a widow or other survivor. In the Columbia Thompson Gale Legal Encyclopaedia, a pension has been defined as a benefit, usually money, paid regularly to retired employees or their survivors by private businesses and federal state, and local governments. Employees are not required to establish pension benefits but do so to attract qualified employees (Kusewa, 2007)

Retirement benefits are classified in different ways. The common classifications are based on who established the scheme, how payments are made and how the scheme is designed.

A retirement benefit scheme can be classified as either occupational or individual based on who established the scheme

Mutuku (2004) gave the definition of an occupation retirement benefit scheme as a scheme to which access is linked to an employment relationship. These schemes are established by employers or groups of employers and membership is limited to employees of these employers.

An occupational pension is a private pension. Although the employer is responsible for sponsoring the scheme, it is actually run by a board of trustees. It is this board of trustees that is responsible for ensuring payment of benefits

Based on how benefits are paid, a retirement benefits scheme can either be a provident fund or a pension fund.

According to the Retirement Benefits Authority (RBA) website, a provident fund has been defined as a retirement benefits arrangement which provides a one of lump-sum payment at retirement. A provident fund is a scheme which pays benefits to members in the form of a lump sum. On attainment of retirement age, the member is paid the accumulated benefits in a single payment and the member has no further relationship with the scheme.

On the other hand, Retirement Benefits Authority (RBA) defines a pension scheme as a retirement benefits arrangement providing periodic payments (pension) upon retirement. The Columbia Encyclopaedia on the other hand defines a pension as a scheme where periodic payments are made to one who has retired from work because of age or disability (Kusewa, 2007).

Based on how the scheme is designed or how benefits are determined, a retirement benefits scheme can be classified as a defined contribution or defined benefit scheme.
In pension funds there are defined benefit schemes and defined contribution schemes. A defined contribution (DC) pension scheme provides an income for a pensioner after retirement from a fund built up from investing a series of contributions during the period of employment. The financial risk is taken by the member of the scheme since the fund is associated with an individual and there is no guarantee of a fixed benefit level at retirement. The pension scheme is split into two phases. During the accumulation (or preretirement) phase, scheme members and/or their employer contribute to the pension fund, which is invested in a portfolio of assets with a particular risk profile. In the distribution (or postretirement) phase pensioners receive periodic income from the fund in order to provide support in old age. There are a number of mechanisms operating in different countries for distributing the pension fund (Lunnon, 2002)

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funding gap risk. The plan sponsor can minimize this risk by choosing financial assets that match both the size and the volatility of the plan's liabilities. Matching the size of liabilities ensures that they would be appropriately covered by assets; matching the volatility of liabilities exactly implies that both assets and liabilities will be perfectly correlated and rules out the possibility that liabilities may exceed assets in the future. Perfect asset-liability matching both in size and volatility is not feasible. However, investments in domestic assets match better domestic liabilities than investments in foreign securities (Blake, 1999 and 2003, and Davis and Steil, 2001).

2.2.1 Defined contribution pension schemes

In a defined contribution pension fund the sponsors are only responsible for making contributions to the plan. There is no guarantee regarding assets at retirement, which depend on growth in the assets of the plan. Accordingly the financial risks to which the provider of a defined contribution plan (as opposed to beneficiaries) is exposed are minimal. In some cases, solely the sponsor and the investment managers it employs choose the portfolio distribution, and hence there is a risk of legal action by beneficiaries against poor investment. But increasingly, employees are left also to decide the asset allocation via choice of mutual funds (e.g. in the US 401(K) plans). The remaining obligation on the sponsor is to maintain contributions (Davis, 2000).

As regards portfolio objectives, a defined contribution pension plan should in principle seek to maximise return for a given risk, so as to attain as high as possible a replacement ratio at retirement. This implies following closely the standard mean-variance portfolio

optimization schema. As noted by Blake (1997), in order to choose the appropriate point on the frontier of efficient portfolios, it is necessary to determine the degree of risk tolerance of the scheme member; the higher the acceptable risk, the higher the expected value at retirement. The fund will also need to shift to lower risk assets for older workers as they approach retirement, thus reducing duration as outlined above and reducing exposure to market volatility shortly before retirement which might otherwise risk to sharply reduce pensions. They will imply marked portfolio shifts over time.

Until the approach of retirement necessitates a shift to bonds, the superior returns on equity are likely to ensure a significant share of the portfolio is accounted for by equities, depending on the degree of risk aversion. Where employers choose the asset mix, the degree of risk aversion is likely to be related to the fear of litigation when the market value of a more aggressive asset mix declines, where employees choose the asset allocation it is more direct risk aversion.

2.2.2 Defined benefit pension schemes

Unlike defined contribution funds, defined benefit funds are subject to a wide range of risks:

Real labour earnings will affect the replacement ratio which can be financed by the pension fund, and given there is usually a guarantee of a certain replacement rate, the fund is subject to risk from this source; Liabilities will also be influenced by interest rates at which future payments are discounted, and hence there are important interest rate risks; Mortality risks affect the cost of the annuities provided by the fund; Falling asset returns

will affect asset/liability balance. There are also risks of changes in government regulation (such as those of indexation, portability, vesting and preservation) that can vastly and unexpectedly change liabilities [Davis (2000)].

Defined benefit fund liabilities are, owing to the sponsor's guarantee, basically a form of corporate debt. Appropriate investment strategies will depend on the nature of the obligation incurred, whether pensions in payment are indexed and the demographic structure of the workforce. Investment strategies will also be influenced by the minimum-funding rules imposed by the authorities which determine the size of surplus assets (Bodie, 1991).

To further elucidate the appropriate strategies in the context of the nature of the defined benefit pension obligation, a number of definitions are needed. The wind-up definition of liabilities, the level at which the fund could meet all its current obligations if it were to be closed down completely, is known as the accumulated benefit obligation (ABO). The projected benefit obligation (PBO) implies that the obligations to be funded include a forward-looking element. It is assumed that rights will continue to accrue, and will be labour earnings-indexed up to retirement, as is normal in a final salary plan. The indexed benefit obligation (IBO) also assumes price-indexation of pensions in payment after retirement (Davis, 2000).

If the sponsor seeks to fund the accumulated benefit obligation, and the obligation is purely nominal, with a minimum-funding requirement in place, it will be appropriate, as for life insurers, to immunise the liabilities with bonds of the same duration to hedge the

interest rate risk of these liabilities. Unhedged equities will merely imply that such funds incur unnecessary risk (Bodie (1995).

With a projected benefit obligation target, an investment policy based on diversification may be most appropriate, in the belief that risk reduction depends on a maximum diversification of the pension fund relative to the firm's operating investments. Moreover, it is normal for defined benefit schemes which offer a certain link to salary at retirement for the liability to include an element of indexation. Then fund managers and actuaries typically assume that it may be appropriate to include a significant proportion of real assets such as equities and property in the portfolio as well as bonds. By doing this, they implicitly diversify between investment risk and liability risk (Ambachtsheer, 1988).

