ALTERNATIVES TO CONVENTIONAL ANNUITIES

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Declaration

I declare that this project is my original work and has not been presented for an award of a degree in any other University.

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Abstract

Provision for post-retirement income has become an important consideration for individual in recent years. Very few employers offer generous pension schemes that guarantee an individual a pre-defined pension amount on retirement. Individuals are increasingly being exposed to investment markets as they strive to make a provision towards their retirement. This study considered conventional annuities, which have been a popular means of providing for pension benefits. This was largely due to regulations that required an individual to purchase an annuity after retirement. However, regulations have changed and individuals now have a wider choice. There has been an emergence of alternative forms of post retirement income such as variable annuities, income drawdown plans and equity release schemes. It was found that these alternatives suit different individuals, depending on their personal circumstances. Data was generated by calculating various annuities for a period of 30years for an individual getting an average income. Descriptive statistics was used to analyze the data. Presentation was in the form of graphs and explanation presented in prose. The study reveals that alternatives are preferred to the conventional annuities. The GMDB provided lower income given that an amount for the death benefit was set aside. The level annuities are considered to the escalating annuities if the individual did not get to survive past the breakeven point. Annuity providers should advice the annuitants on the various options of safeguarding their retirement future that suit their various lifestyles.

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CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

A pension is a contract between a pension provider and the members of the scheme for the purpose of providing benefits to the members on retirement, ill-health or death. The main pension providers are: National Governments (who provide state pension / social security benefits for the citizens of a country), Employers (who provide workplace pension schemes for their employees) and Insurance companies (who provide individual accumulation policies).

The pension industry in Kenya has grown rapidly during the past two decades and it ranks amongst the largest investors in the capital markets. It is regulated by the Retirement Benefits Authority; a body established by an Act of Parliament to regulate, supervise and promote retirement benefits (Chirchir, 2010).It has been a challenge for pension funds to generate sufficient financial resources to ensure long-term assets match their long-term liabilities. Consequently, the ability of pension providers to honor their obligations has been an area of concern to both members of pension schemes and policy makers.

The past few years has witnessed increased emphasis on individuals taking responsibility to secure their financial well-being in retirement. This is in the background of a lot of economic uncertainty and volatility and changing regulations governing the pension sector. As a result, today's retirees may be exposed to a variety of risks that can affect them both as individuals and as members of society (Abbey, 2007). There are different ways that one can fund for his/her post retirement. The employer and employee can contribute towards the pension fund during the working lifetime of the employee. An individual can also save by making regular contributions to various investment vehicles.

The aim of a pension scheme is to provide individuals with a sufficient and reliable source of income after retirement when they are no longer earning a regular income from employment (Retirement Benefits Act, 1997).A Pension fund, therefore, is the pool of assets purchased using

the contributions of its members with the aim of financing their retirement benefits. Any individual above the age of 18 years is eligible to join a pension plan.

For most pension schemes, the maximum age above which one cannot join is 50 years, though it is often specified for every retirement benefits scheme. Escalating costs of funding pension schemes has affected many employers around the world and Kenya is of no exception. As a result of increased financial difficulties that pension sectors face, employers continue to look for ways to contain their costs and liabilities within reasonable and acceptable limits.

1.2Types of Pension Plans available in Kenya

Occupational Pension Scheme: This is a scheme sponsored by an employer and is open to the employees of an organization. Pension benefits form a bulk proportion of the benefits provided by an employer to its employees. In the late 19th and early 20th centuries, employers set up and continued to provide occupational pension schemes in various forms as a way of retaining their skilled workforce (Ward, 1995). Past research suggests that employers used occupational pensions to attract, motivate and reduce the turnover of staff as well as build a paternalistic image for themselves (Terry and White, 2000; Taylor, 2000).

Public Pension Fund/Social Security: This is a fund regulated by public law, such as the National Social Security Fund (NSSF). Under this fund, both an employer and employees make statutory contributions as stipulated by law.

Individual Pension Plan: This scheme caters for individuals who do not belong to an occupational pension scheme (e.g. self-employed) or who would like to make additional provisions towards retirement over and above that provided by the employer.

The occupational pension schemes are three main sub-categories which are the Defined Benefit Schemes, Defined Contribution Schemes and the Hybrid Pension Schemes

Defined Benefit schemes

These are pension schemes where the pension and other benefits are set out in the rules of the scheme. Most benefits of this type depend on the final salary. DB schemes may be funded or they may operate on a pay as you go basis.

In a typical final salary scheme the accrual rate is 1/80. (Accrual rate is the rate at which an individual builds up his/her pension benefits as a function of years in service) .Various benefits are also provided such as death benefits, withdrawal benefits and ill health benefits. The salary used to compute the benefits will be defined in the scheme rules and can be the final salary received in the last three year prior to retirement or the salary earned during one's career, revalued to take inflation into account.

The final salary scheme pension is calculated as:

$$pension = f \times duration\ in\ service \times final\ salary$$

Where f=accrual rate, commonly taken as 1/80.

The career average revalued earnings scheme is where the pension is based upon your average pensionable earnings throughout the whole duration that you were an active member of the scheme.

The career salary schemes pension is calculated as

$$pension = g \times aggregate\ career\ salary$$

Or

$$pension = g \times aggregate\ revalued\ career\ salary$$

Defined Contribution schemes

These schemes are also known as money purchase schemes. Each individual has a pot of money from which contributions made by the employer and employee are deposited. The contributions can take different forms. It can be a fixed proportion of salary made by both the employer and employee, a proportion of salary made by the employee and matched by the employer subject to a maximum, or contributions that increase with age.

The lump sum, payment that will be available is not known in advance as it will depend on factors such as the level of contributions made over the accumulation period, any charges deducted from the investment fund and the investment returns of the fund during the accumulation phase.

In a DC scheme, the amount lump sum pension on retirement depends heavily on how well the scheme's investments have performed working lifetime of the individual. Pension amounts in DC schemes will also depend on the annuity rates available when individuals convert their accumulated investment 'pot' into a regular pension.

DC scheme administrators do not need to keep detailed records of their members' earnings. However, they need to keep an accurate check on members' contributions and the dates they were made. DC schemes are, in effect, aggregated from the individual accounts of each member. Workplace DC schemes may provide extra benefits such as death-in-service or incapacity, usually through group insurance contracts. An employer with a DC scheme may not display paternalism towards their employees like those with a DB scheme since the investment risk is borne solely by the employee. However, an employer may increase their contributions with the employer's duration in service so as to provide benefits similar to a DB scheme.

Hybrid Schemes

These combine the features of both the DB and DC schemes. A sequential hybrid is DC for workers below a certain age and DB for workers above that age. A combination hybrid provides both types of benefits at the same age. A cash balance scheme is a DB scheme which provides notional individual accounts.

1.3The shift from defined benefit (DB) to defined contribution (DC) schemes.

One significant global change, in an effort to achieve more predictable funding costs, has been the widespread shift from defined benefit (DB) pension plans to defined contribution (DC) pension plans (Taylor, 2000). Under the DB scheme, members are guaranteed a specific benefit upon retirement, based on a formula that considers factors such duration in employment and salary earned, with employers funding any deficit.

Under DC arrangements, scheme members receive a lump sum benefit on retirement based on contributions made to the fund and investment returns earned. Members therefore bear the responsibility for their own financial security.
Figures from the Government Actuary Department in United Kingdom (U.K.) showed that in 2004, two-thirds of all employers who operated a DB pension contributed 4 per cent or more on behalf of their employees, in contrast to just a quarter of employers operating DC pensions (GAD, 2005).

Over the past several years the shift has gained momentum. This can be attributed to a confluence of factors e.g. persistent pension underfunding due to a decline in long-term interest rates, increasing regulatory burden and uncertainty and recognition of the effects of increased life expectancy of pensioners. This has reduced the incentives for employers to offer DB plans. Within the pension sector, there has been much greater focus on managing pension fund assets relative to liabilities rather than market benchmarks (Chirchir, 2010). Historically, the shift towards DC pension plans has largely been as a response to changes in industrial structure and labor force composition that have given rise to an increasingly mobile workforce. DB plans, which are often not portable across employers, can penalize job mobile workers since the expected pension benefit generally accrues only to employees who remain with the same employer throughout their career. In DC plans, each individual has a 'pot of money' and this provides mobile workers with much a more flexible means of managing their retirement savings.

Moreover, as is evident from the U.K experience, this shift in focus is also linked to regulatory and accounting reforms that are making the financial risks associated with DB plans more transparent. Since DC contributions can be fixed as a predictable proportion of payroll, migrating to a DC plan offers employers a means of reducing balance sheet and earnings volatility, at least over the long term.

The growth of DCschemes escalated with closure and conversion of DB schemes. The first conversions of DB to DC took place in the United States of American and Australia. This spread to Europe and Africa, with South Africa and Kenya taking the lead. In the United States for example, it is estimated that the DCs grew 600 percent between 1987 and 2002 (Ross, 2002).

The United Kingdom (UK) is known to have experienced significant conversion from DB schemes to DCs in the 2000's. The Association of Consulting Actuaries (ACA) Pension trend survey conducted in the UK in 2009concluded that 87 per cent of DB schemes had closed to new members. This was a 6 percent increase from 2007and the trend of closures is expected to continue.

Government institutions across the world have been converting their DB schemes to DCs schemes from the early 1990s. In the mid 90's conversions from DB schemes to DCs occurred across government units at the state and local levels (Clerk, 2001). India succeeded in introducing a DC pension schemes for new employees joining the Central Government from 2004, closing the previous DB scheme to new employees. The Kenyan Government issued a directive in 2008 to all public parastatols to convert the DB schemes to DC schemes and this has subsequently been undertaken.

1.4 Statement of the Problem

Over the years saving is emphasized rather than spending, especially during the early years of employment. It is imperative that all individuals take measures to ensure a regular income after retirement. Therefore the past few years has witnessed increased emphasis on individuals taking responsibility to secure their financial well-being in retirement. This is in the background of a lot of economic uncertainty and volatility and changing regulations governing the pension sector. As a result, today's retirees may be exposed to a variety of risks that can affect them both as individuals and as members of society.

Taking up the right and suitable pension scheme is said to be crucial for one's post retirement income. Conventional annuities have historically been used to provide retirement benefits using the accumulated lump sum amount on retirement. However, this in recent times has proved to be a poor value for money especially for pensioners who died immediately after retirement, having received little pension benefits relative to the lump sum amount paid. Thus emergence of variable annuities that seeks to address this issue. It is with this in mind that the study tries to analyze the alternatives to the conventional annuities that provide retirees with the best option when it comes to retirement benefits.

1.5General objective

The core objective of this project is to determine the alternatives to conventional annuities that exist and should be implemented in the Kenyan market.

1.5.1 Specific objectives

i. To calculate the alternatives and the conventional annuities in the provision of post retirement income and
ii. To discuss the merits and demerits of each alternative to conventional annuities.
iii. To compare the alternatives to the conventional annuities
iv. To state other forms of alternatives and give their merits and demerits.

