

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY,
KUMASI



ASSESSING REPLACEMENT RATE AMONG GHANAIAI EMPLOYEES

BY

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DECLARATION

I hereby declare that this submission is my own work towards the award of the MSc. degree and that, to the best of my knowledge, it contains no material previously published by another person nor material which had been accepted for the award of any other degree of the university, except where due acknowledgement had been made in the text.

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DEDICATION

This thesis is dedicated to God who saw me through my period of study.

KNUST



ABSTRACT

This paper focuses on assessing the replacement rate of Ghanaian workers. In order to get an assessment, a relationship is developed between the replacement rate and the adequacy of benefits paid out under a defined contribution (DC) scheme, based on an appropriate investment rate of 5% of the current Ghanaian market, an average replacement ratio of 6.67% was reached. Through actuarial assumptions and calculations the accumulated amounts accrued members of the scheme upon qualification were calculated and subsequently the Replacement Rate was obtained. The number of contributions and years in service and was also used in making deterministic projections. It was found out that the higher investment rate certainly brought about increase in the replacement ratio with considerable improvement in retirement adequacy of the retirement benefits paid out under the defined contribution pension plan as well.



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LIST OF ABBREVIATIONS

SSNIT Social Security and National Insurance Trust DC
 Define Contribution

DB Define Benefit RR
 Replacement Ratio

ILO International Labour Organization NHIS
 National Health Insurance Scheme

SOEs State Owned Enterprises EC
 Employees Contributions

APV Actuarial Present Value TPC
 Total Past Contributions

ESB End of Service Benefit

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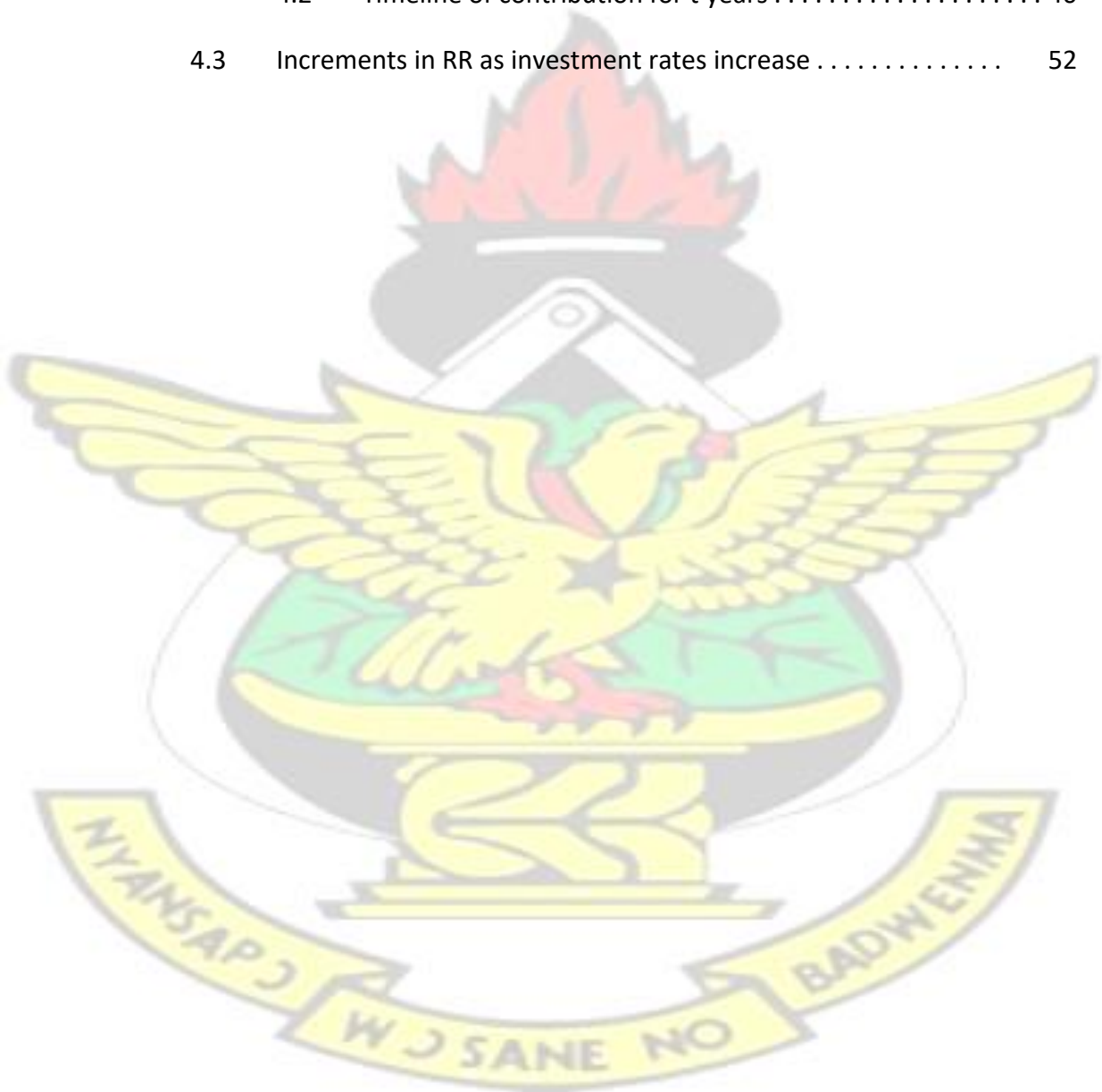
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CHAPTER 1

Introduction

1.1 Background to the Study

In general, a pension is an arrangement to provide people with an income when they are no longer earning a regular income from employment. It is a tax deferred savings vehicle that allows for the tax-free accumulation of the fund for later use as an income. A pension scheme therefore refers to a pension granted upon retirement. Employers, insurance companies, the government or other institutions such as employer associations or trade unions may set up a pension scheme. A pension scheme is typically in the form of life annuity. In Ghana, the pension fund is managed by the Social Security and National Insurance Trust (SSNIT), which was a provident fund from 1965 to 1990 .It became a Social Insurance Scheme in 1991 by PNDC Law 247.SSNIT's primary role which is contained in its mission and vision statement is to promote the economic security of the Ghanaian worker, this is to maintain the standard of living. This could be achieved by, among other means, supplementary pension schemes, although in Ghana it is a market that is yet to be fully explored. These supplementary schemes do not go by the name pension schemes, but are operated as life insurance policies and provident funds. Presently it is mandatory for every worker who has an employeremployee relationship with an identified employer to be covered by the Social Security and National Insurance Trust (SSNIT) pension scheme according to the Social Security Act P.N.D.C Law 247. When most people think about retirement planning, they think "how much do I need to save?" A commonly forgotten element is "what income will I need during retirement?" One of the key components in calculating your retirement income outlook is estimating your wage replacement ratio:

what percentage of your pre-retirement income is needed to fund your retirement years?

The main objective of any pension scheme should be to provide members with adequate incomes when they retire. What constitutes an adequate pension or income is in fact, not easy to point out. However, it is generally accepted that the adequacy of pension is related to the individual's income prior to retirement. A pension policy must therefore, aim at developing the mechanisms by which the objective of adequate pension can be achieved. Under the defined- contribution, benefits are not based upon a predetermined formula; plan participants upon retirement get back their contributions plus their accumulated return with the pension benefit taking the form of a lump-sum payment. For many years, replacement ratios have been used to measure retirement adequacy. Replacement rate is a common measurement which can be used to determine the effectiveness a pension system. It can also be used to help estimate what rate of investments returns should scheme members earn on their on their contributions in order for them to enjoy adequate retirement benefits to replace earnings to maintain a standard of living equivalent to what they used to enjoy before retirement. As such the big question here is that can employees accumulate sufficient funds over their working life, and how can it be determined that the accumulated funds maintain a certain standard of living equivalent to what they used to enjoy pre-retirement. Your replacement ratio under a supplementary defined contribution scheme is directly related to the investment rate of returns of one's contribution and this relationship can help to shape your retirement outlook and how your retirement future might play out. If we therefore devote ourselves to increasing the investment return rate, the replacement ratio will increase too, with better management and prudent choice of investment portfolios, contributors stand to reap significant benefits.

1.2 Problem Statement

Pensions are essentially the only source of income for many retired workers. It is thus critical that the pension fund manager chooses the right type of plan for his/her workers. Every pension scheme follows its own set of rules when calculating the benefits of the fund's members at retirement. Whichever plan the manager chooses for the members, he/she will have to invest their contributions in the financial market. The manager is therefore faced with the daunting task of selecting the most appropriate investment strategy as to maximize the returns from the financial assets. As such when a well-managed and efficiently ran scheme is set up for the workers, their contributions can be used as an effective source of long-term capital for productive investment with high interest yields and ensure that the member does not suffer a loss due to poorly performing investments.

1.3 Objectives of the Study

The main objective of this project is to use formulas and applications in Pension Mathematics and Financial Mathematics to create a model to cater for;

1. A supplementary pension plan for Ghanaian workers, in the form of a defined contribution scheme.
2. A micro simulation of strategies in excel and an analysis, to ascertain the adequacy of retirement benefits for members of a defined contribution scheme through the use of a replacement ratio.