There are also tax considerations. As shown by Black (1980), for both defined benefit and defined contribution funds, there is a fiscal incentive to maximise the tax advantage of pension funds by investing in assets with the highest possible spread between pre-tax and post-tax returns. In many countries this tax effect gives an incentive to hold bonds. There is also an incentive to overfund with defined benefit to maximise the tax benefits, as well as to provide a larger contingency fund, which is usually counteracted by government-imposed limits on funding.

Blake (1997) noted that minimum funding levels and limits on overfunding provide tolerance limits to the variation of assets around the value of liabilities. If the assets are selected in such a way that their risk, return and duration characteristics match those of

liabilities, there is a "liability immunizing portfolio". This protects the portfolio against risks of variation in interest rates, real earnings growth and inflation in the pension liabilities. Such a strategy, which determines the overall asset allocation between broad classes of instrument, may be assisted by an asset-liability modelling exercise (ALM).

2.3 Regulation of the retirements benefits schemes in Kenya

The Retirement Benefits Act was to establish a Retirement Benefits Authority for the regulation, supervision and promotion of the retirement benefit schemes, the development of the Retirement Benefit Schemes (RBS) and for connected purposes [Kenya Gazette Supplement No. 63 (Acts No. 4) 1997, P.339]

The enactment of the Retirement Benefits Act was followed by the gazettement of the Retirement Benefits Regulations (2000). On the management of pension schemes, the Act puts in place a mandatory three-tier dispensation of Trustees, Asset Managers and Custodians. The duties of trustees include setting general investment guidelines for risk, return and asset allocation. Custodians on the other hand hold schemes assets (cash, ownership rights certificates among others) on behalf of the scheme participants. Managers make day-to-day decisions of buying and selling specific assets.

Section 25 of the Retirement Benefits Act provides that a manager be a limited liability company incorporated under the Companies Act, whose liability is limited by shares and whose main objective is to manage scheme funds and has such minimum paid up capital as may be prescribed. The role of scheme managers as provided in section 55 of the

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retirement benefits regulations 2000 are among others; to advise the scheme on the asset classes which are available for investment, to assist the scheme in formulating a prudent investment policy on the investment of scheme funds and to invest capital moneys which form part of the scheme subject to the adopted investment policy.

Further the regulations provide that " a manager shall not be liable for any loss, damage or depreciation in value of the scheme fund or pooled fund of any investment compromised therein or the income there from which may arise by reason of depreciation of the market value of the securities and other assets in which the scheme funds are invested unless such a loss, damage or depreciation in the value of the scheme fund arises from negligence whether professional or otherwise, willful default or fraud by the manager or any of his agents or employees.

2.4 Asset allocation by pension funds

The most fundamental decision of investing is the allocation of your assets. How much should you own in stocks? How much should you own in bonds? How much should you own in cash reserves? According to a recent study, that decision has accounted for an astonishing 94% of the differences in total returns achieved by institutionally managed pension funds. (Bogle [1994], p. 235)

Reilly and Brown (2000) define asset allocation as the process of deciding how to distribute an investor's wealth among different countries and asset classes for investment purposes. An asset class is comprised of securities that have similar characteristics

attributes, and risk return relationships. Although there are no shortcuts or guarantees to investment success, maintaining a reasonable and disciplined approach to investing will increase the likelihood of investment success over time. The process of managing an investment portfolio never stops once the funds are initially invested according to plan; the real work begins in monitoring and updating the status of the portfolio and investors needs.

Asset allocation is the primary determinant of both risk and return in many portfolios. Numerous studies have concluded that the percentage of distribution of financial assets (cash, stocks, bonds, international, real estate, venture capital, and other investments) has accounted for much of the variability of portfolio's return, while market timing and security selection typically account for a smaller percentage, although there is a much debate about these studies and their exact meaning. A common conclusion of many of these studies is that large percentage of the variability is attributable to asset allocation (Sharpe, 1992).

For pension fund managers the asset allocation process is guided by the schemes investment policy. Reilly and Brown (2000) define investment policy as a road map; in it investors specify the type of risks they are willing to take and their investment goals and constraints. While it does not guarantee investment success, a policy statement will provide discipline for the investment process and reduce the possibility of making hasty inappropriate decisions. They identify two important reasons for constructing an investment policy: First it helps the investor decide on realistic investment goals after

learning about the financial markets and risks of investing. Second it creates a standard by which to judge the performance of the portfolio manager.

2.4.1 Choice between asset classes

Flavin and Wickens (2006) examines the optimal allocation each period of an internationally diversified portfolio from the different points of view of a UK and a US investor. They find that investor location affects optimal asset allocation. The presence of exchange rate risk causes the markets to appear not fully integrated and creates a preference for home assets. Domestic equity is the dominant asset in the optimal portfolio for both investors, but the US investor bears less risk than the UK investor, and holds less foreign equity – 20% compared with 25%. Survey evidence indicates actual shares are 6% and 18%, respectively, making the home-bias puzzle more acute for US than UK investors. There would seem to be more potential gains from increased international diversification for the US than the UK investor.

Campbell and Viceira (2002) provide extensive theoretical analysis on strategic asset allocation.

They provide an approach different from the static mean-variance analysis, as they recognize that many investors seek to finance a stream of consumption over their lifetime. The book shows that long-term inflation-indexed bonds are riskless assets for long-term investors and that stocks can be safer assets for long-term investors than for short-term investors. A long-term investor may be willing to hold higher proportion of stocks and inflation-linked bonds, and less cash, than a short term investor.

Campbell and Viceira (2002, p. 7) note that empirical work on long-term portfolio choice has lagged far behind existing theoretical literature. Perhaps for this reason, there has been very slow diffusion of understanding from academic literature to institutional investors, asset managers, financial planners, and households.

Healey and Rozenov (2004) studied the 200 largest defined benefit pension funds in the United States. They found that equity allocation increased its share from 48 percent in 1991 to 57 percent in 2001. They also reported that funds were increasingly allocating to alternative investments, real estate, enhanced indexed equities and bonds.

Blake et al. (1998) report asset allocation and performance of more than 300 UK pension funds. They find that the allocation practices of funds have remained rather steady from 1986 to 1994. Notable observation is the high allocation to equities (78 percent) with only 14 percent in fixed income. However, the Blake et al (1998) study concentrates on the performance rather than asset allocation. Therefore, it remains somewhat unclear why U.K. pension funds invest so much more in equities than their U.S. counterparts.

Papke (1991) reports some interesting data on the asset allocations of U.S. private pension funds, both for defined benefit and defined contribution plans. The main findings for the defined benefits plans are that larger single employer plans hold about 60 percent in fixed income securities and 20 percent in equities; and smaller single employers invest 50 percent and 20 percent, respectively.