1.6Significance of the Study

DC schemes have gained popularity in the recent past as a means of saving towards retirement. Consequently, individuals will need to make a choice upon reaching retirement on how to use their accumulated lump sum amount. Conventional annuities have been widely used in the past. However, regulations have changed and individuals need not purchase an annuity immediately after retiring. This has led to the emergence of other forms of post retirement income. This study seeks to identify these forms and compare them with conventional annuities.

CHAPTER TWO
LITERATURE REVIEW

2.1 General overview of international practice

In North America and Western Europe, the traditional forms of benefit payments from DC pension plans have been either a lump sum payment or some form of life annuity. In several of these countries, especially in Western Europe, the only permitted form had been a life annuity, with a minority allowing the commutation of a relatively small part of the annuity for cash. This focus on lifetime pensions may reflects continuation of the philosophy of most traditional occupational defined benefit pension plans of paying a lifetime pension. It may simply reflect a strong belief in these countries that the true role of a pension plan is to replace pre-retirement employment income with post-retirement pension income (Antolin, 2008).

Although not normally referred to as retirement benefits, there are several countries like Italy where employers are required to pay termination indemnities at retirement. In some countries, these lump sum payments can be significant. It is said that most appropriate forms of benefit payment at retirement should take into account that retirees in these countries will already receive significant benefits in lump sum form. This should provide clear incentives for the conventional retirement benefits to be paid in forms other than lump sum cash, and this does indeed appear to be the effect.

A recent development in the pensions sector is the repackaging of accumulation (or deferred) annuity contracts as investment options for defined contribution (DC) plans. American workers are increasingly receiving retirement benefits in the form of a DC plan lump sum, rather than a lifetime annuity from a defined benefit (DB) plan. Deferred annuities are often referred to as "DB in DC" products because they translate the participant's account balance in the deferred annuity contract into a DB-like annuity payout at retirement age.

2.1.1 Lump sum

Under this approach, the entire value of the accumulated retirement benefit is paid as a lump sum.

Such payment normally would occur at retirement (under occupational pension plans) and at contract maturity (under a personal savings plan).Some regulations permit a percentage of the retirement benefit to be paid as a lump sum, with the balance being used to purchase a life annuity. (Stewart, 2008).As a matter of administrative convenience, many countries allow lump sum payments to be made at retirement when the lump sum benefit is too small to purchase a meaningful amount of life annuity or even too small to justify short-term programmed withdrawals. However, it would be distracting to place too much emphasis on this option, which is only supposed to apply in a relatively small number of situations.

According to Antolin, (2008), the most obvious advantage of lump sum payments, from the perspective of the plan sponsor and especially the plan administrator, is that they are so easy to administer. They do not require any complex calculations or even the active maintenance of plan records. The entire obligation of the occupational pension plan or personal retirement savings product to the individual is discharged at retirement or contract maturity. There is no ongoing obligation to maintain active records or even to maintain a contact with the individual.

2.1.2 Programmed withdrawals

Programmed withdrawals consist of a series of fixed or variable payments whereby the annuitant draws down a portion of the accumulated capital (and continued investment earnings thereon).Programmed withdrawals do not involve longevity guarantees that would require complex actuarial reserving and solvency margins. They are financially uncomplicated, and there is no cross-subsidy from those who live for only a short time in retirement to those who live longer than the expected average.

Programmed withdrawals attempt to produce relatively stable annual income for the lifetime of the retiree. There are still many variations. Under the totally prescriptive approach, the amount to

be withdrawn each year is calculated in accordance with a prescribed formula, and the annual withdrawal is exactly equal to this amount. Other countries set a minimum or a maximum limit on the amount that can be withdrawn. Finally, there are some countries that set both a minimum and a maximum limit on each annual withdrawal, i.e. the amount withdrawn must fall within a prescribed range or band‘.

In some countries, programmed withdrawals are allowed or are even mandatory when the individual's retirement capital is too small to purchase a prescribed minimum amount of life annuity. Stewart, (2008) argues that this is a better approach than just allowing or mandating lump sums when the retirement capital is too small to buy a meaningful amount of lifetime pension.

2.1.3 Life annuities

Under the traditional and most commonly found annuity approach, the plan member‘s DC accumulation is transferred at retirement to a life insurance company. In turn, the insurance company provides an annuity that, in its simplest (single life) annuity form, will make payments to the retiree for the rest of his/her life. These payments will be made on a regular basis, *e.g.* weekly, monthly or quarterly. The retiring plan member normally would be allowed to choose the most competitive and appropriate insurance company to which the DC accumulation should be transferred, although this is not always the case (Pugh, 2008).The main advantage of life annuities is that the payments are fixed and will be made for the entire lifetime of the retiree. In contrast, programmed withdrawals, in its different versions, entail a payment that could easily be exhausted if the individual outlives the fund.

2.2 Theoretical Review

2.2.1 The Risk Averse Theory

The theory points out how the employers with better understanding of the risks associated with the running of retirement benefits schemes given an opportunity transfer the risks to other

entities or avoid all together**.** As mentioned earlier, the risks and associated costs of DB schemes are fully shouldered by employers.

Employers have to make good the promise to pay accrued benefits regardless of the prevailing business and investment environments which are inversely related. DB schemes thrive well under favorable investment and business conditions. A study by Bikker, (2001), showed that asset allocation by pension funds in equity followed the performance of the stock market.
During the 1990s pension funds in invested heavily in the equity market to take advantage of the high returns offered by equity investments. This led to premium reductions and even contribution holidays for pension plan sponsors. However, the risks of equity holdings surfaced after the collapse of the stock market in 2000–02, which resulted in large losses for pension funds. In reaction, pension benefits were curtailed and contributions steeply increased. The impact of investment risks during volatile capital markets and especially the equity market in the late 1990's into 2000 accelerated the conversion of DB schemes to DC schemes (Ross, 2004).
Mercer, a pension and investment specialist firm, at their annual Defined Benefit Conference held in 2010 revealed that 80% of defined benefit pension plans failed to meet the statutory funding requirements.

2.2.2The Excessive Regulation theory

This theory addresses the issues of regulations that schemes must comply with. Once employers establish schemes, the schemes must achieve full compliance with existing regulations. As a result of the Maxwell Scandal, where members' benefits were misappropriated, regulations were introduced that have largely been aimed at protecting members' benefits. Regulations frequently undergo changes. Whereas both DC schemes and DB schemes are equally affected by frequent changes in legal requirements, DB schemes unlike DC schemes are required to conduct actuarial valuation periodically and maintain a minimum funding status.

According to Turner (2008), the introduction of the minimum funding level for DB schemes through the Ireland Pension Act 1990 increased the costs of operating the DB schemes and as attributed to the shift away from DB schemes to DC schemes as was evident by the steady decline in the number of DB schemes and increase in DC schemes. Tuner et al also mentioned

that regulations were designed to limit the loss in tax revenue to the government treasury by restricting the amount of funding allowed in DB schemes. DB schemes were not able to keep sufficient reserves for the future and maintain required minimum funding level, making it even costly for the DB schemes. In the UK, DB schemes with below minimum funding level are regarded as risky and are required to make higher levy payment to the Pension Protection Fund.

The introduction of regulations in Australia mandating employers to establish retirement benefits schemes contributed to the popularity of DC schemes. Employers opted to establish DC schemes to comply with the Law and where DB schemes existed; employers induced employees to transfer to the new DC schemes.

In the United Kingdom, the financial reporting requirements provided by FRS 17 require schemes to report the funding status at fair value in the sponsor's income statement and disallows smoothening of schemes' assets and liabilities. In the DB schemes contributions are often adjusted from time to time to make sure that the correct amount is being accumulated to provide for the promised benefits (Green Paper on Pensions).

Losses adversely affected sponsoring companies' reported profitability and financial performance which did not go well with stakeholders. In addition, employers were required to increase their contributions amounts to offset losses. Employers who opted for DC schemes were better placed than those operating DB schemes. Periodic contributions made up the only expenses for DC schemes and had the advantage of being predictable. Employers were not required to increase their contributions at any one time to meet promised benefits.

In South Africa, prior to the 1980's occupational schemes were largely DB schemes covering 80 percent of the population. DC schemes were preferred by small employers. Significant growth in DC schemes has been through conversions of DB schemes to DC schemes. The Trade Union played a central role in the conversion of schemes from DB schemes to DC schemes. Low skilled workers lacked good understanding of the DB schemes and were also interested in

evading earning pension from the DB schemes. DC schemes were preferred because members paid lump-sum amounts of both employer and employee DC schemes were the more preferred. Under the DB schemes employer portion of contributions were inaccessible and interest applied were less than the market competitive rates. Trade unions had found ground to fight for negotiated funds for the benefit of the people they represented. Besides advocating for DC schemes they also advocated provident schemes.

2.2.3 New Economy theory

The theory takes into consideration the changes in the economic order such as growth in the service sector which employ small scale workforce unlike the manufacturing companies that employed large workforce where the per unit cost is low. DB schemes work well with large workforce. The young workforce is perceived to be more mobile and in need of a new kind of pension plans that suit them. The nature of DC schemes allow for easy mobility. Other reasons cited include peer pressure as a result of wide publicity on scheme conversions; increased longevity of pensioners that have resulted in increased costs of funding pensioners.

2.3 Reasons for the Conversion of DB schemes to DC Schemes

Employers in many parts of the world are not mandated to establish occupational retirement benefits schemes for their employees. Employers therefore voluntarily choose to establish occupational pension schemes for their employees. An employer who starts an occupational scheme has a choice of choosing the scheme design based on his/her objectives and resources.

Upon setting up the scheme, an employer is not prohibited from changing the design or terminating the scheme. The sponsor may choose to convert a scheme from one design to another; introduce parallel scheme; or all close down existing scheme. It is through this window of opportunity that sponsors may convert DB schemes to DC schemes. In converting from DB to DC schemes, employers may opt to fully close the DB schemes to new employees while allowing existing members to continue accruing future benefits until retirement; close the DB schemes and freeze future accrual of benefits; or all together close the DB schemes to existing members and transfer benefits to new DC schemes benefits or individual retirement fund

arrangement. The worst case scenarios are cases where employers, after converting, stop future contributions for active scheme members (Ross, 2002).

2.3.1 Risks involved in shifting a scheme from DB to DC

In a DB pension plan, workers receive regular pension payments from the date of their retirement until their death. The promised life annuity (deferred) is commonly based on a formula linked to an employee's wages or salary and years in service at the sponsoring firm. In a typical DB plan the member earns a unit of pension, usually expressed as a percentage of nominal earnings, for each year of credited service/participation. The DB pension may be indexed to inflation but in a number of countries such as the U.S. and Canada this is uncommon in private sector pensions.

Various measures are used for the earnings base; in Australia, the U.K., and the U.S. and Canada, the most common is 'final salary' –generally the employee's average earnings over a specified period of time prior to retirement or earnings during a specified period of highest earnings. In final salary plans the expected benefit is generally designed to replace a pre-determined percentage of 'final salary 'based on specific employment tenure that is typically ranging from about 35 to 40 years. The replacement rate varies considerably across plans; the most generous DB plans are designed with a salary replacement ratio of between 60-70 per cent of final salary.