1.4 Significance of Study

The challenge facing many African governments today is how to provide income security to all. In order to enhance income security it is important for the workers themselves to embrace a pillar of social security that guarantees extra income they can fall back on in the event of exposure to risk or retirement, thus insuring against the risk of longevity. Longevity is a source of economic insecurity in that individual may outlive their financial capacity to maintain themselves and their dependants. As given by its definition replacement rate should maintain a worker's standard of living after retirement. Thus, the purpose of this study is to develop a model which will provide the potential member with deterministic projections of benefits the plan participants are going to receive based upon a predetermined formula and the relationship between the adequacy of retirement benefits paid out by a Defined Contribution scheme and the replacement ratio will be established based on the data and actuarial assumptions used in the model. In a defined contribution plan, the benefit received equals the contributions to the plan adjusted for returns on possible investments. As such we estimate what level of investment returns contributors must receive on their contributions in order for them to be comfortable post retirement. However, in situations where savings are a person's largest source of retirement income, it is important to define the factors needed to provide an adequate retirement. In this regard, we have considered a case of a pension company that invests in the money market account while basing its investment on the contribution of members.

1.5 Methodology

Based on the data, assumptions, and model, the replacement ratio of all employees are calculated under a defined contribution plan. First, we calculate the expected accumulated

individual account at retirement age for each employee. Then, with the annuity factor provided by life table, we estimate the future retirement benefits.

Finally, the replacement rate is obtained.

1.5.1 Data Collection

Secondary data on salary and contribution of members to SSNIT over the past years will be obtained for the analysis.

1.5.2 Data Analysis

Formulae from Financial Mathematics and Pension Mathematics will be used in excel to forecast the retirement benefits and replacement rate of members of the scheme. The spreadsheet model will also be used to conduct a sensitivity analysis to determine what rates are optimal for adequate retirement benefits so that members do not loss the value of their benefits over time.

1.6 Organisation of the Thesis

The thesis has been structured into five distinct chapters. Chapter one is the introduction of research proposal and featured background information, problem statement, objectives, significant of study, methodology of the study, data collection and data analysis. Chapter two featured the literature review related to the topic of the study Chapter three focuses on the details of the research methodology as well as assessing the adequacy of retirement benefit through the use of replacement ratio. Chapter four presented the analyzed data together with their interpretation as well as discussion of findings. Chapter five summarized the study made recommendations and drew very useful conclusions.

CHAPTER 2

Literature Review

2.1 Introduction

The International Labour Organisation (ILO) defines social security as “the protection which society provides for its members, through a series of public measures, against the economic and social distress that otherwise would be caused by the stoppage or substantial reduction in earnings resulting from sickness, maternity, employment injury, unemployment, invalidity, old age and death; the provision of medical care; and the provision of subsidies for families with children” . The objectives of social security are among others; to replace loss or reduction in incomes, promote health through medical care, and to assist families bringing up children. These objectives are achieved through social security benefits. These benefits vary with society and level of development. Some of the social security benefits are old-age pension, disability benefit, medical care benefit, death benefit, sickness allowance, maternity allowance, employment injury benefit, unemployment allowance and childcare support.

2.2 What are Pensions Schemes?

“Pension” is the generic name of long-term periodical cash benefits that Social Security

Systems pay in case of invalidity, in old age and on the death of the breadwinner. Whether the method of affording protection is social insurance, public service or social assistance, the three kinds of pension should be coordinated.” – (ILO, 1970) As such a pension scheme

is one form of social insurance; it is an arrangement to provide a member with income when he/she retires from gainful employment. The pension received may be a flat rate or dependent on the amount of contributions and the length of time that those contributions have been paid.

The main objective of any pension scheme should be to provide members with adequate incomes when they retire. What constitutes an adequate pension or income is in fact, not easy to point out. However, it is generally accepted that the adequacy of pension is related to the individual's income prior to retirement. A pension policy must therefore, aim at developing the mechanisms by which the objective of adequate pension can be achieved. This poses great challenge for policy-makers, as it is certain that many people retire on inadequate incomes, especially in developing economies. The major issues of concern are the adequacy of benefits currently provided by the scheme and the qualities of the services provided by SSNIT, the body established by law to administer the State pension scheme in Ghana. The current levels of benefits are perceived to be inadequate. Also, the current pension arrangements are seen as not being generous enough. Some members of the scheme have questioned the qualities of

- The services provided by SSNIT, and there seems to be considerable lack of confidence.

Over ninety percent of the members of the scheme are formal sector employees, with the rest of the members being self-employed persons in the informal sector of the economy. A similar pattern is obtained with regards to the coverage of the working population by the private pension schemes. However, the informal sector employs about ninety percent of the working population of Ghana ?.

- This means that a large number of workers in Ghana are currently not making any provisions for guaranteed incomes in retirement.

- Another issue of public concern is the alleged misuse of the pension fund by SSNIT and the Government. There seems to be fears within members of the scheme that given this alleged misuse of the pension fund, the State pension scheme could become insolvent at some point in time, resulting in some members' entitlements not being met.

2.2.1 Historical Background of Pensions in Ghana

Prior to Ghana's independence, there was no universal social security scheme in the country. The existing schemes only provided social protection to some categories of workers. For instance, in 1946, the colonial government of the then Gold Coast introduced a non-contributory pension scheme to cover senior civil servants. This scheme had by 1955 been extended to cover certified teachers and was commonly referred to as "CAP 30". Similarly, a private superannuation scheme was operated to provide social security benefits to retired members of the academic staff of the then University College of the Gold Coast (University of Ghana). In the private sector, there were large foreign trading and commercial firms that operated provident fund schemes, under which benefits were paid to employees at the time of retirement (Adjei, 1999). The compulsory savings scheme of 1960 was the first attempt at developing a social security scheme with a national scope of coverage. This was replaced by the social security Act No. 279 of 1965, under which coverage was extended to all establishments employing five or more workers except those already covered by the "Cap 30" scheme. This national scheme was operated as a provident fund from the onset and was supposed to be converted to a pension scheme after five years (that is, by 1970). However, the conversion was not carried out as scheduled.

In 1972, a decree was passed by which all civil servants employed on or after 1st January 1972 were to be covered by the social security scheme instead of the "Cap 30" scheme. In 1975, another decree (SMCD 8) was passed, which provided civil servants covered by the "Cap 30" scheme, the opportunity to opt to either remain covered by the "Cap 30" scheme or switch to the social security scheme. Refusal to exercise the option automatically led to coverage by the social security scheme. Proposals to convert the social security scheme

from a provident fund scheme to a pension scheme were made to the government in 1987. However, the actual conversion was not carried out until 1991, with the promulgation of social security law (P.N.D.C.L. 247). The social security law (1991) called for the establishment of a Trustee (called SSNIT), with the responsibility to administer the State pension scheme. In Ghana, the social Security Scheme was a provident fund from 1965 to 1990. It became a Social Insurance Scheme in January 1991 by PNDC Law 247.

Under NRCD 127 of 1972, the Provident Fund Scheme that was operated by SSNIT had a superannuation benefit and five direct benefits to cater for the following contingencies, sickness (introduced in 1968), Invalidity, Emigration, Death and survivors, Unemployment (introduced in 1972). However, under the PNDC Law 247 of 1991, only three benefits were to be provided by SSNIT; Superannuation or old age pension, Death/survivors' lump sum benefit, Invalidity benefit. Another contingency, "Minimum Healthcare", has been added under the National Health Insurance Scheme, for which SSNIT is compelled by law to contribute 2.5% out of contributions collected under the National Health Insurance Act 2003, Act 650, Section 78(1) [b] and Section 78(4).

2.2.2 Membership of SSNIT Pension Scheme

The SSNIT pension scheme, in principle, has a universal scope of coverage. However, the social security law (1991) specifies membership of the scheme to be compulsory for some groups of the working population and voluntary for other groups. Other employees are not allowed by the social security law to join the SSNIT pension scheme. According to the social security law (1991), membership of the SSNIT scheme is compulsory for every person who has an employer-employee relationship with an identifiable employer. Membership of the scheme is however voluntary for self-employed persons who opt to join the social security scheme.

2.2.3 Membership and Coverage

There are three internal classifications of SSNIT members. These are:

- Active members: members who have paid their contributions over the last two years.
- Inactive members: those whose social security accounts have not been credited with contributions covering the last two years. These are largely students on study leave and members who have been out of employment for more than two years.
- Paid members: those who have received social security benefits or on whose behalf SSNIT has paid social security benefits. These include members who have received interim benefits, lump sum payments, survivors' benefits as well as those currently on pension.

Those who are not allowed by the social security law to be members of the SSNIT pension scheme are officers and men of the Ghana armed forces, academic staff of the universities, missions and diplomatic corps. These groups of workers have their own respective pension arrangements. However, individuals employed by these establishments may opt to join the State pension scheme as voluntary contributors.

2.2.4 Mandatory Contributions to SSNIT

These are monthly insurance contributions from members of the scheme who have employer-employee relationships with identifiable employers. In this case, the 17.5 % contribution rate is split into two, comprising 5% and 12.5% of employee's monthly insurable income paid respectively by the employee and the employer.

These are mostly social security contributions from self-employed persons who opt to join the State pension scheme. The voluntary contributor is required to pay the full contribution rate (17.5%) with respect to the declared monthly income from his/her profession, business or vocation. Voluntary contributors are required to pay their monthly contributions at the nearest office of SSNIT.

Current employees may also pay voluntary contributions for past years in which they did not contribute to the pension scheme. Similarly, members of the scheme who give up jobs or lose employments before reaching the normal retirement age may pay contributions at the voluntary rate for periods between termination of employment and retirement. Such voluntary contributions may be necessary to enable them either to qualify for pension or to increase their pension rates.

2.3 Investment of Pension Funds

Pension funds invest in capital markets to make profit. They need a future economic recovery that lasts and as such most of them invest for the long term. In many countries pension fund resources are the domestic sources of long term capital. Initially the pension funds are channelled into safe investment areas. As the funds mature some turn towards "alternative investment vehicles, which in general have had better returns than pension fund portfolios, albeit with greater risk" (Vives, 1999).