2.5 Asset allocation strategies

Stux (1995) divides pension fund portfolio management by using two steps. First, a pension fund needs to decide which broad asset classes to invest in. Typically, the asset classes include fixed income, equities, real estate, money market instruments, venture capital and private investments. This step is called strategic asset allocation and it is the most important part of a pension fund's asset management, as the strategic asset allocation decisions heavily affect the performance of a pension fund. The second step includes the actual implementation of the chosen strategic asset allocation by choosing internal or external fund managers and putting in practice the particular investment strategies and security selection process. This step is also important, but has less influence on pension fund's overall performance.

In determining the asset mix of portfolio, managers use various strategies:

2.5.1 Strategic asset allocation

Stux (1995) a pension fund needs to decide which broad asset classes to invest in. Typically, the asset classes include fixed income, equities, real estate, money market instruments, venture capital and private investments. This step is called strategic asset allocation and it is the most important part of a pension fund's asset management, as the strategic asset allocation decisions heavily affect the performance of a pension fund.

Strategic allocation is a method that establishes and adheres to what is a 'base policy mix'. This is a proportional combination of assets based on expected rates of return for each asset class. Strategic asset allocation is used to determine the long term policy of

asset weights in a portfolio. Typically long term average asset returns, risk and covariances are used as estimates of future capital market results. Efficient frontiers are generated using these historical returns information and the investor decides which asset mix is appropriate for his/her asset needs. This results in a constant mix asset allocation with periodic rebalancing to adjust the portfolio to the specificied asset weights (Lofthouse, 2001).

There are however no hard and fast rules for the timing of portfolio rebalancing under strategic or constant-weighting asset allocation. However, a common rule of thumb is that the portfolio should be rebalanced to its original mix when any given asset class moves more than 5% from its original value (Reilly & Brown, 2000).

2.5.2 Tactical asset allocation

Tactical asset allocation can be defined as a moderately active strategy, since the overall strategy asset mix is returned to when desired short term profits are achieved. This strategy demands some discipline, as you must first be able to recognize when short term opportunities have run their course, and then rebalance to the long term asset position. *"Tactical asset allocation is simply an application of Newton's law of gravity, which seems to work in two ways in financial markets. What goes up must come down; it also appears over time that what goes down may come back"* (Omonyo, 2003)

Over the long run, a strategic asset allocation strategy may seem relatively rigid. Therefore, you may find it necessary to occasionally engage in short term, tactical deviations from the mix in order to capitalize on unusual or exceptional investment

opportunities. This flexibility adds a component of market timing to the portfolio, allowing you to participate in economic conditions that are more favorable for one asst class than others (Lofthouse, 2001)

2.5.3 Insured asset allocation strategy

This strategy results in continual adjustments in the portfolio allocation. Insured asset allocation assumes that expected market returns and risks are constant over time, while investors' objectives and constraints change as his or her wealth position changes. Rising portfolio values increase the investors' wealth and consequently his or her ability to handle risk, which means the investor, can increase his or her exposure to risky assets. This strategy is sometimes called a constant proportion strategy because of the shifts that occur as wealth changes (Reilly, 2000)

With an insured asset allocation strategy, you establish a base portfolio value under which the portfolio should not be allowed to drop. As long as the portfolio achieves a return above its base, you exercise active management to try to increase the portfolio values as much as possible. If however, the portfolio should ever drop to the base value, you invest in risk free assets so that the base value becomes fixed. This strategy assumes that the expected market returns and risks are constant over time; while the investor's objectives and constraints change as his/her wealth position changes (Lofthouse, 2001)

2.5.4 Integrated asset allocation

This strategy separately examines the capital conditions and the investors' objectives and constraints. These factors are then combined to establish the portfolio asset mix that offers the best opportunity for meeting the investors' needs given the capital market forecast. The actual Returns from the portfolio are then used as inputs to an iterative process in which changes over time in the investors' objectives and constraints are noted along with changes in capital market expectations. The optimal portfolio is the revised based on this update of investor needs and capital market expectations (William F. Sharpe, 1987).

Integrated asset allocation separately examines the capital market conditions and the investor's objectives and constraints. These factors are then combined to establish the portfolio asset mix that offers the best opportunity for meeting the investor's needs given the capital markets forecasts. The actual returns from the portfolio are then used as inputs to an iterative process in which changes overtime in the investor's objectives and constraints are noted along with changes in capital market expectations. The optimal portfolio is then revised based on this update of investor needs and capital market expectations. Integrated asset allocation is a broader asset allocation strategy, albeit allowing only either dynamic or constant weighting allocation- obviously, an investor would not wish to implement two strategies that are competing with one another (Lofthouse, 2001).

2.6 Asset and liability management in pension funds

"ALM is the practice of managing a business decisions and actions taken with respect to assets and liabilities are coordinated. ALM can be defined as an ongoing process of formulating, implementing, monitoring and revising strategies related to assets and liabilities to achieve organizations financial objectives, given the organizations risk tolerances and other constraints (Society of Actuaries (2003)).

ALM is relevant to, and critical for, sound management of the finances of any organization that invests to meet its future cash flow needs and capital requirements"

Feinberg (2002) reports that many pension funds are now conducting more asset/liability studies mainly due to the deterioration of their funded status. The demand for these asset/liability studies has occurred due to various reasons, including: market conditions; switching from defined benefit funds to defined contribution funds; additional contributions; increased liabilities due to the baby boomers retirement; and changes in the future benefits structure.

Black (1989) divides pension liability into two categories; a narrow view and a broad view. Both of these liability types act like a security. The narrow liability is defined as a present value of all vested benefits for current employees. Hence it is only tied to past and current while not including the future. However, the narrow liability is only a snapshot of current work force, and hence, the narrow liability is changing all of the time. Hedging for the type of narrow liability is mainly performed using interest rate hedging methods and therefore, the narrow view suggests investing in bonds to hedge the

liabilities. According to Black, the broad liability is the present value of all benefits to be paid, and therefore it is always greater than the narrow liability. The broad liability is the narrow liability plus salary increases, benefits to be accrued, changes in the benefits and additions to the workforce. In most cases the broad view suggests investing in stocks is superior.

According to Chernoff (2003a), a pension fund cannot just maximize its return by using traditional efficient frontier method. The correct way is to match pension assets against pension liabilities, and he simplifies: *"match the assets and the liabilities and go to bed"*. Ito (1995) argues that the aim of pension fund asset management is to provide funding for the pension liabilities, but a pension fund sponsor has also a secondary goal that is the achievement of an "earnings spread" (i.e. the positive gap between assets and liabilities). As this earnings spread can reduce the requirement for future contributions.