Employers are generally legally obliged to make the promised payments once they have accrued and have been vested. However, they are under no obligation to pay benefits that might be expected but are yet to accrue. Under certain conditions employers may also terminate pension plans in some countries (e.g. the U.S.) but prohibitive tax penalties normally persuade employers to transform the pension plan rather than terminating it. In other countries such as the U.K. and Canada, the DB plan text may prohibit the termination of the plan (Yermo, 2003). In practice, a full termination plan is often difficult to implement outside of corporate insolvency, particularly in highly unionized industries where a DB pension plan is usually a negotiated benefit.

A full termination plan is therefore the least common of the three types of DB plan closures generally available to plan sponsors. These are the hard freeze or termination (no additional benefits will accrue to any current plan members from either additional tenure or increases in compensation), the soft freeze (generally limits increases for current plan members in accrued benefits due to increases in tenure but may allow the definition of compensation to increase) and a partial freeze (plan is frozen for some but not all members).

The shift from DB to DC plans is, therefore, generally a gradual process incorporating a transition period in which the employer will offer two types of pension plans; a DB plan for existing employees and a DC plan for new employees.

DC plans are an integral feature of the private sector pension systems in the United States and United Kingdom and increasingly represent the main component of the pension system. However, at present DC systems might not produce an adequate pension due to the fact that contributions are too low, the levels of public confidence and understanding of DC are too low, individuals are unable or unwilling to choose appropriate funds, investment strategies offer little or no protection, funds are too volatile in the pre-retirement phase and de-accumulation options lack clarity and in many cases are not fit for purpose

Therefore, it would be essential to improve the design of private DC systems in order to deliver adequate pensions. While the evolution towards DC pension plans can be beneficial for both employees and employers, it nevertheless reallocates risk within the financial system. In DB pension plans, responsibility for funding and investment management rests with the firm sponsoring the plan. In a DC plan these tasks and the associated risks are typically assumed by the employee. This shift of responsibilities and risks from the employer to the employee has potential implications for financial stability.

2.4 Conventional Annuities as a Way of Retirement Income

Individuals have a lump sum on retirement from a DC scheme a proportion of this amount can be taken as a cash free lump sum and individuals have been required to purchase an annuity with the remaining amount. Conventional pension annuities, also referred to as Compulsory Purchase

Annuities (CPAs), are by far the most popular option. Once purchased, the level of income is guaranteed for your lifetime and, with certain annuities, the lifetime of your spouse. Government has required individuals to purchase annuities to mitigate the risk that individuals outlive their wealth and lean towards the state for means tested benefits.

These types of annuity are popular because the retirees will know from the outset the amount of benefit they will receive each year for the rest of your life. This allows you to plan your life and living standards accordingly.

There are many different options when it comes to purchasing your conventional annuity, some of the options available from a conventional annuity include but are not limited to the level annuity, the increasing annuity, the guaranteed annuity, the joint life annuity and the impaired Life Annuity

The pension scheme pays your pension savings to an insurance company who, in return, agrees to pay you a regular income for the rest of your life which is called a lifetime annuity.

The merits attributed to conventional annuities are that your retirement income is guaranteed in line with the options you choose at the time of purchasing your annuity. One receives a secure level of income, allowing you to budget. This is useful if you don't want the risk of your income going down. There are no investment decisions involved and you are protected from any future reduction in annuity rates. A fixed monthly income can be predicted based on your contribution. Security is also assured in the knowledge that you will always have an income and not 'outlive' your pension savings. A cash-free lump sum (up to 25%) at the start of the scheme and an incremental increases can be agreed, but with a lower initial income. (Guaranteed increases / escalation)

The drawbacks associated with the conventional annuities are once their annuity is set changes cannot be made to your annuity options to reflect any changes in personal circumstances. Benefiting from any future increases in annuity rates once your annuity is set up is not possible.

Protection against the effects of inflation if you have chosen a level annuity is not guaranteed. Escalating annuities provide a lower starting income .If you select a single life annuity without a

guarantee period and die shortly after setting up your annuity, there are no further benefits payable and you or your estate may not get back all the money that was used to purchase the annuity and finally the death benefits will mean a lower starting income which cannot be changed once chosen.

CHAPTER THREE
METHODOLOGY

The methodology considers two aspects of providing towards post retirement income.

Contribution/ accumulation stage: This is the phase where the individual contributes money to a fund that will be used to purchase benefits on retirement.

Income Stage: This is the phase where the fund accumulated over the individual's working life is used to purchase benefits.

General formulae and functions

Assuming, salaries are regularly revised for an individual earning an average income annually.

We define $\{\bar{s}_x\}$, the salary function to be such that the salary rate per annum at age $x+t$ of a life now aged x with current salary rate Kshs. (SAL) per annum is:

$$(SAL).\frac{\bar{s}_{x+t}}{\bar{s}_x} \qquad (3.1)$$

Where, $\bar{s}_x$ is the salary scale function at age x last birthday and $\bar{s}_{x+t}$ is at age x+t last birthday.

We also define:

$$s_x = \int_x^{x+1} \bar{s}_y dy = \int_0^1 \bar{s}_{x+t} dt \qquad (3.2)$$

Using approximate integration and interpolation we get:

$$s_x \approx \bar{s}_{x+\frac{1}{2}} \approx \frac{1}{2}\left[\bar{s}_x + \bar{s}_{x+1}\right]$$

And

$$\bar{s}_x \approx s_{x-1/2} \approx 1/2\left[s_{x-1} + s_x\right]$$

3.1 Contributions stage.

Defined Contribution schemes (commonly referred to as money purchase schemes) have scheme rules which specify how contributions will be made. Each member of the scheme has an individual fund or 'pot' and on retirement, the money in the pot is used to purchase post-retirement benefits, and hence the name 'money purchase scheme'.

Contributions can be made in four different ways by using a fixed monetary amount, a fixed Percentage of salary, a percentage of salary increasing with age or service and where the employer matches the percentage of salary chosen by the employee up to some maximum amount.

Fixed monetary amount

This normally only applies to individual accumulation policies. Member can choose to vary their contribution at will (subject to some minimum amount). Member should be advised to increase contribution over working life to keep pace with inflation.

Suppose contributions are independent of salary and that these are fixed annual sum payable continuously. The mean present value is given by

$$\text{MPV} = F \times \int_0^{R-x} V^t \frac{l_{x+t}}{l_x}\, dt \qquad (3.3)$$

This is approximated by:

$$= F * \sum_{t=0}^{(R-1)-x} V^{x+t+1/2} \frac{l_{x+t+1/2}}{V^x l_x}$$

$$\cong F \times 1/Dx \sum_{t=0}^{(R-1)-x} {}^{s}\overline{D}_{x+t}$$

$$= F \times {}^{s}\overline{N}_{x} / Dx$$

A fixed Percentage of salary

This is the simplest and most common approach in workplace DC schemes. The employer's contribution may be a different percentage of salary to that of employees. Employees are normally permitted to increase their own contribution rate without affecting the employer contribution rate.

The MPV of future contributions at rate k% of the salary of a member aged *x* with current salary rate of Kshs. SAL per annum is:

$$\text{MPV} = 0.01k \times \frac{SAL}{\bar{s}_x} \int_0^{R-x} V^t \frac{l_{x+t}}{l_x} \bar{s}_{x+t} dt \qquad (3.4)$$

This is approximated by:

$$= 0.01k \times \frac{SAL}{\bar{s}_x} \sum_{t=0}^{(R-1)-x} V^{t+\frac{1}{2}} \frac{l_{x+t+\frac{1}{2}}}{l_x} s_{x+t}$$

$$= 0.01k \times \frac{SAL}{\bar{s}_x} \sum_{t=0}^{(R-1)-x} V^{x+t+\frac{1}{2}} \frac{l_{x+t+\frac{1}{2}}}{V^x l_x} s_{x+t}$$

$$= 0.01k \times \frac{SAL}{\bar{s}_x} \sum_{t=0}^{(R-1)-x} V^{x+t+\frac{1}{2}} \frac{l_{x+t+\frac{1}{2}}}{D_x} s_{x+t}$$

$$= 0.01k \times \frac{SAL}{\bar{s}_x} \sum_{t=0}^{(R-1)-x} V^{x+t+\frac{1}{2}} \frac{l_{x+t+\frac{1}{2}}}{D_x} s_{x+t}$$

$$= 0.01k \times \frac{SAL}{\bar{s}_x D_x} \sum_{t=0}^{(R-1)-x} {}^{s}D_{x+t+\frac{1}{2}}$$

$$\cong 0.01k \times \frac{SAL}{\bar{s}_x D_x} \sum_{t=0}^{(R-1)-x} {}^{s}\overline{D}_{x+t}$$

$$= \quad 0.01k \times \frac{SAL}{\bar{s}_x D_x} \times {}^{s}\overline{N}_x \qquad (3.5)$$

Where commutation functions are defined as:

$$D_x = v^x l_x$$

$${}^{s}\overline{D}_x = \sum_{t=0}^{(R-x)-1} D_x s_x$$

$${}^{s}\overline{N}_x = \sum_{t=0}^{(R-x)-1} {}^{s}\overline{D}_x$$

Increasing with age or service

Increasing the employer's contribution rate with service, rewards loyal employees. Increasing the employer contribution rate with age compensates for a shorter accumulation period at older ages. The employer may do either of the above to offer similar incentives to a defined benefit (final salary) scheme.

Matching employer contributions

Employer matches contribution paid by employee up to a maximum percentage of salary. This gives employees an incentive to contribute generously. It is also a way of targeting pension benefits at those employees who value them most.

The projected future pension fund on retirement depends on: the current fund value, future contribution rate, the retirement age, the projected cost of life annuity and financial assumptions used.

3.2 Income Stage.

The income stage comes after the accumulation phase (the period during which an individual makes regular contributions towards his/her pension benefits). Conventional annuities have been a popular and common way of providing pension benefits using the lump sum amount on retirement.

3.2.1 Conventional Annuities

The main options available in the conventional annuities market are:

3.2.1.1Level annuity

They provide a monetary amount for life. Such an annuity provides the highest initial income, but the annuitant is not protected against future inflation. There therefore exists the risk that future inflation will erode the value of the annuitant's income and consequently, his/her standard of living.

Suppose the lump sum available to purchase a level annuity for a life aged x is say S payable annually in advance.

$$\text{Annual annuity amount} = S/\ddot{a}_x \qquad (3.6)$$

$$= S * \frac{N_x}{D_X}$$

$$= S * \frac{D_X}{N_x}$$

3.2.1.2Escalating annuity

This is where the amount increases over time. The rate of increase is either fixed or dependent on the inflation rate. A fixed increase rate provides part protection against inflation. An escalating annuity starts at a lower initial level than a level annuity. Without taking into consideration the

time value of money5, an escalating annuity is only more valuable than a level annuity if the annuitant survives beyond a given age, called the break-even lifespan. In addition, even if the payments from an escalating annuity surpasses those from a level annuity, it would take several more years for the cumulative payments from an escalating annuity to surpass those of a level annuity.