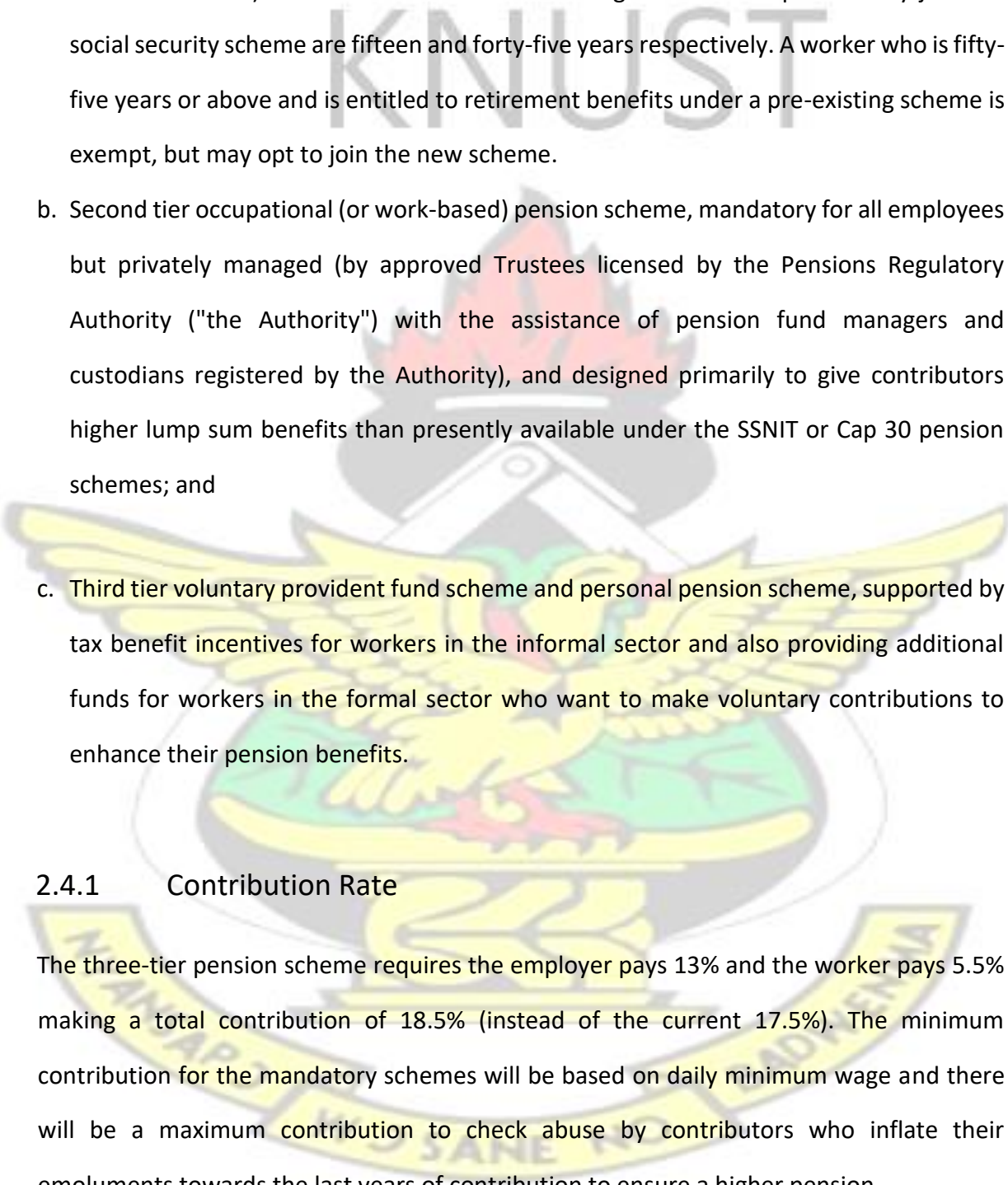
Pension funds all over the world usually invest in equities. When the stock markets are doing well pension funds tend to post strong results. In Ghana SSNIT has invested in majority of the companies listed on the stock exchange. Pension funds rank among the largest institutional investors in developed countries by assets under management. Recent years have witnessed the creation of new public pension funds in several countries, and the modernization of existing ones in others, with special emphasis placed on upgrading their investment policy framework and strengthening their governance structure. Over 10 years to December 2009, pension funds in most industrialized countries posted varied results. There have been reports of inadequate returns generated from the investments of Ghana's pension funds. In February 2010 , SSNIT was reported to be making low returns on monies invested with only six out of forty companies the Trust had invested in being able to declare and pay dividends as of 2004. An article written by Frank Dewotor of the data bank group under the caption "Towards A Sustainable National Pension System" also

buttressed the fact that the returns on investments were unsatisfactory. He stated that “Other problems include SSNIT’s record of investing in many projects that have yielded negative real returns over the years due to political interference, lack of competition and probably inadequate investment expertise at SSNIT.” The nine-member Presidential Commission on Pensions also discovered that the SSNIT Pension Scheme had been mismanaged through, “reckless investments which have undermined the profitability and utility of the Fund and the Scheme. SSNIT in its present form will have to change.

The governance has to change” (Ghanaweb.com). This was Thomas AngoBediako, Chairperson of the Commission, speaking at an Editors Forum in Accra. Many other people have expressed similar opinions on the organizations investments. As such managers of the second tier manager is therefore faced with the daunting task of selecting the most appropriate investment strategy as to maximize the returns from the financial assets. When the scheme is efficiently ran, the contributions can be used as an effective source of long-term capital for productive investment with high interest yields and which ensure that the member does not suffer a loss due to poorly performing investments.

2.4 The National Pensions ACT,2008(ACT,766)

Pension reforms are happening all over the world and Ghana is no exception, as such in July 2004 there was a major reform in the pension system in Ghana. The process started with the establishment of a presidential Commission on Pensions, which reports its findings to government. The findings and recommendations of the commission were passed into law in 2008. The National Pensions Act, 2008 (Act 766) caters for the establishment of a new contributory three-tier pension scheme with a National Pension Regulatory Authority to regulate and oversee the efficient administration of the composite pension scheme. The new scheme will comprise two mandatory schemes and a voluntary scheme as follows:

- 
- a. First tier basic national social security scheme, which will incorporate an improved system of SSNIT benefits and shall be mandatory for all employees in both the private and public sectors; (payment of only monthly pensions and related benefits such as survivors benefit). The minimum and maximum ages at which a person may join the social security scheme are fifteen and forty-five years respectively. A worker who is fifty-five years or above and is entitled to retirement benefits under a pre-existing scheme is exempt, but may opt to join the new scheme.
 - b. Second tier occupational (or work-based) pension scheme, mandatory for all employees but privately managed (by approved Trustees licensed by the Pensions Regulatory Authority ("the Authority") with the assistance of pension fund managers and custodians registered by the Authority), and designed primarily to give contributors higher lump sum benefits than presently available under the SSNIT or Cap 30 pension schemes; and
 - c. Third tier voluntary provident fund scheme and personal pension scheme, supported by tax benefit incentives for workers in the informal sector and also providing additional funds for workers in the formal sector who want to make voluntary contributions to enhance their pension benefits.

2.4.1 Contribution Rate

The three-tier pension scheme requires the employer pays 13% and the worker pays 5.5% making a total contribution of 18.5% (instead of the current 17.5%). The minimum contribution for the mandatory schemes will be based on daily minimum wage and there will be a maximum contribution to check abuse by contributors who inflate their emoluments towards the last years of contribution to ensure a higher pension.

2.4.2 Administering the Three Tier System

The three-tier pension structure is administered as follows:

First Tier

To be administered by a restructured SSNIT, that collects the regular monthly payroll taxes.

It is the Commission's view that after undergoing the proposed restructuring,

SSNIT will provide much improved administrative services to contributors of the Fund.

SSNIT collects 13.5% of payroll taxes, out of which 2.5% is paid as NHIS Levy. The remaining 11% is retained by SSNIT to be managed and invested towards the payment of monthly pensions and other benefits (such as survivors and invalidity benefits).

Second Tier

Privately managed and controlled by Boards of Trustees. The Boards, among other things, are expected to appoint fund managers and custodians approved and certified by the proposed Regulatory Body. The 5% payroll deduction, which is used to fund the Second Tier occupational pension scheme, is paid into clearly identifiable funds, which is managed and invested towards the payment of benefits.

Third Tier

Management of the third tier scheme conforms to the administrative arrangements proposed under the Long Term Savings Act. In view of the three tier pension structure, the Commission recommended a review and strengthening of certain sections of the Long Term Savings Act (Act 679) of 2004, to cover the third tier voluntary privately managed savings schemes. For example, the Commission was of the view that on the appointment of

Trustees by Fund Managers, Section 39(1) of the Act should be amended to allow provident funds and other similar group retirement schemes to appoint their own Trustees.

2.4.3 Tax Incentives on Pension Contribution

Tax is not payable by an employer or employee in respect of contributions under the Act. Contributions up to 13.5% are income tax exempt. The first and second tier mandatory schemes will have a full tax exemption i.e. 18.5% and the third tier voluntary scheme will have a maximum tax exemption of 16.5%. However, contributors on the third tier who do not contribute to the compulsory scheme are allowed 35% tax exemption.

Investment income and Retirement (Pension) benefit are also tax exempt.