Peskin (1997) examines defined benefit funds under the asset and liability management, and states that this framework is substantially different from asset return maximization. The study implies that an appropriate asset and liability management reduces risk and save a considerable amount of sponsors' money. He finds that savings can be more than 20 percent of future contributions.

In order to meet the long-term future obligation, Chernoff (2003b) suggests that pension funds should return to basic asset liability management (ALM) practises. Ryan and Fabozzi (2002) also suggest that pension fund managers should avoid severe

underperformances and asset/liability mismatches every year, in order to follow an appropriate asset liability management (ALM).

Finnish pension funds have been studied by Puttonen and Torstila (2003), with a risk management survey of Finnish corporate pension funds. The results of the survey reveal that risk management issues are generally well covered in pension funds, but there is, nevertheless, much to improve. Pension fund managers see asset/liability mismatch to be one of the greatest challenges facing pension funds.

Alestalo and Puttonen (2005) found that the liability structure of a pension fund affects its asset allocation. The correlation and regression analyses provide evidence that there is a relation between age structures and the strategic asset allocations of pension funds. The average age of employees seems to better explain the proportional equity investment than the proportional fixed income investment. Wide dispersion in asset allocations is also found between the funds. One fund holds its entire portfolio in fixed income securities whereas other funds have none or only few fixed income holdings. Equity investments also vary dramatically, ranging from 0 percent to over 70 percent of the asset allocation. The same applies to investments in a sponsor, real estate investment and money market investments. A portion of these different asset allocations is explained by the liability structure, but another part remains unexplained. The other variables affecting strategic asset allocation of a pension fund are not obvious, but they could include factors such as regulatory environment, historical reasons, mean-variance optimization instead of ALM, sponsor's own preferences or pension fund's irrationality.

2.7 Summary of literature review

For a pension fund, Chaim (2006) connected typical actions to inherent risk factors, as may be show in table 1.

Table 1: Inherent risks by maturity stage of a benefit plan

Pension Fund Phase	**Decisions drivers**	**Inherent Risk Factors**	**Typical Actions**
Accumulation	↑ Strategic asset allocation	↑ High-income (market risks); ↓ low-solvency (liquidity risks) ↑ Higher returns	- A portfolio with more risky assets is structured because the need of credibility and participants expectations; - Interest on new adhesions to reduce costs and get more income. - Loans and other facilities to add value to participants

Maturity	(Strategic asset allocation Punctual payments	↓ low-income (market risks); ↑ high-solvency (liquidity risks) ↓ lower returns	- A portfolio with less risky assets is structured to assure liquid yields to pay liabilities; - The adhesions generally are closed; - The loans follow a historical behavior to maintain credibility
All stages	Authorize new benefits plan Better manage the assets Low Costs Good Solvency Higher yields	- Legal risks: out of the limits fixed by the regulation - Compliance - Legal obligations and schedule - Bad corporative governance Reducing transaction costs	- Market monitoring - Actuarial assessments - Emphasis on actuarial constraints and the plan equilibrium. - A program to maintain good internal controls is desirable to assure

			better corporate governance Economies of scale through volume of transactions and controlling the information flow to better decide and act accordingly the needs.

Source: Chaim (2006)

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction

This chapter examines the research design, population of study, sample size, data collection and data analysis in evaluation of asset liability management in defined benefit schemes.

3.2 Research design

This study was a comparative research design. The study sought to compare the asset liability structure of defined benefit schemes in the period January 2002 to December 2008, a period of 7 years. Based on this, an assessment of the asset liability management in pension funds was determined.

3.3 Population

The population of the study consisted of all defined benefits pension funds in Kenya, registered with the retirement benefits authority (RBA), a number of 142.

3.4 Sample

The data sampling process required a preliminary survey in order to construct the sampling frame and draw a sample. In order to get sufficient data for the financial performance and comparison across years, importance was given to the length of time the pension fund had been in existence and the economic sector of operation of the sponsors.

Preference was given to schemes that are at least five years old by the end of year 2008. Based on this, a random sample of thirty (30) occupational defined benefit schemes (about 21% of the population by the end of 2008, after the enactment of the Retirement Benefits Regulation of 2000 and which the financial data will have been audited and valuation of actuaries done) was selected. Most the Pension funds selected were based in Nairobi for ease of accessibility.

3.5 Data collection

The data collected was secondary data from the financial records of the pension schemes. For every pension fund, age structure data, solvency margin data and asset allocation information was collected. The first data set, containing age structure information was gathered for the purpose of this study from the pension scheme administrators. The second data set, was collected from the pension fund managers, contains public balance sheet information of solvency margins and asset allocations. However, the asset allocation information obtained from balance sheet was not comprehensive, and the amount of pure equity investments was not available. Due to this problem, supplementary information of asset allocation was needed, and the third data set was collected from the Retirement Benefits Authority in order to calculate the solvency margins.

3.6 Data analysis

3.6.1 Variables

The main parameters of pension fund used in this study were asset allocation figures, liability structure information, and solvency margin limits.

The indicators used were the investment portfolio of these pension funds and were divided into five asset classes: long-term fixed income securities, equity, short-term money market instruments, real estate, and other investments.

Fixed income consists of bonds and long-term debt instruments either invested directly or through mutual funds. *Equity* investments include both direct equity investments as well as investments in equity mutual funds. *Money market* includes short-term debt instruments. *Real estate* investments include only direct real estate investments, and not loans to real estate companies. The category *other* is usually very small and includes investments which cannot be classified into the first four groups. *Other* could include private equity and hedge funds.

The liability structure of pension funds was examined by the age structure. As the whole age structure of pension fund's beneficiaries was not available, employees working in the sponsoring company at the end of 2008 were used as a proxy. Average age of employees, median age of employees and number of employees in a pension fund was used to establish the liability structure of the pension funds.

Correlation and regression analyses were carried out and their significance analyzed. According to Alestalo and Puttonen (2005), the variables used in the correlation and regression analyses were as follows:

Fix%i	Proportional fixed income investment in *i*:th pension fund;
Equity%i	Proportional equity investment in *i*:th pension fund;
Agei	Average age of employees in a sponsor company of *i*:th pension fund;
Solvency%i	Solvency margin divided by the lower target limit in *i*:th pension fund;
Di	Dummy variable, which receives value 1 if the solvency margin is over the lower target limit in *i*:th pension fund.
ei	Natural algorithm

The average age of employees (*Agei*) was used as a proxy for the liability structure of a pension funds (As the arithmetic average stresses the extreme values, a control variable of *median age* of employees was also used. All the correlations and regressions will be computed for this control variable, in order to verify the results). All the other variables will be dependant variables.