Suppose the lump sum available to purchase an escalating annuity for a life aged x is say S payable annually in advance.

$$\text{Annual annuity amount} = S/I\ddot{a}_x \qquad (3.7)$$

$$= S * \frac{S_x}{D_x}$$

Where $Sx = \sum_{t=0}^{\infty} Nx + t$

If it is an increasing/ escalating annuity limited for say n years then it is given by

$$Ia^{\cdot\cdot}_{x:n} = Ia^{\cdot\cdot}_x - v^n \frac{l_{x+n}}{l_x}[n\ddot{a}_{x+n} + Ia^{\cdot\cdot}_{x+n}] \qquad (3.8)$$

$$= S_x/D_x - \frac{S_{x+n}}{D_x} - nN_{x+n}/D_X$$

3.2.1.3A guarantee period

The period is guaranteed such that payments continue until the end of the period in case the annuitant dies before the period ends.

Suppose the lump sum available to purchase an annuity for a guaranteed period of say n years for a life aged x is say S payable annually in advance.

$$0.75X = P\ddot{a}_n \ @ \ i\% + V^n \frac{l_{x+n}}{l_x} * \ddot{a}_{x+n} * P \qquad (3.9)$$

Alternative variations of annuities have been developed by insurance firms to address some of the shortfalls associated with conventional annuities, which made them relatively unpopular. These shortfalls include: poor value for money for annuitants with a lower life expectancy, unfavorable interest rates at retirement and increasing life expectancy leading to low annuity payments. These are called variable annuities.

3.2.2 Variable Annuities

Variable annuities are akin to unit linked investment products with flexible options and guarantees. There can be a considerable variation in the actual design and insurance providers offer an array of products that are designed for particular market segments. There are four variations of conventional annuities as described below.

3.2.2.1Guaranteed Minimum Death benefit (GMDB)

This offers a guarantee value on death. They offer a minimum return of premium. GMDB schemes can be quite simple, such as offering a minimum return on capital or the premium rolled up at a pre-set interest rate. However, they can be far more complex, such as offering a minimum guarantee of the highest point the fund ever reached, or the average fund value on the last few policy anniversaries.

Assume amount X is a lump sum on retirement. Let the tax free cash lump sum be 0.25 of X
The amount available to purchase annuities is 0.75 of X

Guaranteed amount= premium rolled up at i% or a lump sum

Using the equation of value to calculate the benefit;
Present value of Premium = Present Value of Benefits+ Present Value of Expenses

E.P.V of Lump sum (0.75X) = E.P.V annuity payments+ EPV Expenses+ E.P.V death benefit

$$0.75X=A*\ddot{a}_{55}+ 0.5\% * A*\ddot{a}_{55}+ D* A_{55} \qquad (3.10)$$

Where A= annuity payment

$\ddot{a}_{55}$=annuity factor

Expenses = 0.5% of each annuity payment

A_{55}= probability of death

D=guaranteed minimum death benefit

3.2.2.2Guaranteed Minimum Accumulation Benefit (GMAB)

This offers a guarantee on fund value, usually at a specific date. The guarantee can be simple such as offering a minimum return of the premium rolled up at a pre-set interest rate. More complex guarantees could include the highest point ever reached, or the value of the last policy anniversary.

A person aged x can contribute payments of P guaranteed that at retirement say 55years the fund would have a minimum rate accumulated at say k%

Fund value at 55= Max [Accumulation at *i*%, Accumulation at k%] where *i*% is the average investment return over the accumulation period. The guarantee will bite if *i*% is < k%. The life office can either cost for this guarantee using Black Scholes option pricing or by running a stochastic simulation of investment return and determining the likelihood of *i*% being less than k%.

3.2.2.3 Guaranteed Minimum Income Benefit

This typically requires an accumulation phase and an income phase. The income levels are guaranteed, at outset, on minimum conversion rates regardless of the movements in the financial and mortality markets.

The annuity will be calculated at k%. Based on the accumulated value, compute the annuity payment on retirement

$0.75X= A*\ddot{a}_{55}$ @ k% (3.11)

Where A is the annuity payments

This implies that $A=0.75X/ \ddot{a}_{55}$ @k%

If the prevailing interest rate at age 55 is less than k% the policy holder will take the guarantee rate at k%. If the market interest rates are higher than k% the policy holder will take the annuity at prevailing interest rates.

Given that i=2% and take i= 7%

3.2.2.4Guaranteed Minimum Withdrawal Benefit-

This guarantees regular income from the fund during a defined period. For example, a policyholder can withdraw 7% of the guaranteed level each year for 15 years, and as the fund may be invested in equities and the guaranteed level may be the initial investment with bonuses added based on fund performance. Another version might be, for a policyholder aged 60, a 5% withdrawal of the guaranteed amount for life. If there is a fund balance after the guaranteed period then this is paid as a death or surrender benefit.

Guaranteed amount= $0.75X^* (1+i)^{30}$ (3.12)

The guaranteed period is 30yrs

Each year one can withdraw $i\%^* 0.75X^* (1+i)^{30}$

Max[((i%* 0.75X* (1+i)35)*30- 0.75X* (1+i)30),0] represents the amount that can be withdrawn.

3.3 Other Alternatives

3.3.1 Income Drawdown

Legislation may permit the purchase of annuity to be delayed until a specified age, say 75. Members can draw income from fund, provided that income drawn is within legal limits. The fund can be invested as member chooses during drawdown period and is inherited on death.

However, if a pensioner decides to take an income drawdown rather than an annuity, he/she will lose out on the cross subsides created by those who 'die early'. Moreover, although the pension amount at age 75 is expected to be higher to reflect the age of the pensioner, it could be eroded by unfavorable interest rates.

"Mortality drag" means that the return on the member's fund must exceed that on the assets of a life annuity fund to provide the same income. The income drawdown only provides a higher Income than an annuity if the return on the fund exceeds the break-even rate.

$$Break\ even\ return = (\ddot{a}_x^{\ i} - 1)(1 + r) = \ddot{a}_{x+1}^{i}$$

This implies $r \approx i + q_x$

Where: r = break-even return; i = annuity interest rate

3.3.2 Equity release scheme

This is totally independent of accumulated fund during your working life. It depends on the value of your property and as such, we can make an assumption of the average value of a family house in Kenya for illustration purposes.

The aim of equity release products is to unlock equity held in domestic homes without the need of individual to sell the property. It's particularly appealing to older people who are "asset rich, cash poor" however it's also useful in areas such as inheritance tax planning. There are two types of equity release schemes, home reversion and lifetime mortgages.

Home reversion is where the client sells all or part of their home in return for a cash lump sum, a regular income or both. They are allowed to continue to live in that home, normally paying a nominal rent, until they die or choose to move.

Life mortgages are the most common, where the policy holder takes out a loan secured on their home, the amount of this loan is usually being restricted to a maximum percentage of the current

house value. The loan is repaid when the home is eventually sold or when the policy is surrendered.

CHAPTER 4

DATA ANALYSIS

As an illustration, Bob is aged 25 years and he is earning a salary of Kshs.800, 000p.a and whose retirement age is 55.

Assumptions

Fixed percentage contributions with rate k =4%

25% tax free lump sum and 75% for purchasing annuities.

No salary escalation.

Using the pension fund tables that are provided by the actuarial society we get the commutation functions with their values.

4.1 CONTRIBUTION STAGE

Assume that the mode of contribution is a fixed percentage of salary (k %).

$$\text{MPV of Future Contribution} = 0.01k \times \frac{SAL}{\bar{s}_x D_x} \times {}^{s}\overline{N}_x$$

$$= \frac{4}{100} * \frac{800{,}000}{\bar{S}_{25} D_{25}} * {}^{s}\overline{N}_{25}$$

$$where\ \bar{S}_{25} = \frac{1}{2}\ [S_{24} + S_{25}]$$

From the pension tables we get the values of S_{24} and S_{25} as 3.065 and 3.882 respectively

$$\bar{S}_{25} = \frac{1}{2}\ [3.605 + 3.882]$$

$$= 3.74$$

Given that $D_{25} = 14550$ and $s_{\overline{N}_{25}} = 915673$ from the Actuarial pension tables then the MpPV of future contributions is given by;

MPV of Future Contribution = 0.04* 800,000/ (3.74*14550) *915673

=538,462.91

Bob makes a future contribution of 538,462.91and accumulating it for the 30years to retirement at an interest rate of 8% on average.

Fund value at retirement is given by;

MPV of Future Contribution*(1+ investment return interest rate) $^{55-25}$

$$= 538{,}462.91 * (1.08)^{30}$$

$$= 5{,}418{,}367.48$$

4.2 INCOME STAGE

4.2.1 Conventional Annuities

Using the lump sum amount from the contribution stage, we can compute the annuity payments that Bob will be entitled to under the following types of conventional annuities.

If Bob chooses to get the annual Level annuities he will be entitled to the following amount as shown:

Bob takes a 25% tax free lump sum from the total contribution this becomes.

$$\text{cash free lump sum} = 0.25 * 5{,}418{,}367.48$$

$$= 1{,}354{,}591.945$$

The amount left to purchase the conventional annuities is therefore Ksh.4, 063,775.535

The resultant annuities are calculated as shown using the 75% left for purchasing annuities.

$$\text{Annual Level annuities} = \frac{S}{\ddot{a}_{55}}$$

$$= \frac{4{,}063{,}775.535}{15.873}$$

$$= \text{Kshs } 256{,}018$$

If Bob takes an escalating annuity that changes with the rate of inflation and therefore may start at a very lower level

$$\text{Escalating annuity} = S/\frac{S_{55}}{D_{55}}$$

$$= 4{,}063{,}775.535/\frac{S_{55}}{D_{55}}$$

Where from the pension tables we get $S_{55} = 209616.55$ and $D_{25} = 1105.47$

$$\text{escalating annuity} = 4{,}063{,}775.535/56.14$$

$$= 21{,}431.4175$$

It is worth noting that the payout from an escalating annuity starts at a much lower level than that of a level annuity. However, beyond a certain age, known as the break even age, the pension payments from an escalating annuity will exceed that of a level annuity.

If the annuity payment is guaranteed for a period of say five years, it will be computed as follows.

$$\text{Present value of lump sum amount} = P * (\ddot{a}_{5\neg} + V^5 * l_{60}/l_{55} * \ddot{a}_{60})$$

Solving for P, which is the guaranteed annuity payment for Bob yields;

$$P = \frac{\text{Present value of lump sum amount}}{(\ddot{a}_{5\neg} + V5 * l60/l55 * \ddot{a}_{60})}$$

$$P = \text{Kshs } 234{,}808.$$

This amount is slightly lower than that of a level annuity due to the fact that it's guaranteed to be paid for five years even if Bob were to die within the first five years into retirement.

4.2.2 Variable Annuities

Using the lump sum amount from the contribution stage, we can compute the annuity payments that the individual will be entitled to under the following types of variable annuity products.