2.4.4 Regulatory Framework

The National Pensions Regulatory Authority (Authority) was established to supervise, regulate and monitor the three-tier pension scheme. The functions of the Authority are among others to advise on pension policy, ensure compliance with provisions of the Act and supervise the implementation of the basic national social security scheme. The Authority registers occupational pension schemes, provident fund and personal schemes and regulates the affairs and activities of approved trustees to ensure that they are responsible and prudent in the handling of the assets entrusted to them. It also sensitizes the public on matters related to the various pension schemes, receive and investigate complaints of impropriety in respect of the management of pension schemes, receive, and investigate grievances from pensioners and provide for redress and advise government on the general welfare of pensioners. The governing body of the Authority is an eleven member Board consisting of a Chairperson, the Chief Executive of the Authority and other representatives from the Bank of Ghana, Organized Labour, National Pension Association and the Securities and Exchange Commission, among others.

The Act provides for the management of occupational pension schemes, provident fund and personal pension schemes including the funds. The second tier mandatory scheme and the voluntary third tier will be privately-managed by approved Trustees licensed by the Regulatory Authority with the assistance of pension fund managers and custodians registered by the Authority. Trustees who must be licensed by the Authority will be entrusted with the overall responsibilities for the administration and management of the privately managed second and third tier schemes. They;

a. May delegate administration to third party service providers;

b. Will not keep custody of pension funds and

c. Will also be responsible for appointing pension fund managers, custodians and other service providers as well as ensure their compliance with regulatory requirements.

Pension fund managers will be responsible for achieving the best possible returns on the funds within the specific investment parameters set by the trustees. They will

a. not have access to pension funds;

b. First be licensed by the Securities and Exchange Commission and thereafter registered by the Pensions Regulatory Authority and

c. Be independent of trustees and custodians. Custodians licensed by the Securities and Exchange Commission and thereafter registered by the Pension Regulatory

Authority will be responsible for

a. The safe holding of assets of a fund, separate from the trustee and pension fund manager;

- b. The settlement of transactions involving fund assets and
- c. Will be independent of pension fund manager.

To safeguard the security of fund assets and hence the interest of the members, trustees, pension fund managers and custodians have to meet certain requirements. These include requirement for a license as a trustee, requirements for a license as a pension fund manager, investment policy restrictions on investments, possible penalty for breach of investment limits, and requirements for license as a custodian. Trustees licensed by the Authority would be required to take adequate insurance to indemnify scheme members against any losses of scheme assets caused by malfeasance or misconduct of the trustees or their service providers. Custodians are also required to have a performance guarantee to cover the pension fund assets under their custody. The Act provides for member-nominated trustees and directors. A specified number of trustees are to be nominated from beneficiaries (workers) to serve on board of trustees. Member involvement in the management of a scheme helps promote a sense of ownership and create confidence in the scheme. A trustee or pension fund manager is required to invest funds of the second tier and third tier schemes in permitted investments in order to obtain safe and fair returns on the amount invested. The Act provides for restrictions on the investment of funds as well as restrictions on the sale, purchase or disposal of privately managed pension fund assets.

Among other impacts, the scheme ensures improved living standards of the elderly; financial autonomy and independence of retirees; increased national savings and availability of long-term funds for economic development; and the promotion of growth and development of the capital, mortgage and insurance markets. Contributors can use their future lump sum pension benefits to secure mortgages. This means that workers can obtain their own houses before retirement by using their pension benefits

as collateral.

2.5 Defined Contribution Scheme as a Second Tier Pension

Scheme

Under the pension act 2006 of Ghana was mandated that a second tier pension scheme be set up by employers to provide pensions and life assurance benefits for employees. The scheme is a fully funded, contributory scheme in which funds are managed privately and benefits paid as lump sum to the employee or his dependants in case of death. The employer and the employee make regular contributions into the scheme on behalf of the employee. These contributions are invested. When the employee reaches retirement age, become permanently incapacitated or dies prior to retirement, the total contributions together with investment income is paid as a lump sum to the employee or his/her dependants in case of death. In some cases, it is possible for the employee to draw income from the fund prior to retirement ?. The fund is also a contributory scheme since it is funded by employer and employee.

Under the pension act emphasis was laid on the need for a contributory supplementary scheme in the submissions of public sector workers and pensioners. These groups favoured a two-tiered pension structure, a basic national contributory pension scheme for both the public and private sector and a fully funded, contributory, occupational scheme, managed privately. The supplementary scheme could either be a defined benefit or a defined contribution scheme. As such the model will fall under the second tier, which is a mandatory, privately managed supplementary pension scheme.

2.5.1 Historical Background of Supplementary Pension Plans in Ghana

The development of private sector pension schemes in Ghana is not well documented. Before the establishment of SSNIT as a pension fund in 1991, many companies in Ghana operated retirement plans for their employees in the form of end of service benefits (ESB), which were unfunded liabilities. Some religious bodies also operated separate retirement plans for their teachers and pastors. It is to be noted that the establishment of provident funds and private pension schemes in recent times was intended to replace the End of Service Benefit schemes, frozen in 1991. Until 1991, there were lump sum payments made by an employer to retiring employees, typically one-month salary for each year of service in line with the End of Service Benefit (ESB) concept. This concept formed part of the formal conditions of employment for the employee. The decision to freeze and pay off ESBs occurred when SSNIT was being established as a pension scheme, when workers' compensation was being consolidated for tax purposes and many state owned enterprises (SOEs) were being privatized. After 1991, many organizations came up with various kinds of savings schemes, private retirement plans, benevolent funds and provident funds. Many of these schemes allowed withdrawals for nonretirement purposes, after a vesting period, usually five years. This tended to limit the accumulation of long-term savings. A handful of companies such as Unilever Ghana Ltd., Ghacem Ltd., the erstwhile Ghana Breweries Ltd (now Guinness Ghana Breweries Ltd.), run schemes that can fit the description of a supplementary Pension scheme. These pension schemes are governed by Trust Deeds and Rules. However, they were not under the control of any central regulatory authority. Some public sector institutions, especially SOEs, also operate provident funds with contributions from the employer and employee. Such funds are generally managed by professional fund managers, i.e. banks, stock brokers, insurance companies, etc. The majority of these supplementary pension schemes provide salary related benefits and are either of the defined benefit type or the defined contribution type.

2.6 Types of Pension Plans

Pension plans or schemes are designed primarily to provide regular streams of income to members of the plan during their retirement. These plans could be private, state or occupationally designed. An example of the state pension plan is the Ghana pension scheme which is administered by SSNIT, which has approximately one million – registered members with over 58,000 pensioners. There are two basic forms of pension plans, the Defined Benefit Scheme and the Defined Contribution Scheme however the focus of this document is the latter. However there are other pension plans which are hybrids of these basic plans.

2.6.1 Defined Benefit (DB) Scheme

A defined benefit (DB) scheme specifies the formula for the determination of benefit entitlements and employees are promised a "guaranteed" or "defined" amount of pension. The cost of the Plan is determined on an actuarial basis, as the amount of money required to provide the given level of benefit to all employees on the Scheme. The Scheme specifies that the employee contributes a percentage of his earnings to help fund the benefit. The employer contributes the difference between the cost of providing the benefits as indicated by the actuary and the level of the employee's contribution. The DB scheme provides a guaranteed pension, calculated on the basis of the member's salary in the final years of employment and the number of years of service. It may be based on the employee's final salary or the average of the salary earned over a number of years. Fewer years of contributing to the Scheme means a relatively small pension after the minimum qualifying years of service. On the basis of this arrangement, it is expected that an employee, particularly a public servant, would remain in service for a long period of time and the employer accordingly, should accept a far reaching responsibility to provide for him or her. This view is consistent with the idea of pensions as a form of deferred earnings. In

some schemes, the employee may not be required to contribute a specific predetermined amount or a percentage of salary on a monthly basis into the scheme. The contribution rate is calculated as the contribution which in conjunction with the member's future contributions will be required to provide security for the defined benefits promised under the Scheme.

2.6.2 Advantages of DB Schemes

Arguments in favour of a DB scheme include:

i. Maintenance of living standards

Since the pension level is related to the employee's earnings immediately prior to retirement, it is supposed to guarantee (with sufficient service), a standard of living in line with what the beneficiary was enjoying prior to retirement.

ii. Security

The investment risks and rewards associated with the pension promise and the payment of expected benefits at retirement rest with the Plan Sponsor (government/employer), rather than with the employee. The employer will usually make good any shortfall in the financing of the Scheme.

iii. It is easier to provide targeted benefits to participants by an adjustment of the benefit formula.

iv. Older employees can still receive adequate benefits, even after a few years of contribution.

- v. There are cross subsidies/solidarity among members.

2.6.3 Disadvantages of DB Schemes

Arguments, which may be made against a DB scheme, include:

- i. Pensions are seen as deferred, not extended earnings

It is generally accepted that pensions represent deferred earnings, a portion of the remuneration package that is set aside or saved in order to provide for the individual's old age. If that were the case, it would be more appropriate that pensions are correlated with earnings all through the beneficiary's service, rather than with his or her earnings at retirement.

- ii. Salary Progression

The final salary principle employed for benefits computation, favours those whose careers offer a high salary during the final phase of their career. This approach raises questions as to the fairness of the system. It also raises cost issues for the employer.

- iii. Manipulation of Final Earnings

There is a risk that the final salary principle may encourage manipulation of an employee's earnings for the purpose of achieving an excessively high pension.

- iv. Uncertainty of Costs

In a DB structure, the final cost of pension cannot be predicted. Detailed actuarial calculations, usually based on uncertain assumptions, are necessary to ascertain the long term cost. Employees do not need to worry about its financing, since it is the employer who bears the risk if the costs are higher than estimated.

v. Extra Fees

Extra fees are required for periodic actuarial valuations. This adds to the cost of administration and the tendency for scheme operators to avoid this important responsibility.