The solvency margin rules force pension funds to observe the risk level of asset allocation, although all the coverage rules were followed. The minimum requirement and target limits for a solvency margin depend on the risk level of the investment portfolio: A

pension fund holding a riskier portfolio has higher solvency margin limits. These limitations will be taken into account. In the solvency margin calculations, the asset classes will be divided into five risk categories, and the risk level of the total portfolio is calculated based on these categories. In the categorization, equity investments will clearly belong to the riskier category than fixed income investments, and equity exposure increases the solvency margin limits. Thus, the solvency margin regulations limit the amount that a pension fund can invest in equities. Not all fixed income securities belong to the same risk category, but for the sake of simplicity, fixed income is regarded in this study as investments with no limitations.

3.6.2 Analysis

Data was analyzed and tables were used to present the descriptive statistics. The development of the investment portfolios of the Defined Benefits pension funds was included (The investment portfolio was divided into five asset classes: (1) Money market instruments, (2), equity, (3) real estate, (4) bonds and loans, and (5) loans to a sponsor, and the descriptive statistics for 30 pension funds' liability structures, and studies age structure of employees working in a sponsor company at the end of 2008). The total value-weighted asset allocation of the thirty (30) defined benefits schemes were included. Other variables including average age, median age and number of employees in a pension fund were determined using the statistical package the Statistical Package for the Social Sciences (SPSS).

Using the statistical package the Statistical Package for the Social Science (SPSS) correlation results between different variables, were ascertained, that is;

average age of employees (*Age),* proportional fixed income investment (*Fix%*), proportional equity investment (*Equity%*), Solvency margin divided by lower target limit (*Solvency%*) and dummy-variable (which receives value 1 when solvency margin is over lower target limit) (*D*).

Correlation analysis was performed for the total sample population consisting of 30 pension funds at the end of 2008.

The Pearson correlation coefficient was used to illustrate the significance of relation between the average age and the proportional fixed income investments as well as a significance of correlation between the average age and the proportional equity investment.

In order to establish the relationship between age and investments in fixed income and equity, as well as the effect of the solvency margin, regression results using the statistical package the Statistical Package for the Social Sciences (SPSS) for :

The proportional fixed income investment (*Fix %*) against the average age of employees (*Age*),

$$Fix\%i = a + b\,Agei + ei,$$

and

The proportional equity investment (*Equity%*) against the average age of employees (*Age*),

$$Equity\%i = a + b\ Agei + ei$$

was obtained to show the relation among the variables.

Intercept, variable coefficient, F statistics, R^2 value, and adjusted R2 value were computed.

Due to the limitations of equity investments, the proportion of equity investment against the solvency-variable and the age structure was determined. As the solvency margin of a pension fund decreases close to the minimum requirement or even the lower target limit, the pension fund has to be careful with its investments and particularly watch the equity investments. The solvency- variable takes into account the fact that not all funds can invest in equities due to the solvency margin regulations.

A multiple regression model was formed as the proportional equity investment against both the average age variable and the solvency margin variable (*Solvency%i*),

$$Equity\%i = a + b\ Agei + c\ Solvency\%i + ei.$$

(*Solvency%i* is defined as solvency margin divided by the lower target limit in i: th pension fund).

F-statistics will indicate how the coefficients are statistically significant, and the adjusted R^2 of the model improves.

CHAPTER FOUR

4.0 DATA ANALYSIS, RESULTS AND DISCUSSIONS

4.1 Introduction

A request was put forward to the Retirement Benefits Authority, several scheme administrators and fund managers, through telephone and email contact, and visits to physical locations, for provision of the data required. The respondents were asked to give preference to schemes that were at least five years old by end of year 2008, in selecting the sample of schemes for which they were to provide data. They were also asked to consider the economic sectors of the schemes and provide data for schemes whose sponsors were in different sectors.

Responses were received from the following scheme administrators: - Alexander Forbes Financial Services (EA) Limited, Octagon Pension Services Ltd, and CFC Life Assurance Limited. The three scheme administrators experienced difficulties in getting data for the years 2002 to 2008. However, data on age structure as at 2008 was used as a proxy in the regression analysis computation. For confidentiality purposes, scheme administrators and Retirement Benefits Authority (RBA) were also unwilling to disclose the names of the various schemes for which they provided data. Instead various schemes were assigned numbers. The data was received via email on excel spreadsheets and was organized in terms of investment portfolios of the defined benefits pension funds and fund values per scheme.

The data was first analyzed into tables for each variable i.e. a table was created for all schemes in the sample, the investment portfolios of each of the years, 2002 to 2008 and another table for the age structure as at 2008.

4.2 Descriptive statistics

	Mean	Stdev	Min	Max
Equity	21.04%	14.36%	0.00%	47.49%
Fixed	10.66%	11.20%	0.00%	70.38%
Money Market	40.12%	21.38%	0.00%	100.00%

For the 7-year period between 2002 and 2008 the majority of the pension funds under study held their assets were held in liquid assets as evidenced by the 40.12% average cash and cash equivalents holding. In the same period equity holdings and fixed income holdings averaged 21.04% and 10.66% respectively. Liquid exposures varied from 0% to 100%, which was above the 35% maximum RBA limit on cash and cash equivalents. Similarly equity exposures varies from 0% to 47.5%, and was well below the RBA maximum of 70%, while Fixed income varied from 0% to 70.4% somewhat below the

RBA maximum of 90%. This trend indicates that pension funds were more cautious in their exposure to equity mainly due to their higher downside risk.

4.3 Correlation analysis

	Money	*Fixed*	*Equity*	*Age*	*Solvency*
Money	1				
Fixed	-0.226185002	1			
Equity	-0.030526594	-0.11057	1		
Age	0.07706588	-0.04859	0.403423	1	
Solvency	0.783570583	-0.18724	0.105913	0.235627	1

The relationship between cash assets, fixed income and equity were all negatively correlated. This is the case given that investing in one asset class translates taking away investments from the other. Equity and age were positively while fixed income and age were negatively correlated meaning that pension funds with a higher age profile were divesting from fixed income and loading more funds into equity to try and gain mileage in terms of returns implying that to some extent a good number of the pension funds had incurred an asset – liability mismatch. Solvency was as expected positively correlated to cash and negatively correlated with fixed income. However, it registered a positive correlation with equity.

4.4 Regression analysis

	Fix%i= a + b Agei	*Equity%i = a + b Agei*	*Equity%i = Agei +c Solven*
Intercept	-0.2748827	0.152228	-0.2
	(-3.5768396)*	(2.326423)*	(-3.54
Age	0.0119464	-0.01112	0.01
	(6.3586458)*	(-0.70164)*	(6.123
Solvency			0.00
			(0.175
F	40.432376*	0.492294*	20.13
R^2	0.1627500	0.002361	0.16
Adjusted R^2	0.1587248	-0.00244	0.15

Significance at the 5% confidence level

t-statistic in parenthesis

The regression analysis indicates that there is a statistically significant positive relation between the proportional fixed income investment and the average age (significant at 5% level). One year's increase in the average age increases the proportion of fixed income investment by 1.2 percent. The relation between the proportional equity investment and the average age is negative, and it is statistically significant at 5% level. One year's increase in the average age decreases the proportion of equity investment by 1.1 percent.