4.2.2.1Guaranteed Minimum Income Benefit (GMIB):

Suppose Bob was guaranteed an income that was to be commutated using an interest rate of 6%, regardless of the movement in the financial markets. Assume that the prevailing interest rate is 4%, as computed in the illustration of level annuities. He will be better placed taking a pension annuity at 6 % since it is 'in the money'. He will receive an annuity amount as computed below.

$$annuity\ income = 0.75 * \frac{S}{\ddot{a}_{55}} @\ 6\%$$

$$= (\ 4{,}063{,}775.535)/13.057$$

$$= Kshs\ 311233.47$$

This benefit is higher than that at the prevailing interest rate of 4 % (Kshs 256,018). Suppose the guaranteed interest rate that will be used to commute the pension benefit is 2%. This will be 'out of the money' and Bob will receive a much lower pension benefit that than that calculated at the prevailing interest rate of 4%, as shown below.

$$annuity\ income = 0.75 * \frac{S}{\ddot{a}_{55}} @\ 2\%$$

$$= \frac{4{,}063{,}775.535}{19.911}$$

$$= Kshs\ 204{,}096$$

Therefore, the company is exposed to a risk if it guarantees an interest rate is lower than the prevailing interest rate on retirement. It can price for this risk using derivatives such as a call option put this comes at an additional cost.

4.2.2.2 Guaranteed Minimum Withdrawal Benefit (GMWB):

Assume that the fund grows at a rate of 5% per annum and Bob can withdraw 7% per annum from the fund for a maximum of 15 years, thereafter he remainder of the fund will be taken as a lump sum.

The amount of each withdrawal for the next 15 years is computed as follows:

$$P*\ddot{a}_{15\neg}^{@7\%-5\%} = 4{,}063{,}775.535$$

$$\text{Solving for P} = 4{,}063{,}775.535/\ddot{a}_{15\neg}^{@7\%-5\%}$$

$$P = 4063775.535/13.512$$

$$= \text{Kshs } 300,\ 735.65$$

The total amount he will withdraw over the 15 years 4,511,296.109

Any balance will be taken as surrender/ lump sum benefit. However, the withdrawals will closely be monitored especially at later years to ensure that the withdrawals aren't sustainable.

4.2.2.3Guaranteed Minimum Death Benefit (GMDB)

This offers a guaranteed value on death benefits.

$$0.75\,S = A * \ddot{a}_{55} + D * A_{55}$$

Since this annuity payment comes with a guaranteed death benefit, the payments will be of a lower amount than that of a conventional annuity. However, Bob will have peace of mind that if he dies early, his estate will receive the death benefit.

Take D, the death benefit to be Kshs 500,000.

Solving for A, we have:

$$A*15.873 + 500{,}000* 0.38950 = 4{,}063{,}775.535$$

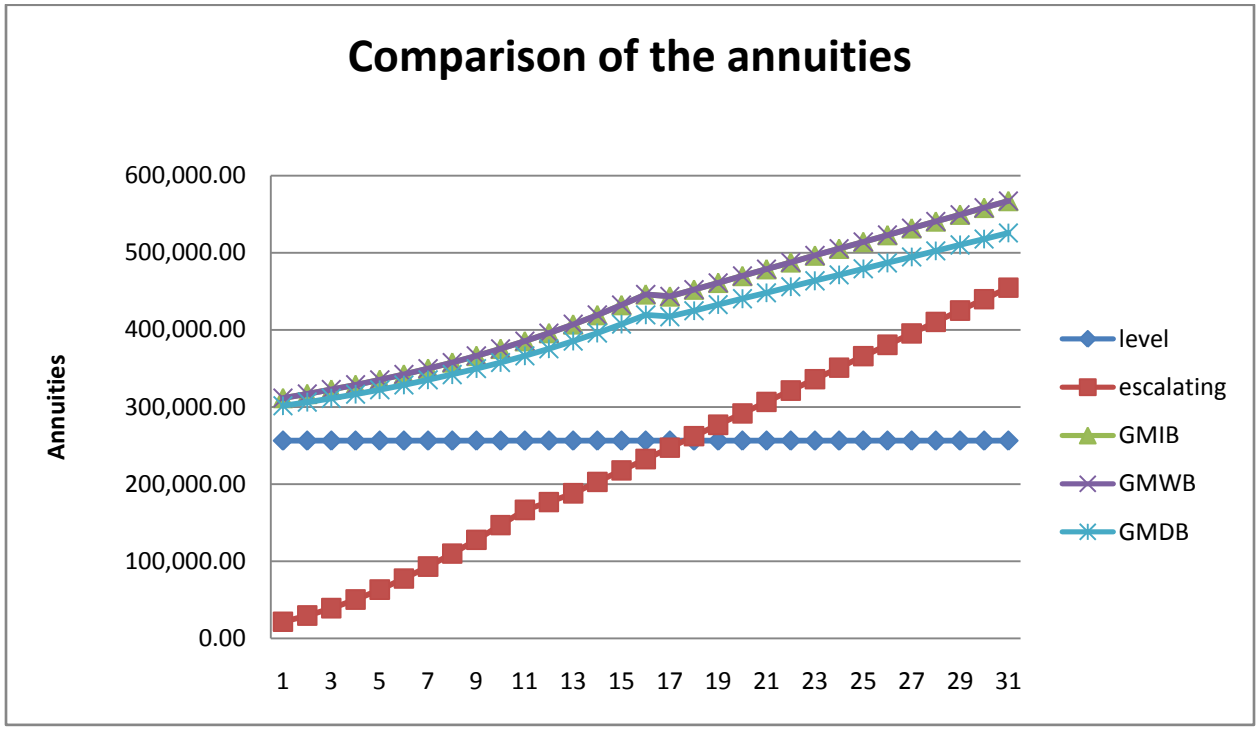
$$A = 243{,}748.85.$$

This is marginally lower than an annual payment provided by a conventional annuity of Kshs256,018.

4.2.2.4 Guaranteed Minimum Accumulated Benefit (GMAB)

This affects the contribution or accumulation phase during which Bob is working. The life office can guarantee that the contributions will be accumulated at a given interest rate, say 5%. This will increase the marketability of the annuity but it will come at a cost. If the average investment return is greater than the guaranteed rate, the life office will be exposed. Conversely, if the average investment returns is lower than the guaranteed rate, the life office can offer the annuity at the prevailing interest rate without any consequential financial strain.

Subsequently, if the guaranteed accumulation interest rate is greater than 4% (used to compute the lump sum benefit above), the corresponding annuity payment higher (due to a larger lump sum benefit). The converse holds.



The graph above shows a comparison of the conventional annuities and the alternatives till when Bob is aged 85 years. The break-even point between the level and escalating annuities is evident at where they cross "equilibrium". The variable annuities provide a better income after

retirement unlike the conventional annuities. If Bob does not survive to the break-even point then the escalating annuities are preferable.

4.2 Immediate Variable Annuities

An immediate variable annuity has some features similar to a conventional annuity. The annuity is usually payable for life, and can be taken on a single life or joint life basis. The major difference comes in the investment of the premium and the resultant income. For a conventional annuity, the insurance company invests the premium in low risk, low return assets like government bonds. The annuitant usually receives a fixed income for life. Premiums for variable annuities on the other hand are invested in higher risk, higher expected return investments like equities and property. This offers the opportunity for income to grow in 'real' terms i.e. in excess of inflation, since such investments usually provide returns in excess of inflation.

The income increases or decreases at different time periods, depending on the investment returns. However, most immediate variable annuities will have a minimum income guarantee, below which the income will not fall (Retirement Academy, 2013). Usually, the starting income from a variable annuity is lower than that from a conventional fixed annuity. However, this is offset by the potential for 'real' growth in income due to higher expected future investment returns.

There are two types of immediate variable annuities the with-profits and the unit linked annuities.

4.2.1 With-Profits Variable Annuities

Premiums are pooled together in the insurer's with-profits fund. The income they provide depends on the performance of this fund which is divided into two parts. The **minimum starting income which is** usually set at a low level, and provides the minimum amount beyond which an annuitant's income cannot fall and the **Bonuses which** are added onto the minimum starting income, usually annually. The bonuses can either be 'reversionary' or 'special'. Reversionary bonuses are usually declared annually for the duration of the annuity while special bonuses are usually one off declarations, e.g. following a one-off windfall from sale of with-profits assets.

The level of bonuses declared is not guaranteed but depends on the performance of the with profits fund investments all else being constant, the higher the returns, the higher will be the bonus declared and the financial strength of the insurer and the level of capital it has available. If

the insurer has lots of free capital, it will be able to declare a higher level of bonuses. However, an insurer facing financial constraints may not offer any bonuses if it needs the cash to sustain its operations.

Usually, the annuitant is given the option to choose an Anticipated Bonus Rate (ABR). The ABR is within a given range, e.g. between 0% and 5%. The annuitant chooses his/her ABR at the outset and may amend it later if the insurer allows such amendments.

The insurance company declares new bonus rates every year depending on the investment performance of it's with profits fund. If the declared bonus rate equals the ABR, the annuitant's income remains unchanged. The income increases if the bonus declared is greater than the ABR. However, if the bonus rate is lower than the ABR, income falls.

The lower the ABR, the lower an annuitant's starting income would be. However, this increases the probability of future bonuses being greater than the ABR and hence, the likelihood that their income will rise. The risk of future income falling is also reduced. A higher ABR leads to a higher starting income but increases the risk that future income will fall since there is a higher likelihood of future bonuses being less than the ABR (FSA, 2006).

4.2.2 Unit Linked Variable Annuities

Unlike with profits annuities whose income depend on the performance of the insurer's with profits fund, the income from unit linked annuities depend on the performance of the specific investment fund chosen by the annuitant. There is no smoothing of investment returns, which results in larger fluctuations of income. Hence, they are more risky than with profits annuities. This extra risk however means that they offer higher expected returns, and hence higher expected income growth (The Annuity Bureau, 2012a).

Unit linked annuities offer more investment choice than with profits annuities. There are different investment funds available, which are designed to match the risk appetites of different prospective annuitants. For example, the available funds may be in form of an index tracking fund where the portfolio of this fund is designed to track the performance of a particular stock market index e.g. the Nairobi Stock Exchange's FTSE 100 index.

Medium risk managed fund where the fund is invested over a wide selection of stocks and other investments. Such diversification is designed to reduce the exposure to risk and lastly the higher risk fund where the fund is invested in shares from a particular country or industry sector, e.g.

shares in developing countries. The reduced diversification increases risk but also the potential for higher returns.

It is possible for unit-linked annuities to have options that work in a similar way to with-profits annuities. For instance, the starting income can be based on a required annual growth rate, similar to an ABR. If the fund grows at the required rate, the annuitant's income is unchanged. If growth is less than the required rate, the income falls but if the growth is greater than the required rate, future income increases. In addition, some unit linked annuities may have a 'protected investment fund', which limits the fall in income due to poor investment returns (FSA, 2006). It should also be noted that unlike with profits annuities, most unit-linked annuities do not offer a minimum guaranteed income.

Variable annuities provide for a lifetime income, hence eliminating concern about the retiree outliving his/her pension fund. The annuity can also be taken on a joint-life basis, therefore providing an income to the surviving spouse in case of earlier death of the main annuitant. They provide a flexible income which can be varied to fit a retiree's particular circumstances. For example, if the retiree does not require a high level of income immediately after retirement, he/she can choose a low ABR, leading to a lower level of starting income, but with a high potential for future growth. The unit linked annuities offer investment choice to the retiree by providing a range of investment funds designed to suit different risk appetites. Annuitants with a high risk tolerance can increase their expected future income by investing in more risky funds.