2.7 Defined Contribution (DC) Schemes

Under the DC plan, the employer and usually the employee make a predetermined contribution, expressed as a percentage of salary, into an account held on behalf of the employee, the individual investment fund. The contributions, fewer charges levied on them are invested in underlying investments, in assets such as stocks, bonds, property, etc. up to retirement. A Defined Contribution (DC) plan does not explicitly promise a level of benefit during retirement but instead can be viewed as regular savings account in which employers and Sometimes employees contribute money on the regular basis. The level of benefits received at retirement is determined by the accumulated value of the assets in the pension fund into which contributions are made. This is sometimes referred to as the investment reserve. Thus the amount of retirement income that may be purchased with the account balance is unknown till the actual retirement date. The pension is determined directly by the size of contributions, the growth in investment returns and annuity rates at retirement. It is also open to employees to make additional contributions to secure additional benefits. However, because the worker's benefit is tied to the rate of return on the assets in his or her account, a downturn in the value of assets at the point of retirement may greatly reduce the worker's retirement income. Under the DC arrangement therefore, the participant bears the investment risk. Once a plan sponsor makes the required contribution into the Fund, there are no other guarantees and the sponsor's obligation is settled, the liability of

the plan sponsor being limited to the contribution to the plan. There are two basic types of DC Pension Schemes:

a. Money Purchase Pension Scheme.

b. Profit Sharing Pension Scheme

i. Profit Sharing Pension Scheme

This type of DC scheme is an employer-sponsored arrangement where employer and employee contributions are defined. They may be fully employer paid or require employee contributions as well. The employer's contribution may be conditional to and/or vary with the employee's contribution. Contributions may be a fixed percentage of earnings, a fixed cedi amount, or a specified amount per year of service.

ii. Profit Sharing Pension Scheme A profit sharing pension plan is a type of DC scheme where employer contributions are linked to the profitability of the company. The employer's total annual contribution is determined using a formula related to profits. Allocation of profits among Plan Members may be based on a points system, where points are assigned in relation to service, earnings or on both. Investment earnings and forfeitures are allocated to employees in proportion to their account balances. This type of plan may act to motivate employees and lead to increased productivity. However, the only drawback of this arrangement is that contributions are linked to profit and this increases the uncertainty associated with the level of retirement income. From the employer's perspective, costs are linked to the company's ability to pay.

2.7.1 Advantages of Defined Contribution Schemes

Arguments for adopting a DC scheme structure for pension scheme include:

- i. Allowing greater flexibility for the individuals to tailor their retirement package to suit their own circumstances. For instance, an individual could decide to increase his or her level of contributions or pay a lump sum into the Fund, subject to Tax Laws, to meet changing needs.
- ii. Enables the individual to make contributions towards additional benefits at retirement on the basis of earnings or allowances that would not be pensionable under existing arrangements, e.g. overtime
- iii. Giving individuals the potential to benefit from the upside of the investment market, by providing them with a range of funds in which to invest their money.
- iv. Allowing the contributor to draw some money from the fund prior to retirement;
- v. Providing a more equitable arrangement for service, as it would more accurately represent income earned during the course of each person's whole career, not just salary at retirement, (which favours those with favourable promotion progression). In addition, defined contribution schemes tend to deliver a relatively higher benefit to those who experience a lower level of salary progression over their career.
- vi. Providing a clearer picture of year by year costs, thereby making budgeting easier for employers.
- vii. Transparency of defined contribution schemes and their closeness to other everyday financial transactions. This would mean that communications with scheme members are relatively straight forward.

- viii. Plan Sponsor, the employer or the State avoids investment and mortality risks. ix. Younger employees can accumulate substantial funds for retirement needs.

2.7.2 Disadvantages of Defined Contribution Schemes

Arguments which may be made against a DC pension structure include:

- i. Employees, rather than employers, would be required to bear the investment and mortality risks associated with defined contribution schemes.
- ii. For any individual, the amount of future benefits to be earned on retirement would be difficult to quantify. On a broader level, there could be a concern that the contributions made would not be sufficient to provide the same level of benefits as under the existing scheme.
- iii. In many cases, particularly for those retiring early and who experience high salary progression, benefits would not be comparable with existing arrangements. The final salary principle applicable in defined benefit schemes acts as a greater incentive for the employee to earn promotion, than a defined contribution scheme.
- iv. Older employees usually cannot accumulate enough funds because of the shorter time remaining before retirement.

2.7.3 Characteristics of Defined Contribution Scheme

Participants

The sponsor of the plan generally has detailed records on all participants. These records, called the Plan census, include information on each participant's age, salary, years of service and sex. This information becomes helpful to the plan actuary in the estimation and timing

of the benefit payments that are expected to be made to each participant. Plan participants can generally be classified in one of the following groups:

1. Retirees: participants (in some cases beneficiaries of participants) who are no longer in employment and are currently receiving retirement benefits from the plan.
2. Actives: most pensions require participants to be in employment for a certain period of time before they become eligible for pension benefits. Once this period of service has been achieved, participants are vested in the plans and their right to the accrued benefits cannot be forfeited. Active participants therefore are employees who are currently working and are vested, who may retire at some point in the future and are entitled to pension benefit.
3. Terminated vestees: These are plan participants who are neither active nor retired, having left the plan after their vesting period has been completed but before reaching the minimum retirement age. This group has qualified for a pension, but is not yet old enough to draw benefits or have elected to defer them.
4. Non-Vested Actives: These are participants who have not yet become vested in the plan but who may have joined the active participant group in the future.

2.8 Types of Pension Benefits

In addition to basic retirements benefit of a pension plan there are other ancillary benefits for which are sometimes provided in a pension plan. In what follows, we describe the various possible benefits.

a. **Withdrawal:** This is a return of contributions with or without interest to a participant who decides withdrawal from the plan before the normal retirement age.

b. **Death in Service Benefits:** On the death of a participant plan, the benefits are paid to the surviving spouse or beneficiary of the participant in the form of a lump sum amount or as an annuity as specified in the plan document. This benefit is sometimes referred to as the spouse/widow's pension.

c. **Disability/ill-health Benefits:** When a participant becomes disabled prior to the normal retirement age, these benefits are paid in accordance with the specified conditions in the plan

It is usual to value benefits in respect of

- a. Past service
- b. Future service

2.9 Annuities

An annuity is a series of equally spaced payments or savings of equal amount. In other words if the same amount is saved or paid at the end or beginning of each year for a number of years or at the end or beginning of each period for a number of periods, it is called an Annuity. The time between successive payments is called the payment period. The time from the beginning of the first period to the last payment period is called the term of the

annuity. Examples of annuities are: insurance premiums, monthly salaries, house rent etc.

Annuities may be paid;

- i. At the end of each period (An ordinary annuity also referred as annuity-immediate)
e.g. a monthly salary.
- ii. At the beginning of each period (An annuity-due). Deposits in savings, rent payments, and insurance premiums are examples of annuities due.

insurance premiums are examples of annuities due. The terms of an annuity may begin and end on fixed dates (annuity certain) that is the length of time that the payments will be made is predetermined and no risk is involved. In contrast, a contingent annuity has payments for an uncertain term that is payments depend on some event that cannot be fixed. If the term of the annuity is the lifetime of the recipient, it is called a life annuity. An annuity that carries on indefinitely and has an infinite term is called perpetuity. Non-level payments are also common in annuities, and such annuities are called non-level or varying annuities. If the sequence of payment has a pattern, computing the annuity's value at a given date may be facilitated if one makes clever use of level annuities. Many simple varying annuities may be valued by elementary algebraic methods. An example is an annuity of which successive payments increase or decrease by a common difference and this is known as an annuity with arithmetic progression, or an annuity of which successive payments increase or decrease by a common ratio, known as an annuity with geometric progression.

2.10 Replacement Ratio

One of the generally accepted goals of retirement is explicitly a relative one: that retirees should not experience a markedly reduced standard of living (or economic welfare) upon retirement. The "replacement rate" is the conventional measure, typically calculated by

dividing some measure of retirement income by some measure of working life income. These measures are used, often for different purposes, by a number of actors with interests in the retirement income system, including:

1. By researchers and policy-makers to describe and evaluate retirement income systems, and examine population trends over time,
2. By employers, unions and actuaries in the design of employee benefit programs, and
3. By individuals and financial planners to plan for retirement and make retirement savings decisions.

Replacement rates have consequently been calculated in widely-different manners that have depended not only on their purpose but also on the availability of data, human and technological resources.

The “replacement rate” is the conventional measure used to evaluate the extent that individuals are able to replace their pre-retirement earnings with other sources of income in retirement. An individual’s replacement rate is simply the fraction of his/her preretirement income replaced by retirement income: $\text{Replacement rate} = \frac{\text{retirement income}}{\text{pre-retirement income}}$

Theoretically, a target replacement rate is the replacement rate necessary for an individual to maintain his/her standard of living after retirement. In most cases, replacement rates are used in an attempt to establish whether, or to what degree, individuals are able to continue their pre-retirement standard of living after ceasing employment (Moore and Mitchell, 1977); (Munnell and Soto, 2005); (Moore et al., 2010); (MacDonald et al., 2011); (Wolfson, 2011). One’s replacement ratio will be directly related to how your expenditures change from pre-retirement to post-retirement and how one envisions their retirement lifestyle. According to the Society of Actuaries’ Pension Section the percentage of

Replacement Ratio an individual needs to continue their standard of living in retirement is 75 %.