These trends may be due to the conversion of equity into cash and then into fixed income as pension funds divested away from equity income the action had the result of increasing both cash and equity holdings. Further, the F-statistic also records a significance in variation between the independent variable (age) and the two dependent variables namely equity and fixed income securities and to some extent confirms that the strong possibility of fixed income divestiture into equity and cash and cash equivalents for pension schemes with a higher age profile.

The R^2 on the other hand, indicates that in the case of equity age accounts for 16.27% of its variation while in the case of fixed income securities age accounts for 0.24% of their variation. Solvency does not improve on the explained variation in equity given that both age and solvency account for 16.28% which is slightly more than what age accounts for on its own.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter concludes the findings of the study and highlights any limitations to the study. It also suggests areas for further study.

5.2 Summary and conclusion

The findings of this research indicate that the liability structure of a pension fund affects its asset allocation. The correlation and regression analyses provide evidence that there is a relation between age structures and the strategic asset allocations of pension funds. The average age of employees seems to better explain the proportional equity investment than the proportional fixed income investment. When the solvency variable is added to the proportional equity investment –model, the coefficient of determination improves.

The striking feature in asset allocations is the wide dispersion among pension funds. For example, equity exposures vary from 0 to 47.49 percent, money market exposures from 0 to 100 percent and fixed income exposures from 0 to 70.4 percent. This dispersion can be only explained by factors such as regulatory environment, historical reasons, mean-variance optimization instead of ALM, sponsor's own preferences or pension fund's irrationality.

The regression analysis indicates that there is a statistically significant positive relation between the proportional fixed income investment and the average age (significant at 5%

level). One year's increase in the average age increases the proportion of fixed income investment by 1.2 percent. The relation between the proportional equity investment and the average age is negative, and it is statistically significant at 5% level. One year's increase in the average age decreases the proportion of equity investment by 1.1 percent. This indicates that pension funds with younger participants have longer investment horizon, and thus, hold riskier investments in their portfolios than pension funds with more mature participants.

F-statistic also records a significance in variation between the independent variable (age) and the two dependent variables namely equity and fixed income securities and to some extent confirms that the strong possibility of fixed income divestiture into equity and cash and cash equivalents for pension schemes with a higher age profile. This means that pension funds with weaker (better) solvency hold less (more) equity in its portfolio.

The study finds a relationship between the liability structure and the asset allocation. However, the age structure and the solvency margin measures only explain less than one quarter of the proportion of equity investments with the adjusted R2 in the regression being 20%. This means that obviously there are other variables that affect the strategic asset allocation of a pension fund.

Solvency was also significantly and positively correlated to equity. From these findings, this study indicates that pension funds in which pension funds have sought to divest away from fixed income securities into equities in the period 2002 to 2008 which was

indicative of the possibility of an asset liability mismatch which they intended to eliminate by seeking higher yield equity securities.

The findings point to the fact that pension funds have been realigning their investment portfolios with a view to downsizing their fixed income asset allocations and increasing their equity exposure which signals that the pension funds are encountering an asset liability mismatch and are therefore keen to catch up on the run away liability position.

5.3 Limitations of the study

The study was plagued by a number of difficulties, which included the following:

There was shortage of material regarding historical age structure of the defined benefit schemes. This stemmed mainly from the fact that regulatory requirements in Kenya do not obligate the pension schemes to provide age structure information on a yearly basis. This resulted to use of one year as proxy to the study.

Respondents withheld much important information that they deemed "confidential", yet this information would be important in bringing the patterns and relationships within the data. For instance, the Retirement Benefits Act requires that the fund managers report to the trustees on a quarterly basis the performance of their portfolio. If the information was availed the regression and correlation analysis would have given better relations rather than working on end of year reports seasoned for fluctuations in portfolio asset performance.

The outcome of this study cannot be generalized to all pension funds, since the study was limited to defined benefits pension schemes.

5.4 Recommendations for further study

There is scope for further research in the following areas with regard to asset liability management of pension schemes in Kenya:

A repetition of the same survey but on a large scale to all pension schemes, since the outcome of this study cannot be generalized to all pension schemes.

Further analysis of defined benefit schemes to determine the age structure effect and portfolio asset allocation, taking into consideration the new Retirement Benefit Act rules of early retirement/leaving employment that gives access to pension funds and the refund of pension amounts in full for persons living the country.

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APPENDIX I: Asset Distribution of Defined Benefits Pension Funds

Pension fund (PF) Asset Allocation – 2002

PF	EQUITY	FXD INC	MONEY
1	13.415%	3.73%	57.55%
2	0.151%	3.04%	0.00%
3	5.268%	7.65%	55.30%
4	2.502%	50.37%	6.21%
5	0.731%	15.62%	75.52%
6	5.972%	0.00%	86.31%
7	11.746%	8.34%	43.06%
8	7.710%	1.01%	30.06%
9	18.026%	3.38%	36.98%
10	0.120%	1.32%	22.65%
11	26.579%	3.53%	33.77%
12	1.269%	25.65%	61.90%
13	8.167%	15.48%	58.66%
14	6.947%	30.36%	37.90%
15	10.439%	12.38%	64.45%
16	0.000%	29.19%	1.54%
17	3.900%	0.06%	0.95%
18	0.000%	0.00%	1.51%
19	18.250%	13.55%	57.85%
20	12.500%	5.01%	65.49%
21	8.803%	7.28%	75.61%
22	8.697%	2.51%	45.35%
23	5.614%	17.65%	67.84%
24	4.667%	70.38%	14.41%
25	0.981%	4.44%	40.91%
26	6.041%	22.08%	67.77%
27	0.000%	14.76%	76.18%
28	40.385%	21.35%	0.00%
29	0.000%	24.37%	113.54%
30	0.000%	7.08%	94.89%

Source: Retirement Benefits Authority (RBA)

Pension fund (PF) Asset Allocation – 2003

PF	EQUITY	FXD INC	MONEY
1	13.415%	3.73%	57.55%
2	0.151%	3.04%	0.00%
3	5.268%	7.65%	55.30%
4	2.502%	50.37%	6.21%
5	0.731%	15.62%	75.52%
6	5.972%	0.00%	86.31%
7	11.746%	8.34%	43.06%
8	7.710%	1.01%	30.06%
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18	0.000%	0.00%	1.51%
19	18.250%	13.55%	57.85%
20	12.500%	5.01%	65.49%
21	8.803%	7.28%	75.61%
22	8.697%	2.51%	45.35%
23	5.614%	17.65%	67.84%
24	4.667%	70.38%	14.41%
25	0.981%	4.44%	40.91%
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28	40.385%	21.35%	0.00%
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Source: Retirement Benefits Authority (RBA)