In variable annuities both with profits and unit linked annuities invest a portion of the funds in equities and real estate which offer returns in excess of inflation. Thus, an annuitant's future income can grow at a rate greater than inflation, providing protection against the value of that income being eroded by inflation. Most variable annuity products offer a minimum level of income, below which future income cannot fall irrespective of investment returns.

However, variable annuities also have disadvantages in that the future income level fluctuates depending on future investment returns which make these annuities unsuitable for retirees who prefer a predictable level of income.The flexibility that these products offer comes at a cost.

Returns from unit linked annuities incur fund management charges and other deductions which may be reviewed upwards in case of future adverse experience. For with profits annuities, the bonus rates declared may be lower in future if life expectancy increases. These charges and deductions reduce the rate of future expected income growth. Lastly, these products are more complex than the usual conventional annuities. Prospective annuitants will need to seek the advice of financial experts which is expensive and adds to the cost of these products.

4.4 Income Drawdown

An income drawdown is a flexible alternative to purchasing an annuity. The retiree draws periodic payments from his/her pension fund, while it remains invested. The retiree chooses the amount of income they wish to withdraw, usually within specified limits. In the UK, there is no minimum amount that should be withdrawn in a given year. Hence, a retiree can defer accessing their pension fund if they have no immediate need of the cash.

Many occupational pension schemes do not offer income drawdown as a retirement benefit option. Hence, a retiree should first transfer their pension fund to a personal pension plan before using a drawdown (The Annuity Bureau, 2012a). A retiree can take up to 25% of their pension fund as a tax free lump sum and use the rest of the fund for income drawdown. In addition, the retiree has the right to convert the drawdown into an annuity at any time.

The retiree decides on the investment funds that they wish to invest in, which can be changed at a later date. Therefore, they can obtain exposure from investments in equities, bonds or real estate and the value of their fund could increase or decrease depending on investment returns. Such variation in fund value results in a variable income. The retiree is also exposed to the risk of running out of income if the fund is exhausted before he/she dies.

Income drawdown is also usually arranged through a financial adviser. Charges are deducted from the fund to cover advisory fees as well as fund management charges. These charges coupled with the regular income withdrawals, reduce the value of the fund over time, unless investment returns are higher than the withdrawals.

An income drawdown offers a greater level of flexibility as opposed to a conventional annuity. The retiree can decide on how is pension fund will be invested, the level of income they will receive. This is especially useful if the retiree has an extra source of income and they don’t

require a huge amount of cash from their pension fund. The retiree can choose a lower level of income to reduce the income tax they pay.

Although income drawdown is available to anyone in a personal pension or occupational scheme that offers drawdown, it's not suitable for everyone. According to FSA (2006a), drawdown plans may be viewed as complex, and are not suitable for retirees with a small/average pension fund. They are more suitable for retirees with an above average pension fund or extra retirement income who can bear the risks that drawdown poses.

An income drawdown offers a higher expected income than a conventional annuity to compensate its extra risk. Estimates by Deloitte (2013) indicate that an income drawdown can be used to increase retirement income by up to 20%. According to Deloitte (2013), income drawdown is misunderstood, underused and undervalued...About 400,000 people buy an annuity every year and many could increase their retirement income by using income drawdown...it allows retirees to live off the income generated from their pension fund and delay buying an annuity to get better value.
An individual member fund should be at least ***KShs 5m*** for income drawdown to be available as an option (RBA act)

There are two types of income drawdown products in the market currently the Capped drawdown and the Flexible drawdown.

4.4.1 Capped Drawdown

A capped income drawdown is available to anyone in a scheme offering the drawdown option. However, there are rules regarding the amount of income that can be withdrawn, how the funds are to be invested and the treatment of any unutilized funds in case of death of the retiree (Retirement Academy, 2013).

There is no minimum withdrawal amount, and the pension fund can be invested for as long as needed without any drawing of income. However, there is a maximum withdrawal amount, which is determined from annuity rates calculated by the Government Actuary Department

(GAD). The maximum withdrawal amount is aimed at minimizing the risk that unsustainably high withdrawals lead to the depletion of the retirement fund during the lifetime of the retiree and it's currently set at 100% of the income receivable from a single life level annuity without any guarantees as calculated by GAD.

The retiree can change the level of income to be received annually, though it must be within the limit set. The maximum amount is reviewed every three years up until the retiree attains age 75 and annually thereafter. This review takes into consideration the value of the unutilized fund and the retiree's age. However, regular annual reviews can also be undertaken to ensure that the investment strategy is still appropriate or to take into consideration any changes in income requirements.

If the annuitant dies before the fund runs out, the unutilized funds can be paid out as a lump sum to any dependants after payment of a flat tax rate of 55% or be used to provide an income to dependants, either through an annuity purchase or continuation of the drawdown and the death benefits can be decided upon at the time of death rather than at the outset.

4.4.2. Flexible Drawdown

A flexible drawdown is similar to a capped drawdown, but has no maximum withdrawal limit for retirees with a secured pension income of more than Kshs2,800,000 a year. This secured income is set to be reviewed every five years. This secured pension can include any state pension, annuity income and pension from an occupational scheme (The Annuity Bureau, 2012a). Such retirees can access unlimited withdrawal amounts from their funds, although the income is taxable. Since there are no maximum withdrawal limits, there is no need for the regular reviews that are carried out for capped drawdown.

The main advantages of an income drawdown are that it offers greater flexibility than both conventional and variable annuities. The retiree can opt not to receive any income from the fund if they don't need it. Individuals can use this flexibility to reduce their tax liability. The retiree can also move their fund between different providers, if another provider is offering better returns and/or lower charges. The retiree can defer purchase of an annuity if rates are expensive. Since drawdown offers the option to purchase an annuity at any future date, he/she can use a drawdown as a tax efficient investment vehicle while waiting for annuity rates to improve. The

retiree also has freedom regarding the investment of their pension fund. They can therefore suit their investment strategy to their risk appetite. In the event of early death of the retiree, unutilized funds are bequeathed to dependants who have various options regarding the utilization of those funds. The funds can be accessed as a lump sum, converted to an annuity or continued to be drawn down.

However, an income drawdown has its drawbacks in that where future income level is not predictable but depends on future investment returns. The retiree also is exposed to the risk of the fund running out within their lifetime if withdrawals are unsustainably high. The retiree may have lower income in the future if returns are lower than expected or earlier withdrawals were excessively high. If a retiree is using the drawdown to defer annuity purchase, they face the risk that future annuity rates won't improve and annuities may become even more expensive. This may lead to a lower than expected future annuity income. Income drawdown incurs a higher level of charges and deductions than an investment linked annuity would incur. A drawdown has higher administrative requirements due to the need for regular advice and reviews on the level of income being drawn out. Due to mortality drag, an income drawdown must obtain a higher investment return than a given annuity fund. This extra required return increases with age which necessitates investments in more risky assets like equities. Such a risky investment strategy may be less appealing the older a retiree gets.

4.5 Equity Release Schemes.

Equity release schemes enable you to take cash from the equity built up in your property. They are targeted at older homeowners who would struggle to take on a regular mortgage and probably have little or no income to make regular repayments. There are two main types of scheme these are the lifetime mortgages and reversion schemes. The minimum age is typically 55 on lifetime mortgages and 60 on reversion plans.

Lifetime mortgages are the most common type of scheme that enable you to take out a loan on your property in return for a lump sum, an income or a combination of the two. You continue to own the property. Usually, you will not make monthly repayments and the debt will be repaid

only when you die or go into long-term care. As there are no monthly repayments, the interest "rolls up", and this compounding effect will quickly increase the amount you owe.

The most popular sort of lifetime mortgage is the "drawdown" version, designed for those who don't need a large cash lump sum at the outset. Instead, a pot of money is set aside for you to draw from, as and when you need it. You only pay interest on the cash you release, which could save you a great deal of money.

Home reversion schemes account for a tiny part of the market. With these, you sell all, or part, of your home to a company in return for a lump sum, or regular income, and the right to remain living there. When the property is eventually sold, you or your estate only receive the percentage of the property's value that you still own. If, for example, you have sold 60%, you will only keep 40% of the final sale price.

The amount you can raise through equity release depends on a number of factors including the value of your property and how old you are but if there are two people jointly taking out the plan, it will be based on the age of the younger person.

On a lifetime mortgage, the maximum loan is typically around 50% of the property's value, but younger borrowers will have their loans capped well below that. On a reversion plan, you can sell up to 100% of your interest in the property in some cases.

Equity Release Schemes: Relative merits and demerits

On the upper side Equity release schemes will either avail a lump sum cash amount or a lump sum amount to the retiree thus unlocking any money ‘stores’ in the value of the house. No payments will be required from the retiree thus there are no cash outflows, apart from administrative charges at the outset. The retirees can live in the comfort of their house until they die or move into a care home. The cash payment can be structured to suit the retiree’s needs e.g. it can be issued in tranches. If the house is too large, the retiree can sell it and move to a smaller house, thus availing more cash.

Just like any other thing equity release has its downsides in that it reduces the value of your estate and subsequently the amount of property that your beneficiaries can inherit, the products involve borrowing against or selling all or part of your home. The amount of money you can get will heavily be influenced by the prevailing property market rates, they may work out to be more expensive in the long term than downsizing to a smaller property and if state provision is by means-tested benefits, an equity release scheme may disadvantage a retiree who might have otherwise qualified for means tested benefits.

CHAPTER FIVE
DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussion

During the contribution stage an individual may choose to pay a fixed percentage of their salary or a fixed monetary amount. After contributing to a port till the retirement age the individual can now decide on which type of income he prefers. Using the traditional method of conventional annuities, he may consider taking the level annuities or the escalating annuities in which case at the level annuities are higher at the beginning. Before the breakeven point is reached the individual prefers to take up the level annuities since the payout from the escalating annuities is lower. But after the breakeven point is attained "equilibrium" a consideration of escalating annuity may be the best option. The invention of variable annuities was set to achieve more income during retirement in that the annual income was more that the level income/escalating income. Although, the guaranteed income death benefit provides a low income since it has set aside a death benefit, the individual will be comfortable that his family will be financially fit in case of early death. With Income drawdown, the retiree keeps withdrawing from the invested fund but he is at the risk of running out of funds before he dies. For the equity release depending on how "asset" rich one is then this will be the best alternative for safeguarding once future.

5.2 Conclusion

Saving towards retirement is important for all individuals. It is imperative to understand one's financial position and their target income during retirement. There are two phases involved when planning for retirement benefits-the contribution/accumulation phase and the income phase.

Most individuals prefer to spend rather than save, especially during the early years of employment. Employers in the past offered Defined Benefit pension schemes that provided pre-defined post-retirement benefits for their employees. However due to escalating costs of running these schemes, employers now offer Defined Contribution schemes. This has subsequently shifted responsibility of saving towards retirement to employees. It is therefore necessary for employees to understand the importance of making sufficient regular contributions towards their retirement.