Retirement benefits should do more than prevent destitution in old age but should ensure a reasonable correspondence between pre and post retirement living standards. Replacement rate is thus a yardstick for measuring the effectiveness of retirement benefits systems. Retirement benefits system constitute the different tiers of retirement benefits arrangements which conventionally include the first tier funded government social security schemes, the second tier mandatory retirement benefits schemes and the third tier additional self-driven voluntary savings preserved for retirement. The retirement benefits systems are usually driven by a twin vision of income distribution and targeted reasonable income replacement rate. Income distribution is done using the first tier. The second and third tiers achieve a targeted income replacement rate in retirement. At the individual level, all existing members of retirement benefits schemes or to those considering starting the journey to saving for retirement need to interrogate them on the whether the retirement saving commitments they are making are sufficient to provide comfortable retirement. This question needs to be answered using both objective and subjective indicators for life in retirement. Subjective indicators play the crucial role of influencing individual's perceptions that trigger saving behaviour. Individuals can achieve high replacement rates through established retirement benefits system.

Income replacement rate as the required resources in retirement can be measured in a simple or complex ways. In its simplistic form, it is some fixed fraction of pension income received in retirement relative to the income an individual received while in employment or to some poverty benchmark without factoring in many things. Income replacement rate becomes a complex measure when factors such as: tax application for different income distributions; work related expenses; time horizon or the survival curve of the household; changing consumption profile with age; household's use of its increased leisure in

retirement in ways that elevate or decrease spending; and returns to scale in consumption are accounted for in the calculation of incomes.

The sources of retirement income are many: social security transfers; self-generated wealth from housing, and other investments; and remittances from children. In Ghana besides pension income, retirees earn their retirement income from engaging in activities such as consultancies, farming, financial investments and rental income which generate much higher incomes. This research is biased towards looking at income replacement rate from a defined contribution scheme. In the regard, pension income is represents as the compounded value of the stream of pension payments that takes into account the amount of periodic contributions paid as a percentage of earnings (in the case of contributory scheme), earnings, the duration of membership, the eligible age of receiving pension, people's life expectancy and how pensions are adjusted after retirement to reflect growth in wages or prices. Different countries have different replacement rates depending on the emphasis. The success behind the high retirement benefits replacement rates released in the developed countries is attributed to the existence of government supported social security; mandatory contributory retirement benefits program and the positive response of the citizens to make voluntary savings through alternative retirement benefits schemes. According to E. Whitehouse (2007) , virtually all 24 high income Organisation of Economic Cooperation and Development (OECD) countries have targeted first tier target social security assistant programmes.

Income Replacement from the first tier non funded schemes alone account between 19 percent to as high as 46 percent. Pension income from the first tier for 15 of these countries, account for 30 per cent and more of overall replacement rate. In addition to the first tier, these countries have second tier earnings related mandatory contributory and funded retirement benefits schemes that provide coverage to 90 percent and above of the population. The second tier schemes accounts for an additional income replacement. Lump sum withdrawals of accrued benefits upon retirement are discouraged. In a survey

conducted in America in 1994, all retirees who were receiving annuity benefits in 1994 from a private pension plan replaced a median of 26% of reported pre-retirement earnings and Social Security replaced 31 % of earnings. The combined replacement rates for those who received Social Security benefits as well as a private pension summed to 67%. On the contrary, Ghanaian Retirees depend largely on the state run pension scheme only which for many years has been poorly managed with investments whose returns were miserably low.

Unlike the many countries in Latin America and African, the second tier mandatory schemes in the OECD countries are defined benefits (DB) as opposed to being defined contributions (DC). Defined Benefits schemes are by design protected from the fluctuations of investment returns because the sponsor takes responsibility to offset the negative effects of poor investments performance. Members therefore have secured and guaranteed benefits. These Defined Benefits scheme in many of OECD countries have generous accrual pension factor averaging approximately 1.5 percent. Spain has the highest at 3 percent accrual rate. However, the OECD accrual rates fall below those offered in Middle East and North Africa that average 2.4 percent. An accrual factor is used to compute the amount of pension a worker earns per year of work. There is a positive relationship between accrual factor and the accrued retirement benefits. The higher the accrual rate the higher the accrued benefits and the higher the replacement rate.

Replacement Rate therefore is positively related to accrual factor. Accrual rates can be flat across earnings or may follow a different pattern. Accrual rates that are flat are the more common. In UK accrual rates are “U” shaped meaning that the rates vary across incomes. Rates are higher at lower incomes and similarly higher for those in higher incomes. The likely purpose is for encouraging early enrolment and late withdrawals. Accrual rates are progressive in USA and Nordic countries; the rates are high for low income workers and relatively low for the high income workers. In Luxembourg accrual rates increase with

people with longer contribution histories. E. Whitehouse (2007). Besides the accrual factor, the pension earnings used for the calculations of pension benefits determine the income replacement rate. Using average lifetime earnings yield lower earnings base than using the average final few years' earnings. Final years' of earning are regarded as time when workers earn their peak salaries. Countries using shorter earnings period and especially final year earnings, the derived replacement rates work out to be lower. When lifetime earnings are used, some countries valorize the earnings by adjusting past earnings to account for changes in living standards between the time when pension rights were earned and when they are claimed. Past earnings can be revalued in line with economy-wide earnings growth or in line with prices as Belgium, France, Korea, and Spain. Past earnings valorized with prices leads to substantially lower replacement rates than wage earnings because wages usually grow faster than prices. Price valorization for a full-career worker could result into a 40 percent lower earnings than under wage earnings valorization. Ireland is considered among the OECD countries with the low replacement rates among of 30.6 percent replacement rate. This is because Ireland depends on State pension programmes that provide only basic, flat rate and targeted pensions. Analysis of the data generated from the Study of Health and Retirement in Europe (SHARE) by Gannon B, show that majority 68 percent of the males and 52 percent of retirees are on State Pension either the contributory or non-contributory programmes. Only an additional 40 % of male and 26 percent of female retirees draw additional pension from occupational pension programmes.

CHAPTER 3

Methodology of the Study

3.1 Introduction

Generally the amount of pension received by an individual may be a flat rate or dependent on the amount of contributions and the length of time that contributions have been paid. The main objective of any pension scheme should be to provide members with adequate incomes when they retire. What constitutes an adequate pension or income is in fact, not easy to point out. However, it is generally accepted that the adequacy of pension is related to the individual's income prior to retirement. A pension policy must therefore, aim at developing the mechanisms by which the objective of adequate pension can be achieved. Under the defined- contribution, benefits are not based upon a predetermined formula; plan participants upon retirement get back their contributions plus their accumulated return with the pension benefit taking the form of a lump-sum payment.

For many years, replacement ratios have been used to measure retirement adequacy. Replacement rate is a common measurement which can be used to determine the effectiveness a pension system. It can also be used to help estimate what rate of investments returns should scheme members earn on their on their contributions in order for them to enjoy adequate retirement benefits to replace earnings to maintain a standard of living equivalent to what they used to enjoy before retirement.

As such the big question here is that can employees accumulate sufficient funds over their working life, and how can it be determined that the accumulated funds maintain a certain standard of living equivalent to what they used to enjoy pre-retirement. Typically there has

never been any formal requirement for actuarial or other advice to help defined-contribution (DC) fund members choose how to invest.

3.2 Data Collection

This part explains the methods and procedures used in this research. To achieve some degree of credibility for our model sample data used in our analysis is secondary data was collected from SSNIT because it has the largest data base of information of employees. The returns received by SSNIT as per their financial statements were also analyzed. These returns were compared to the general rates that were prevailing in the ten years. Other economic indicators such as inflation rates and yields on treasury bills during the period of study were considered in assessing the returns on investments to draw conclusions on the general investment returns in the Ghanaian economy.

3.3 Actuarial Assumptions and Functions

In order to make proper financial judgements on the payments of pension benefits which is used to calculate the Replacement ratio the plan sponsor makes certain assumptions. The assumptions include but not limited to demographic and financial assumptions.

In what follows we shall be looking at these assumptions in brief:

3.3.1 Interest Rate Assumptions

In the valuation of pension costs and liabilities, actuaries make assumption's about the expected rate of return on the plan's assets. In making the assumption, the actuary takes in to consideration the following components: Pure rate, Investment Risk, Inflationary premium. One must therefore have considerable experience in making such assumptions

since there is some element of subjectivity in making the assumptions. In this course we shall be using the function $v = \frac{1}{1+i}$ as a discount function in the valuation of pension liabilities, where i is the interest rate.

1. The future salary increase rate is 2% per annum
2. The fixed rate of annual salary contribution is 5.5% which is a fixed percentage of salary.
3. The retirement age for both male and female is 60
4. The mean investment income rate is 5% per annum based on historical investment returns in Ghana spanning a period of 10 years (2002-2010) sourced from SSNIT

Every retirement pension plan presents several risks and the design of each plan determines how the risks are divided between employers and employee's one obvious risk is investment return. If the asset earns more than expected, the employee under this risk is happier. If the asset earns less, there may be a loss of benefits. Another risk is inflation rate. In this model, we regard inflation as one component of investment return. The investment return will provide some protection. The inflation depreciates the value of future accumulated accounts.

The next risk is longevity. In this model, we assume that the future pension benefits will be paid until death benefit. Finally, the salary increase risk is considered. The salary at retirement age is a predominant factor which needs to be monitored. If the salary is relatively higher than expected, there are more contributions for the pension plan. The salary increase rate is predicted based on the future service years.