Pension fund (PF) Asset Allocation – 2003

PF	EQUITY	FXD INC	MONEY
1	13.415%	3.73%	57.55%
2	0.151%	3.04%	0.00%
3	5.268%	7.65%	55.30%
4	2.502%	50.37%	6.21%
5	0.731%	15.62%	75.52%
6	5.972%	0.00%	86.31%
7	11.746%	8.34%	43.06%
8	7.710%	1.01%	30.06%
9	18.026%	3.38%	36.98%
10	0.120%	1.32%	22.65%
11	26.579%	3.53%	33.77%
12	1.269%	25.65%	61.90%
13	8.167%	15.48%	58.66%
14	6.947%	30.36%	37.90%
15	10.439%	12.38%	64.45%
16	0.000%	29.19%	1.54%
17	3.900%	0.06%	0.95%
18	0.000%	0.00%	1.51%
19	18.250%	13.55%	57.85%
20	12.500%	5.01%	65.49%
21	8.803%	7.28%	75.61%
22	8.697%	2.51%	45.35%
23	5.614%	17.65%	67.84%
24	4.667%	70.38%	14.41%
25	0.981%	4.44%	40.91%
26	6.041%	22.08%	67.77%
27	0.000%	14.76%	76.18%
28	40.385%	21.35%	0.00%
29	0.000%	24.37%	113.54%
30	0.000%	7.08%	94.89%

Source: Retirement Benefits Authority (RBA)

Pension fund (PF) Asset Allocation – 2004

PF	EQUITY	FXD INC	MONEY
1	2.406%	0.00%	67.96%
2	28.406%	1.81%	49.48%
3	1.602%	6.43%	0.00%
4	9.274%	4.01%	38.50%
5	11.793%	22.63%	61.36%
6	13.521%	4.96%	67.23%
7	16.348%	14.29%	36.62%
8	19.173%	0.53%	50.56%
9	18.416%	4.13%	32.95%
10	0.117%	3.05%	28.93%
11	36.208%	5.40%	20.30%
12	9.395%	12.69%	59.86%
13	19.977%	10.21%	68.18%
14	32.411%	5.63%	39.64%
15	19.927%	9.79%	68.97%
16	0.000%	12.27%	0.00%
17	3.092%	0.36%	7.62%
18	33.353%	11.19%	43.07%
19	12.809%	16.17%	42.64%
20	27.806%	11.33%	57.13%
21	16.729%	7.98%	53.85%
22	0.000%	7.47%	53.41%
23	31.324%	9.16%	51.61%
24	10.967%	4.17%	59.13%
25	6.585%	1.19%	35.38%
26	9.834%	11.88%	64.98%
27	23.580%	4.75%	41.66%
28	30.663%	28.85%	0.00%
29	2.372%	16.13%	51.24%
30	22.711%	8.44%	44.54%

Source: Retirement Benefits Authority (RBA)

Pension fund (PF) Asset Allocation – 2005

PF	EQUITY	FXD INC	MONEY
1	3.609%	0.00%	65.04%
2	36.213%	3.53%	39.78%
3	0.000%	34.19%	0.00%
4	11.044%	0.00%	0.00%
5	0.000%	0.24%	0.00%
6	17.523%	5.97%	61.89%
7	0.000%	3.83%	22.29%
8	21.155%	7.84%	47.74%
9	33.333%	0.24%	33.86%
10	0.072%	4.55%	34.64%
11	40.533%	7.10%	16.91%
12	25.745%	12.47%	54.43%
13	34.428%	12.07%	39.31%
14	35.719%	9.44%	34.45%
15	22.258%	13.41%	62.31%
16	0.000%	14.01%	0.72%
17	2.677%	4.28%	5.67%
18	38.750%	8.53%	43.13%
19	21.256%	15.28%	39.40%
20	27.767%	10.55%	57.10%
21	20.138%	1.24%	56.37%
22	34.049%	4.99%	27.63%
23	33.251%	9.81%	48.66%
24	18.072%	2.76%	58.44%
25	9.147%	6.03%	25.73%
26	7.772%	5.44%	73.99%
27	28.129%	6.92%	38.91%
28	35.028%	37.80%	0.00%
29	15.581%	12.28%	46.78%
30	18.568%	15.69%	42.82%

Source: Retirement Benefits Authority (RBA)

Pension fund (PF) Asset Allocation – 2005

PF	EQUITY	FXD INC	MONEY
1	3.609%	0.00%	65.04%
2	36.213%	3.53%	39.78%
3	0.000%	34.19%	0.00%
4	11.044%	0.00%	0.00%
5	0.000%	0.24%	0.00%
6	17.523%	5.97%	61.89%
7	0.000%	3.83%	22.29%
8	21.155%	7.84%	47.74%
9	33.333%	0.24%	33.86%
10	0.072%	4.55%	34.64%
11	40.533%	7.10%	16.91%
12	25.745%	12.47%	54.43%
13	34.428%	12.07%	39.31%
14	35.719%	9.44%	34.45%
15	22.258%	13.41%	62.31%
16	0.000%	14.01%	0.72%
17	2.677%	4.28%	5.67%
18	38.750%	8.53%	43.13%
19	21.256%	15.28%	39.40%
20	27.767%	10.55%	57.10%
21	20.138%	1.24%	56.37%
22	34.049%	4.99%	27.63%
23	33.251%	9.81%	48.66%
24	18.072%	2.76%	58.44%
25	9.147%	6.03%	25.73%
26	7.772%	5.44%	73.99%
27	28.129%	6.92%	38.91%
28	35.028%	37.80%	0.00%
29	15.581%	12.28%	46.78%
30	18.568%	15.69%	42.82%

Source: Retirement Benefits Authority (RBA)

Pension fund (PF) Asset Allocation – 2005

PF	EQUITY	FXD INC	MONEY
1	3.609%	0.00%	65.04%
2	36.213%	3.53%	39.78%
3	0.000%	34.19%	0.00%
4	11.044%	0.00%	0.00%
5	0.000%	0.24%	0.00%
6	17.523%	5.97%	61.89%
7	0.000%	3.83%	22.29%
8	21.155%	7.84%	47.74%
9	33.333%	0.24%	33.86%
10	0.072%	4.55%	34.64%
11	40.533%	7.10%	16.91%
12	25.745%	12.47%	54.43%
13	34.428%	12.07%	39.31%
14	35.719%	9.44%	34.45%
15	22.258%	13.41%	62.31%
16	0.000%	14.01%	0.72%
17	2.677%	4.28%	5.67%
18	38.750%	8.53%	43.13%
19	21.256%	15.28%	39.40%
20	27.767%	10.55%	57.10%
21	20.138%	1.24%	56.37%
22	34.049%	4.99%	27.63%
23	33.251%	9.81%	48.66%
24	18.072%	2.76%	58.44%
25	9.147%	6.03%	25.73%
26	7.772%	5.44%	73.99%
27	28.129%	6.92%	38.91%
28	35.028%	37.80%	0.00%
29	15.581%	12.28%	46.78%
30	18.568%	15.69%	42.82%