Conventional annuities have historically been used to provide retirement benefits using the accumulated lump sum amount on retirement. However, this represented poor value for money especially for pensioners who died shortly after retirement, having received little pension benefits relative to the lump sum amount paid. This led to the emergence of variable annuities that sought to address this issue. Regulations that previously required pensioners to purchase an annuity immediately on retirement were changed and individuals can defer an annuity purchase to a later age. This led to the development of income drawdown plans where individuals invest their retirement benefits in a fund and make regular withdrawals within prescribed limits. In the recent year, the age limit beyond which one was required to purchase an annuity has been abolished in some countries thus the income drawdown can continue for life.

Most people are likely to own a home upon attaining retaining age. The house value could potentially be high but the pensioner could be short on cash. Equity released schemes were established to 'unlock' the potential of property. This may be a popular means of providing additional cash on retirement since the pensioner retains ownership of the house until death. However, the dependents will be left with no property to inherit.

There are relative merits and demerits of each of alternative and what might suit a particular individual may not necessarily suit another. There may be other products that will emerge in the future and it will be important to consider ones financial commitments, health and other sources of income so as to choose a suitable alternative.

5.3Recommendation

Insurers should inform their customers that there are other options that they can purchase other than annuities and educate them on the benefits of each and inform them of the hidden charges behind each alternative. Income drawdown should be calculated to show how a pensioner will receive an income for the rest of his life.

References

Aaronson, S. and Coronado, J. (2005),*'Are Firms or Workers behind the Shift Away from DB Pension Plans?*', Finance and Economics Discussion Series 2005-17, Federal Reserve Board, Washington DC.

Abbey T, Henshall C (2007), *Variable Annuities,* Staple Inn Actuarial Society.

Ainslie R (2000), *Annuity and insurance products for impaired lives,* Staple Inn Actuarial Society.

Andrietti, V. and Hildebrand, V. (2001), '*Pension Portability and Labor Mobility in the United States: New Evidence from SIPP Data'*, Center for Research on Pensions and WelfarePolicies working paper 10/01.

Antolin, P. (2008), "*Pension Fund Performance*", OECD Working Papers on Insurance and Private Pensions,No. 20, OECD publishing, © OECD.doi:10.1787/240401404057

Deloitte (2012), *Solvency II Rules Could Make Retirement More Expensive,* [Online] Available

Bateman, H. and Mitchell, O.S. (2004), 'New Evidence on Pension Plan Design and Administrative Expenses: The Australian Experience', *Journal of Pension Economicsand Finance*, **3**:1, 63–76.

Bayer, P.J., Bernheim, B.D. and Scholz, J.K. (1996), '*The Effects of Financial Education inthe Workplace: Evidence from a Survey of Employers'*, NBER working Paper 5655,National Bureau of Economic Research, Cambridge, Massachusetts.

Benartzi, S. and Thaler, R.H. (2002), '*How Much is Investor Autonomy Worth?*' *JournalofFinance*, **57**, 1593–616.

Bernheim, B.D., Garrett, D.M. and Maki, D.M. (2001), '*Education and Saving: The Long-term Effects of High School Financial Curriculum Mandates*', *Journal of Public Economics*, Elsevier, **80**:3, 435–65, June.

Bernheim, B.D and Garrett, D.M (1996), '*The Determinants and Consequences of Financial Education in the Workplace: Evidence from a Survey of Households*', NBER Working Papers 5667, National Bureau of Economic Research.

Bikker, J. and de Dreu, J. (2006), '*Pension Fund Efficiency: The Impact of Scale,Governance and Plan Design*', Working Paper No. 109/2006, De NederlandscheBankNV.

Campbell, J.Y. and Viceira, L.M. (2002), *Strategic Asset Allocation: Portfolio choice for LongtermInvestors*, Clarendon Lectures in Economics series, Oxford University Press

Clark, R. and d'Ambrosio, M. (2002), '*Saving for Retirement: The Role of FinancialEducation*,' TIAA–CREF Institute Working Paper n. 4–070102–A.

Cooper, Russell W. and Thomas W. Ross. 2002.) "*Pensions: Theories of Underfunding*". Labour Economics 8:667-689.

Clark, R.L and Shieber, S (1998), '*Factors Affecting Participation Levels in 401(k) Plans'*, pp.69–97 in O. Mitchell, (ed.), *Living with Defined Contributions Plans: Remaking Responsibilityfor Retirement*, Pension Research Council, University of Pennsylvania Press, Philadelphia.

Dermine, J. and Roller, L. (1992), 'Economies of Scale and Scope in French Mutual Funds',*Journal of Financial Intermediation*, **2**, 83–93.

Department of Work and Pensions (2005), 'Hybrid Pension Plans: UK and InternationalExperience', a report prepared by Hewitt Bacon & Woodrow.

Department of Work and Pensions (2006), 'Personal Accounts: A New Way to Save',December.

Department of Work and Pensions (2007), 'Personal Accounts: A New Way to Save—Summary of Responses to the Consultation', June.

Dimson, E., Marsh, P. and Staunton, M. (2006), '*Global Investment Returns Yearbook 2006'*,ABNAmro.

James, E., Smalhout, J. and Vittas, D. (2005), '*Administrative Costs and the Organization ofIndividual Retirement Account Systems: A Comparative Perspective*', Working Paper,World Bank, Washington DC.

KNUiFE (2006), 'Open Pension Funds Market 2005'.

Madrian, B.C. and Shea, D.F. (2001), 'The Power of Suggestion: Inertia in 401(k)Participation and Savings Behavior', *Quarterly Journal of Economics*, **116**, 1149–187.

McCarthy, D. (2003), 'A Life-cycle Analysis of Defined Benefit Pension Plans', *Journal of Pension Economics and Finance*, **2**:2, 99–126.

McCarthy, D. and Neuberger, A. (2005), 'Pricing Pension Insurance: The Proposed LevyStructure for the Pension Protection Fund', *Fiscal Studies*, **26**:4, 471–89.

Muir, D. and Turner, J. (2003), 'Longevity and Retirement Age in Defined Benefit PensionPlans', memo available at http://www.nd.edu/~tghilard/Turner-Muir%20paper.htm.

Munnell, A.H. and Sunden, A. (2006), '401(k) Plans are Still Coming Up Short', *An Issue inBrief*, **43**, March, Center for Retirement Research, Boston College.

Pugh, C. and J. Yermo (2008), "*Funding Regulations and Risk Sharing*", OECD Working Papers on Insurance and Private Pensions, No. 17, OECD Publishing. doi:10.1787/241841441002

Pension Policy Institute (2003), '*The shift from DB to DC*', PPI Briefing Note Number 2.

The Pensions Regulator (2006a), '*Abandonment of Defined Benefit Pension Schemes*',discussion paper.

The Pensions Regulator (2006b), '*How the Pensions Regulator wills Regulate DefinedContribution Schemes in Relation to Risks to Members*', November.

The Pensions Regulator (2007), '*The Governance of Work-based Pension Schemes*',discussion paper, April.

Salome Chirchir. "*Conversion of Defined Benefits Schemes to Defined Contribution Schemes*. " (June 2010): 10-17.

Stephen Taylor, (2000) "*Occupational pensions and employee retention: Debate and evidence*", Employee Relations, Vol. 22 Iss: 3, pp.246 – 259

Stewart, F. and J. Yermo (2008), "*Pension Fund Governance: Challenges and Potential Solutions*", OECD Working Papers on Insurance and Private Pensions, No. 18, OECD publishing, © OECD. doi:10.1787/241402256531

U.S. Department of Labor (USDOL), Advisory Council on Employee Welfare and Pension Benefits, "*Are We Cashing Out Our Future*?" (November 13, 1998), www.dol.gov/dol/pwba/ public/adcoun/leaknew1.htm.

Ward, S. (1995). Managing the pensions revolution, London: Nicholas Brealey.

VanDerhei, Jack, and Copeland, Craig. "*The Changing Face of Private Retirement Plans*," EBRI Issue Briefs. (April 2001). Washington DC: Employee Benefit Research Institute.

Willette, Anne. "*Saving Your Retirement: Few Workers Know Risks of 401(k) Plans*." USA Today. February 20, 1995, Section A, p. 1.

Appendices

Appendix A

Generated using different interest rates

interest rate	4%
Discounting Factor	0.961538

Formula

$$D_x = v^x l_x,$$
$$N_x = D_x + D_{x+1} + D_{x+2} + \text{etc.},$$
$$S_x = N_x + N_{x+1} + N_{x+2} + \text{etc.},$$
$$C_x = v^{x+1} d_x,$$
$$M_x = C_x + C_{x+1} + C_{x+2} + \text{etc.},$$
$$R_x = M_x + M_{x+1} + M_{x+2} + \text{etc.}$$

APPENDIX B

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x	l_x	d_x	D_x	N_x	S_x	C_x	M_x	R_x	$a¨x$	x
17	10000.00	6.00	5133.73	119950.69	2397377.49	2.962	520.24	27743.9	23.37	17
18	9994.00	5.94	4933.32	114816.96	2277426.79	2.818	517.28	27223.6	23.27	18
19	9988.06	5.86	4740.76	109883.64	2162609.83	2.676	514.46	26706.3	23.18	19
20	9982.20	5.81	4555.75	105142.88	2052726.19	2.549	511.79	26191.9	23.08	20
21	9976.39	5.76	4377.98	100587.14	1947583.31	2.429	509.24	25680.1	22.98	21
22	9970.63	5.70	4207.16	96209.16	1846996.17	2.314	506.81	25170.8	22.87	22
23	9964.93	5.67	4043.04	92002.00	1750787.01	2.212	504.50	24664.0	22.76	23
24	9959.26	5.65	3885.32	87958.96	1658785.01	2.118	502.28	24159.5	22.64	24
25	9953.61	5.63	3733.77	84073.64	1570826.05	2.032	500.17	23657.3	22.52	25
26	9947.98	5.64	3588.13	80339.87	1486752.41	1.956	498.13	23157.1	22.39	26
27	9942.34	5.67	3448.17	76751.74	1406412.54	1.890	496.18	22659.0	22.26	27
28	9936.67	5.70	3313.66	73303.58	1329660.79	1.829	494.29	22162.8	22.12	28
29	9930.97	5.76	3184.38	69989.92	1256357.22	1.776	492.46	21668.5	21.98	29
30	9925.21	5.86	3060.13	66805.54	1186367.30	1.736	490.68	21176.0	21.83	30
31	9919.35	5.97	2940.69	63745.41	1119561.76	1.702	488.95	20685.3	21.68	31
32	9913.38	6.12	2825.89	60804.72	1055816.35	1.677	487.25	20196.4	21.52	32
33	9907.27	6.30	2715.52	57978.83	995011.63	1.661	485.57	19709.2	21.35	33
34	9900.96	6.53	2609.42	55263.31	937032.80	1.656	483.91	19223.6	21.18	34
35	9894.43	6.82	2507.40	52653.89	881769.49	1.661	482.25	18739.7	21.00	35
36	9887.61	7.16	2409.30	50146.48	829115.61	1.677	480.59	18257.4	20.81	36
37	9880.45	7.56	2314.96	47737.18	778969.12	1.703	478.91	17776.8	20.62	37
38	9872.90	8.03	2224.22	45422.22	731231.94	1.739	477.21	17297.9	20.42	38
39	9864.87	8.58	2136.93	43198.00	685809.72	1.788	475.47	16820.7	20.21	39
40	9856.29	9.24	2052.96	41061.07	642611.71	1.850	473.68	16345.2	20.00	40
41	9847.05	9.98	1972.15	39008.11	601550.64	1.923	471.83	15871.6	19.78	41
42	9837.07	-25.14	1894.37	37035.97	562542.53	-4.655	469.91	15399.7	19.55	42