3.4 Annuity Function

In the valuation of plan liabilities, annuity functions become very crucial and are used very extensively. In this section we shall briefly consider some of the annuity functions, which are used in pension mathematics.

a. Straight Life Annuity: At retirement participants of pension plans receive payments on regular intervals (i.e. monthly). These payments cease upon the death of the retiree. The annuity paid under such a condition is referred to as the straight life annuity. If we assume payments at the beginning of each year, the annuity function can be expressed as:

$$\ddot{a}_x = \sum_{t=0}^{\infty} {}_tP_x^{(m)} V^t \quad (3.1) \quad \text{b. Period Certain Life}$$

Annuity: In a plan where benefits payments are made until the last failure of either a pre-defined period (say n) or the participant is known as Period Certain Life/Last Survivor Annuity. The annuity function is given as:

$$\ddot{a}_{\overline{x:n}|} = \ddot{a}_{\overline{n}|} + {}_n P_x^{(m)} V^{(m)} \ddot{a}_{x+n} \quad (3.2)$$

$${}_n \ddot{a}_{x+n} \quad (3.3)$$

3.4.1 Deferred Annuities (Annual payments)

Suppose that m and n are non-negative integers. The value at time 0 of a series of n payments, each of amount 1, due at times $(m+1), (m+2), \dots, (m+n)$ is denoted by $m|a_n|$ (see the figure below).

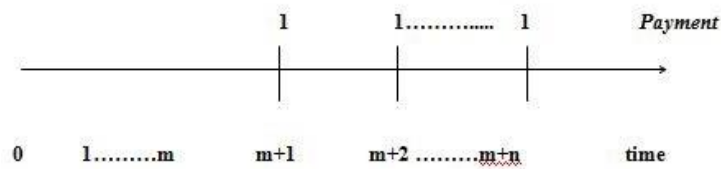


Figure 3.1: A timeline of payments of a deferred annuity annually

Such a series of payments may be considered as an immediate annuity, deferred for m time units. When $n > 0$:

$$\begin{aligned}
 {}_m|a_n| &= v_{m+1} + v_{m+2} + v_{m+3} + \dots + v_{m+n} \\
 &= (v + v^2 + v^3 + \dots + v^{m+n}) - (v + v^2 + v^3 + \dots + v^m) \\
 &= v^m (v + v^2 + v^3 + \dots + v^n)
 \end{aligned}$$

The last two equations show that:

$${}_m|a_n| = a_{m+n}| - a_m| \quad (3.4)$$

$${}_m|a_n| = v_m a_n| \quad (3.5)$$

Either of these two equations may be used to determine the value of a deferred immediate annuity. Together they imply that:

$$a_{m+n}| = a_m| + v_m a_n| \quad (3.6)$$

This formula could easily be deduced using general reasoning. The present value of a series of $(n+m)$ payments of one unit payable at the end of each time period is equal to the sum of

1. present value of m payments of one unit payable at the end of each time period
2. present value of n payments of one unit payable at the end of each time period, deferred for m years.

3.5 Retirement Benefits

Normally it is a Pension, based on service and/or salary Fixed amount every year

(based on service) Pension = $n \times P$ -

Number of years in service

P - Amount every year

- i. Career average schemes (based on service and salary) Pension is calculated as a fraction of employee's salary, averaged on his/her career, for each year of service. The fraction is called accrual rate, e.g.

$$\frac{1}{k} = \frac{1}{60}, \frac{1}{80}, \frac{1}{100}$$

If salaries throughout working life are $S_1, S_2, S_3, \dots, S_n$ and the accrual rate $\frac{1}{k}$ then,
Pension(Career Average Scheme) = $\frac{S_1 + S_2 + S_3 + \dots + S_n}{n} \times \frac{1}{k} \times n$

- ii. Revalued career average schemes (service and salary related Same as career average schemes but the salaries are revalued in line with some index (e.g. linked to inflation index) up to retirement before the average salary is calculated.

- iii. Final salary scheme: Most common type of Define Benefit pension scheme in UK. Pension is calculated as a fraction (accrual rate) of averaged salary in the last m years (usually m = 1, 3) before retirement, for each year of service.

m - Number of years for averaged 'final salary' n -
Number of years in service

$\frac{1}{k}$ - Accrual rate

S_n - Final Salary

$$\text{Pension(Final Salary Scheme)} = \frac{S_n + S_{n-2} + \dots + S_{n-m+1}}{m} \times \frac{1}{k} \times n$$

3.6 Actuarial Modelling Process

The model is obtained by creating a "defined contribution plan" spreadsheet model in excel. The relative symbols of the parameters to be used are inputted into excel. Using the Input fields, various parameters related to the employees' information are also entered. The model is tested and a sensitivity analysis is performed using a spreadsheet model by entering the established assumptions as parameters into the model. The model is used to calculate replacement ratios at retirement age for an individual employee under the conditions of the scheme. Charts were also plotted using excel to show graphical representation of the data.

CHAPTER 4

Data Analysis

4.1 Introduction

In a defined contribution plan, the benefit received equals the benefits received adjusted for possible investment. Foreign researches on supplemental pension plan are wide and generally all retirement plans are regarded as a deferred survival annuity. A deferred annuity is an annuity in which the annuitant does not begin to receive payments until some future date. It consists of two components, a savings phase and an income phase. During the savings phase, the annuitant places money into the annuity, which invests it on behalf of the annuitant. In the income phase, the annuitant receives payment. Within the prescribed period of time, the annuitant is to pay a fee every year to the annuity, which will be maintained until the annuitant retires. If the annuitant survives till retirement, the annuitant receives a certain amount from the annuity each year until death. The actuarial present value of the annuitant's contribution equals the actuarial present value of the annuity's future payments. In this model, application is given priority and a pictorial view of that application is shown in Figure 1. All of these try to give some explanations of the actual application of the scheme and provide some suggestions for Ghanaian pension market.

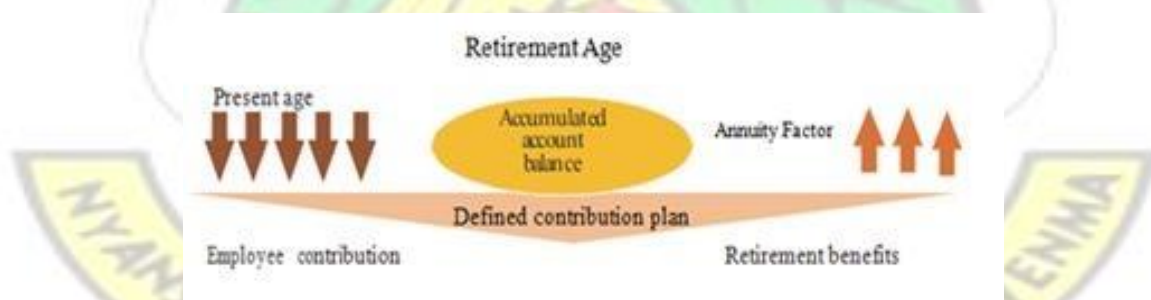


Figure 4.1: Defined contribution Plan mechanisms

4.2 Salary Scale (S_x)

Salaries tend to increase annually, due to wage inflation and to promotional increases. A "salary scale" is used to estimate future salaries, taking into account these increases. A

salary scale is a sequence of numbers from 18,...,60 such that $[x+t, x+t+1]$ If S is salary in year of age $[x, x+1]$ then $S \times \frac{S_{x+t}}{S_x}$ is expected salary in year of age $[x+t, x+t+1]$

4.3 Contribution Dependent on Salary per Annum

4.3.1 Employee Contribution(EC)

Contributions to the scheme by scheme members are usually made by a deduction from salary. We assume, for simplicity, that contributions are payable continuously. Usually contributions are fixed percentage of salary $k\%$. If C denotes the annual contribution between ages $x+t$ and $x+t+1$ then;

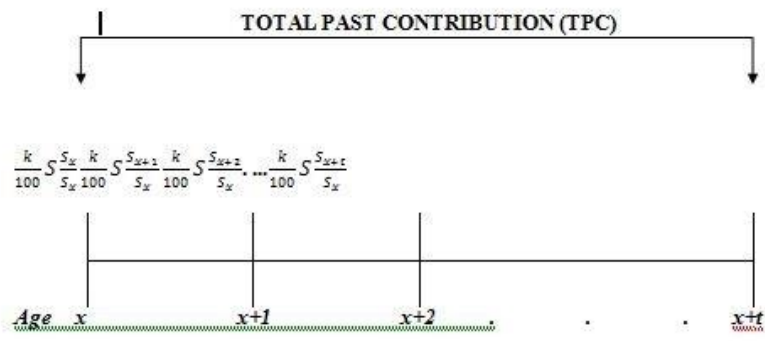


Figure 4.2: Timeline of contribution for t years

$$C = \frac{K}{100} \times S \frac{S_{x+t}}{S_{x-\frac{1}{2}}} \quad (4.1)$$

Where k is % of the salary S

Note that here we assume that S is the annual salary from age $x - \frac{1}{2}$ to $x + \frac{1}{2}$. If the salary is defined for age range x to $x+1$ then,

$$C = \frac{K}{100} S \frac{S_{x+t}}{S_{x-\frac{1}{2}}} \quad (4.2)$$

Then the APV of the contribution for the year $x+t \rightarrow x+t+1$ is

$$APV = C \int_t^{t+1} V^r \frac{l_{x+r}}{l_x} dr \quad (4.3)$$

$$APV = \frac{K}{100} S \frac{S_{x+t}}{S_{x-\frac{1}{2}}} \int_t^{t+1} V^r \frac{l_{x+r}}{l_x} dr$$

$$APV = \frac{k}{100} S V^{t+\frac{1}{2}} \frac{l_{x+t} + \frac{1}{2}}{l_x} \frac{S_{x+t}}{S_{x-\frac{1}{2}}}$$

$$APV = \frac{k}{100} S \frac{\bar{D}_{x+t}}{D_x} \frac{S_{x+t}}{S_x} \frac{S_x}{S_{x-\frac{1}{2}}}$$

(4.4)

(4.5)

(4.6)

$$APV = \frac{k}{100} S \frac{S_x}{S_{x-\frac{1}{2}}} \frac{{}^x \bar{D}_{x+t}}{{}^x D_x} \quad (4.7)$$

Where ${}_x D_y^- = S_y D_y^-$

Summing over all t and noting ${}_x \bar{N}_x = \sum_{t=0}^{59-x} \bar{D}_{x+t}$ the APV of the future contribution is

$$APV = \frac{k}{100} S \frac{S_x}{S_{x-\frac{1}{2}}} \frac{{}^x \bar{D}_{x+t}}{{}^x D_x} \quad (4.8)$$

Where $\frac{k}{100} S \frac{S_x}{S_{x-\frac{1}{2}}}$ is the contribution for year of age $x \rightarrow x + 1$.