Source: Retirement Benefits Authority (RBA)

Pension fund (PF) Asset Allocation – 2006

PF	EQUITY	FXD INC	MONEY
1	32.743%	0.00%	43.44%
2	37.464%	2.58%	40.61%
3	0.000%	52.51%	0.00%
4	29.582%	7.23%	50.42%
5	21.267%	40.18%	0.00%
6	18.081%	5.91%	57.31%
7	26.934%	2.38%	48.39%
8	26.934%	2.38%	48.39%
9	25.043%	8.92%	29.61%
10	0.083%	5.78%	39.46%
11	44.314%	6.79%	17.75%
12	26.262%	7.77%	59.50%
13	36.122%	11.09%	36.90%
14	46.172%	8.68%	29.82%
15	26.562%	6.52%	64.39%
16	0.000%	22.10%	1.27%
17	35.616%	7.34%	44.25%
18	46.410%	4.74%	42.63%
19	21.644%	12.90%	46.95%
20	37.099%	9.39%	51.50%
21	22.557%	3.05%	51.49%
22	40.536%	6.80%	17.00%
23	40.985%	12.57%	37.11%
24	29.386%	8.50%	44.90%
25	13.470%	1.16%	28.40%
26	17.348%	17.18%	64.58%
27	32.829%	6.87%	28.41%
28	35.709%	38.51%	0.00%
29	30.541%	12.03%	41.21%
30	11.506%	2.07%	24.52%

Source: Retirement Benefits Authority (RBA)

Pension fund (PF) Asset Allocation – 2007

PF	EQUITY	FXD INC	MONEY
1	31.982%	0.00%	40.99%
2	38.936%	1.32%	42.31%
3	44.307%	5.07%	40.10%
4	31.173%	10.90%	46.97%
5	27.649%	8.74%	49.77%
6	23.855%	2.74%	54.17%
7	28.799%	9.26%	40.17%
8	28.799%	9.26%	40.17%
9	29.213%	4.00%	36.61%
10	0.077%	11.88%	31.44%
11	40.827%	8.47%	20.43%
12	31.303%	19.92%	41.12%
13	26.494%	6.85%	58.53%
14	41.448%	5.20%	34.30%
15	30.062%	6.59%	59.82%
16	9.827%	1.47%	12.20%
17	42.632%	4.23%	45.65%
18	42.632%	4.23%	45.65%
19	33.403%	8.45%	35.03%
20	41.475%	16.16%	41.29%
21	34.028%	3.79%	48.91%
22	35.581%	15.61%	25.43%
23	37.704%	11.65%	40.74%
24	37.943%	4.16%	43.71%
25	16.753%	1.59%	25.84%
26	28.121%	12.75%	50.05%
27	30.058%	12.06%	27.80%
28	22.841%	12.12%	54.51%
29	31.894%	15.26%	47.44%
30	31.487%	17.68%	35.90%

Source: Retirement Benefits Authority (RBA)

Pension fund (PF) Asset Allocation – 2008

PF	EQUITY	FXD INC	MONEY
1	1.668%	1.22%	4.28%
2	40.295%	10.80%	28.71%
3	0.000%	7.30%	44.03%
4	36.714%	3.18%	38.54%
5	33.963%	5.57%	44.49%
6	34.368%	4.17%	32.48%
7	34.368%	4.17%	32.48%
8	18.072%	15.00%	25.16%
9	0.427%	21.85%	28.14%
10	36.567%	11.15%	17.73%
11	34.643%	6.26%	51.17%
12	38.439%	14.44%	36.59%
13	39.531%	11.17%	34.64%
14	35.438%	8.45%	50.48%
15	24.655%	21.17%	63.02%
16	36.901%	13.68%	50.26%
17	33.418%	4.07%	58.57%
18	27.428%	10.78%	44.34%
19	39.553%	9.30%	48.07%
20	36.862%	6.09%	52.78%
21	47.489%	11.70%	16.71%
22	46.573%	12.58%	32.81%
23	38.585%	10.82%	36.96%
24	26.140%	3.45%	40.53%
25	39.480%	9.31%	25.79%
26	12.101%	6.48%	22.17%
27	0.085%	0.00%	0.68%
28	29.459%	8.36%	51.78%
29	41.139%	5.17%	44.24%
30	33.548%	15.27%	45.42%

Source: Retirement Benefits Authority (RBA)

PPENDIX II : SUMMARY OUTPUT REGRESSION ANALYSIS

SUMMARY OUTPUT-Fixed Income

Regression Statistics	
Multiple R	0.40342289
R Square	0.162750028
Adjusted R Square	0.158724788
Standard Error	0.131739885
Observations	210

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*	
Regression	1	0.701719953	0.701719953	40.43237625	1.26911E-09	*
Residual	208	3.609922635	0.017355397			
Total	209	4.311642588				

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.274882743	0.076850732	-3.576839603	0.000432546	-0.426388936	-0.123376549	-0.426388936	-0.123376549
Age	0.011946395	0.001878764	6.358645788	1.26911E-09	0.008242534	0.015650255	0.008242534	0.015650255

SUMMARY OUTPUT-Equity

Regression Statistics	
Multiple R	0.048592297
R Square	0.002361211
Adjusted R Square	-0.002435129
Standard Error	0.112169612
Observations	210

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*	
Regression	1	0.006194058	0.006194058	0.492294366	0.483689928	*
Residual	208	2.617060539	0.012582022			
Total	209	2.623254597				

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.152228052	0.065434373	2.326423324	0.020958638	0.023228464	0.28122764	0.023228464	0.28122764
Age	-0.001122387	0.001599669	-0.701636919	0.483689928	-0.00427603	0.002031256	-0.00427603	0.002031256

SUMMARY OUTPUT-Multiple Regression

Regression Statistics	
Multiple R	0.403577516
R Square	0.162874811
Adjusted R Square	0.154786645
Standard Error	0.132047873
Observations	210

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*	
Regression	2	0.702257974	0.351128987	20.13742176	1.02049E-08	*
Residual	207	3.609384614	0.017436641			
Total	209	4.311642588				

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-0.273929609	0.077221269	-3.547333663	0.000481341	-0.426170596	-0.121688621	-0.426170596	-0.121688621
Age	0.011866193	0.001937715	6.123806006	4.52513E-09	0.008046006	0.015686381	0.008046006	0.015686381
Solvency	0.003481578	0.019820204	0.175658055	0.860734304	-0.035593762	0.042556919	-0.035593762	0.042556919