43	9862.21	47.87	1826.17	35141.59	525506.56	8.523	474.57	14929.8	19.24	43
44	9814.34	13.02	1747.41	33315.43	490364.97	2.230	466.04	14455.2	19.07	44
45	9801.31	14.36	1677.97	31568.02	457049.54	2.364	463.81	13989.2	18.81	45
46	9786.95	15.87	1611.07	29890.05	425481.52	2.513	461.45	13525.4	18.55	46
47	9771.08	17.61	1546.59	28278.98	395591.47	2.680	458.94	13063.9	18.28	47
48	9753.47	19.60	1484.43	26732.39	367312.49	2.869	456.26	12605.0	18.01	48
49	9733.87	21.79	1424.46	25247.96	340580.10	3.067	453.39	12148.7	17.72	49
50	9712.07	24.36	1366.61	23823.50	315332.13	3.296	450.32	11695.3	17.43	50
51	9687.71	27.21	1310.75	22456.89	291508.63	3.540	447.03	11245.0	17.13	51
52	9660.50	30.45	1256.80	21146.13	269051.74	3.809	443.49	10798.0	16.83	52
53	9630.05	34.08	1204.65	19889.34	247905.61	4.099	439.68	10354.5	16.51	53
54	9595.97	38.15	1154.22	18684.68	228016.27	4.413	435.58	9914.8	16.19	54
55	9557.82	42.71	1105.41	17530.46	209331.59	4.750	431.17	9479.2	15.86	55
56	9515.10	47.81	1058.15	16425.05	191801.13	5.113	426.42	9048.1	15.52	56
57	9467.29	53.49	1012.34	15366.90	175376.08	5.500	421.30	8621.7	15.18	57
58	9413.80	59.80	967.90	14354.56	160009.18	5.912	415.80	8200.4	14.83	58
59	9354.00	66.79	924.76	13386.66	145654.61	6.349	409.89	7784.6	14.48	59
60	9287.22	74.50	882.85	12461.90	132267.95	6.810	403.54	7374.7	14.12	60
61	9212.71	83.00	842.08	11579.05	119806.06	7.295	396.73	6971.1	13.75	61
62	9129.72	92.32	802.40	10736.97	108227.00	7.802	389.44	6574.4	13.38	62
63	9037.40	102.52	763.74	9934.57	97490.03	8.331	381.64	6185.0	13.01	63
64	8934.88	113.62	726.03	9170.84	87555.46	8.877	373.31	5803.3	12.63	64
65	8821.26	125.64	689.23	8444.81	78384.63	9.439	364.43	5430.0	12.25	65
66	8695.62	138.61	653.28	7755.58	69939.82	10.013	354.99	5065.6	11.87	66
67	8557.01	152.52	618.14	7102.30	62184.25	10.594	344.98	4710.6	11.49	67
68	8404.49	167.36	583.77	6484.15	55081.95	11.178	334.38	4365.6	11.11	68
69	8237.13	183.08	550.14	5900.38	48597.80	11.757	323.21	4031.2	10.73	69
70	8054.05	199.60	517.23	5350.24	42697.42	12.325	311.45	3708.0	10.34	70
71	7854.45	486.83	485.01	4833.01	37347.18	28.905	299.12	3396.6	9.96	71
72	7367.62	-35.39	437.45	4348.00	32514.17	-2.020	270.22	3097.5	9.94	72
73	7403.01	252.77	422.64	3910.55	28166.17	13.876	272.24	2827.2	9.25	73
74	7150.24	271.07	392.51	3487.91	24255.62	14.308	258.36	2555.0	8.89	74
75	6879.17	289.24	363.11	3095.40	20767.71	14.680	244.05	2296.6	8.52	75
76	6589.93	306.95	334.46	2732.29	17672.31	14.979	229.37	2052.6	8.17	76
77	6282.98	323.81	306.62	2397.83	14940.02	15.195	214.39	1823.2	7.82	77
78	5959.17	339.41	279.63	2091.21	12542.19	15.314	199.20	1608.8	7.48	78
79	5619.76	353.30	253.56	1811.58	10450.98	15.328	183.89	1409.6	7.14	79
80	5266.46	361.98	228.48	1558.02	8639.41	15.100	168.56	1225.7	6.82	80
81	4904.48	376.98	204.59	1329.53	7081.39	15.121	153.46	1057.2	6.50	81
82	4527.50	379.83	181.60	1124.94	5751.85	14.649	138.34	903.7	6.19	82
83	4147.67	382.07	159.97	943.34	4626.91	14.169	123.69	765.4	5.90	83
84	3765.60	380.35	139.65	783.37	3683.58	13.563	109.52	641.7	5.61	84

85	3385.25	374.41	120.71	643.72	2900.21	12.837	95.96	532.2	5.33	85
86	3010.84	364.10	103.23	523.01	2256.49	12.004	83.12	436.2	5.07	86
87	2646.74	349.44	87.26	419.77	1733.48	11.078	71.11	353.1	4.81	87
88	2297.30	330.65	72.83	332.51	1313.71	10.079	60.04	282.0	4.57	88
89	1966.65	308.10	59.95	259.69	981.20	9.030	49.96	221.9	4.33	89
90	1658.55	282.36	48.61	199.74	721.51	7.957	40.93	172.0	4.11	90
91	1376.19	254.20	38.78	151.13	521.77	6.888	32.97	131.1	3.90	91
92	1121.99	224.49	30.40	112.35	370.63	5.849	26.08	98.1	3.70	92
93	897.50	194.18	23.38	81.95	258.29	4.865	20.23	72.0	3.50	93
94	703.32	164.26	17.62	58.56	176.34	3.957	15.37	51.8	3.32	94
95	539.06	135.66	12.99	40.94	117.78	3.142	11.41	36.4	3.15	95
96	403.40	109.20	9.34	27.95	76.84	2.432	8.27	25.0	2.99	96
97	294.21	85.50	6.55	18.61	48.89	1.831	5.84	16.7	2.84	97
98	208.71	64.99	4.47	12.06	30.28	1.338	4.01	10.9	2.70	98
99	143.71	47.86	2.96	7.59	18.22	0.948	2.67	6.9	2.56	99
100	95.85	34.07	1.90	4.63	10.63	0.649	1.72	4.2	2.44	100
101	61.77	23.39	1.18	2.73	6.00	0.428	1.07	2.5	2.32	101
102	38.38	15.45	0.70	1.55	3.27	0.272	0.64	1.4	2.21	102
103	22.93	9.79	0.40	0.85	1.72	0.166	0.37	0.8	2.11	103
104	13.14	5.94	0.22	0.45	0.87	0.097	0.21	0.4	2.02	104
105	7.20	3.44	0.12	0.23	0.42	0.054	0.11	0.2	1.93	105
106	3.76	1.89	0.06	0.11	0.19	0.028	0.05	0.1	1.85	106
107	1.87	0.99	0.03	0.05	0.09	0.014	0.03	0.0	1.77	107
108	0.88	0.49	0.01	0.02	0.04	0.007	0.01	0.0	1.70	108
109	0.39	0.23	0.01	0.01	0.01	0.003	0.01	0.0	1.65	109
110	0.16	0.10	0.00	0.00	0.01	0.001	0.00	0.0	1.61	110
111	0.06	0.04	0.00	0.00	0.00	0.001	0.00	0.0	1.62	111
112	0.02	0.02	0.00	0.00	0.00	0.000	0.00	0.0	1.77	112
113	0.01	0.01	0.00	0.00	0.00	0.000	0.00	0.0	2.33	113
114	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.0	4.43	114
115	0.01	0.01	0.00	0.00	0.00	0.000	0.00	0.0	1.27	115
116	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.0	1.00	116
117	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.0		117
118	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.0		118
119	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.0		119
120	0.00	0.00	0.00	0.00	0.00	0.000	0.00	0.0		120

APPENDIX C

Comparison data for the conventional annuities and the variable annuities

	level	Escalating	GMIB	GMWB	GMDB
55	256,248.48	21,459.42	311,479.42	311,479.42	301,457.41
56	256,248.50	29,432.08	316,818.76	316,818.76	306,139.81
57	256,248.48	39,022.32	322,528.59	322,528.59	311,147.11
58	256,249.50	50,245.78	328,635.88	328,635.88	316,502.97
59	256,248.48	63,033.35	335,169.54	335,169.54	322,232.74
60	256,250.50	77,290.57	342,160.53	342,160.53	328,363.57
61	256,248.48	92,902.01	349,642.60	349,642.60	334,925.06
62	256,251.50	109,742.40	357,651.84	357,651.84	341,948.85
63	256,248.48	127,684.69	366,227.08	366,227.08	349,469.01
64	256,252.50	146,605.38	375,409.83	375,409.83	357,521.93
65	256,248.48	166,387.74	385,245.53	385,245.53	366,147.46
66	256,253.50	176,567.84	395,782.89	395,782.89	375,388.32
67	256,248.48	187,943.44	407,074.58	407,074.58	385,290.71
68	256,254.50	202,750.46	419,177.25	419,177.25	395,904.28
69	256,248.48	217,557.48	432,151.98	432,151.98	407,282.63
70	256,255.50	232,364.50	446,064.87	446,064.87	419,483.69
71	256,252.69	247,171.52	443,361.23	443,361.23	417,112.71
72	256,252.98	261,978.54	452,203.57	452,203.57	424,867.10
73	256,253.27	276,785.57	461,045.91	461,045.91	432,621.50
74	256,253.56	291,592.59	469,888.26	469,888.26	440,375.89
75	256,253.85	306,399.61	478,730.60	478,730.60	448,130.29
76	256,254.13	321,206.63	487,572.94	487,572.94	455,884.68
77	256,254.42	336,013.65	496,415.28	496,415.28	463,639.08
78	256,254.71	350,820.67	505,257.62	505,257.62	471,393.47
79	256,255.00	365,627.69	514,099.97	514,099.97	479,147.87
80	256,255.29	380,434.72	522,942.31	522,942.31	486,902.26
81	256,255.58	395,241.74	531,784.65	531,784.65	494,656.66
82	256,255.87	410,048.76	540,626.99	540,626.99	502,411.05
83	256,256.15	424,855.78	549,469.33	549,469.33	510,165.45
84	256,256.44	439,662.80	558,311.68	558,311.68	517,919.84
85	256,256.73	454,469.82	567,154.02	567,154.02	525,674.24