Note that if salary is defined for age range $x \rightarrow x + 1$ then the contributions for

$x \rightarrow x + 1$ is

$$\frac{k}{100} S \frac{S_x}{S_x} = \frac{k}{100} S$$

4.4 Retirement Benefits(RB)

The APV of a lump sum benefit on retirement for a member aged x whose salary for x to $x+1$ is S and who has received a total of PC in past contribution.

$$TPC = \frac{k}{100} S \frac{S_x}{S_{x-\frac{1}{2}}} \times n \quad (4.9)$$

Where

$$APV = (TPC) \sum_{t=0}^{60-x} V^{t+\frac{1}{2}} (1+j)^{t+\frac{1}{2}} \frac{r_{x+t}}{l_x} \quad (4.10)$$

$$APV = (TPC) \sum_{t=0}^{60-x} (1+j)^{-x} (V(1+j))^{x+t+\frac{1}{2}} r_{x+t} \quad (4.11)$$

Thus APV of benefit is

$$APV = (TPC)(1+j)^{-t} \frac{M_x^r}{D_x} \quad (4.12)$$

this is because for retirement the individual is expected to survive till 60

(x) = Notation for a life age x l_x = Survival

at exact age r_x = Retirement in the year

of $[x, x+1]$

TPC = Total Past Contribution

APV=Actuarial Present Value

Table 4.1: Sample Employees' Information

	DATE OF BIRTH	ENTRY AGE	CURRENT AGE	ANNUAL SALARY
1	1/7/1972	9/30/1993	43	10473.78
2	10/7/1967	9/30/1991	48	3695.46
3	2/18/1974	1/7/1991	41	7646.64
4	1/1/1972	8/31/1994	43	23722.68

5	3/18/1978	1/7/1993	37	8281.62
6	1/7/1965	6/30/1994	50	30314.58
7	1/7/1966	6/22/1994	49	7621.92
8	12/6/1965	12/31/1997	50	9076.02
9	1/7/1969	12/31/1996	46	3699.12
10	1/5/1965	12/31/1995	50	17062.56
11	5/7/1965	9/30/1992	50	6154.86
12	1/9/1976	1/31/1997	39	8031.42
13	4/5/1973	8/31/1992	42	1533.9
14	1/7/1965	9/30/1992	50	5726.34
15	11/2/1973	12/31/1994	42	18287.88
16	4/6/1970	6/30/1991	45	18626.52
17	1/7/1965	6/30/1996	50	8415.42
18	1/19/1965	5/31/1997	50	8540.82
19	1/7/1965	1/31/1999	50	3178.32
20	9/7/1965	3/31/1997	50	2781.96
21	1/1/1970	3/31/1994	45	3772.08
22	1/1/1975	8/31/1998	40	3736.74
23	7/20/1965	7/31/1993	50	2885.52
24	1/7/1965	6/30/1998	50	4358.46
25	1/7/1964	1/31/1991	51	20091.22

Continuation of Table 4.1

	DATE OF BIRTH	ENTRY AGE	CURRENT AGE	ANNUAL SALARY
26	1/7/1965	4/30/1998	50	3416.82
27	1/27/1965	7/31/1999	50	12293.58
28	1/17/1965	7/31/1993	50	6308.82
29	8/4/1967	8/31/1994	48	18294.9
30	1/12/1965	9/30/1994	50	8446.8

31	1/5/1970	2/13/1995	45	5733.54
32	1/3/1979	2/28/1997	36	20881.68
33	1/9/1971	6/30/1998	44	8353.14
34	1/7/1965	7/31/1998	50	2964.66
35	4/7/1965	7/31/1999	50	4126.86
36	1/8/1965	10/31/1998	50	12327.24
37	1/6/1978	6/30/1994	37	19838.76
38	1/12/1978	12/31/1998	37	3332.64
39	1/1/1967	10/31/1998	48	5087.1
40	1/17/1965	10/30/1992	50	7785.18
41	1/10/1965	6/30/1996	50	6505.74
42	12/29/1972	2/28/1998	43	17463.36
43	1/7/1965	8/31/1998	50	2949.18
44	1/25/1969	5/31/1997	46	26166.12
45	1/8/1978	8/31/1998	37	5829.78
46	12/11/1970	4/30/1994	45	2541.72
47	1/7/1965	6/30/1995	50	11699.58
48	1/30/1973	12/31/1997	42	10052.52
49	1/7/1965	10/31/1995	50	12210.12
50	1/25/1968	3/31/1997	47	11307.48

Resource: Social Security and National Insurance Trust (SSNIT) sample data Table 4.2:
Model calculation showing Pension Benefits

	DATE OF BIRTH	ENTRY AGE	CURRENT AGE	ANNUAL SALARY	RETIREMENT BENEFITS
1	1/7/1972	9/30/1993	43	10473.78	1436.64
2	10/7/1967	9/30/1991	48	3695.46	370.22
3	2/18/1974	1/7/1991	41	7646.64	1271.83
4	1/1/1972	8/31/1994	43	23722.68	2805.06
5	3/18/1978	1/7/1993	37	8281.62	3914.97

6	1/7/1965	6/30/1994	50	30314.58	1647.60
7	1/7/1966	6/22/1994	49	7621.92	471.92
8	12/6/1965	12/31/1997	50	9076.02	660.25
9	1/7/1969	12/31/1996	46	3699.12	343.66
10	1/5/1965	12/31/1995	50	17062.56	954.06
11	5/7/1965	9/30/1992	50	6154.86	317.96
12	1/9/1976	1/31/1997	39	8031.42	3331.08
13	4/5/1973	8/31/1992	42	1533.9	928.98
14	1/7/1965	9/30/1992	50	5726.34	295.83
15	11/2/1973	12/31/1994	42	18287.88	1983.23
16	4/6/1970	6/30/1991	45	18626.52	1682.22
17	1/7/1965	6/30/1996	50	8415.42	485.23
18	1/19/1965	5/31/1997	50	8540.82	628.35
19	1/7/1965	1/31/1999	50	3178.32	1940.36
20	9/7/1965	3/31/1997	50	2781.96	165.84
21	1/1/1970	3/31/1994	45	3772.08	3963.00
22	1/1/1975	8/31/1998	40	3736.74	1185.82
23	7/20/1965	7/31/1993	50	2885.52	2609.10
24	1/7/1965	6/30/1998	50	4358.46	269.39
25	1/7/1964	1/31/1991	51	20091.22	881.77

Continuation of Table 4.2

	DATE OF BIRTH	ENTRY AGE	CURRENT AGE	ANNUAL SALARY	RETIREMENT BENIFITS
26	1/7/1965	4/30/1998	50	3416.82	211.19
27	1/27/1965	7/31/1999	50	12293.58	790.43
28	1/17/1965	7/31/1993	50	6308.82	333.98
29	8/4/1967	8/31/1994	48	18294.9	1279.88
30	1/12/1965	9/30/1994	50	8446.8	676.48
31	1/5/1970	2/13/1995	45	5733.54	573.35

32	1/3/1979	2/28/1997	36	20881.68	7260.56
33	1/9/1971	6/30/1998	44	8353.14	1020.35
34	1/7/1965	7/31/1998	50	2964.66	1295.79
35	4/7/1965	7/31/1999	50	4126.86	265.34
36	1/8/1965	10/31/1998	50	12327.24	761.93
37	1/6/1978	6/30/1994	37	19838.76	3931.59
38	1/12/1978	12/31/1998	37	3332.64	751.08
39	1/1/1967	10/31/1998	48	5087.1	404.72
40	1/17/1965	10/30/1992	50	7785.18	402.19
41	1/10/1965	6/30/1996	50	6505.74	375.12
42	12/29/1972	2/28/1998	43	17463.36	2348.29
43	1/7/1965	8/31/1998	50	2949.18	182.28
44	1/25/1969	5/31/1997	46	26166.12	2513.22
45	1/8/1978	8/31/1998	37	5829.78	1313.87
46	12/11/1970	4/30/1994	45	2541.72	344.25
47	1/7/1965	6/30/1995	50	11699.58	2723.06
48	1/30/1973	12/31/1997	42	10052.52	1430.31
49	1/7/1965	10/31/1995	50	12210.12	682.73
50	1/25/1968	3/31/1997	47	11307.48	973.57

Resource: Model calculation results

4.5 Investment Returns Rate

The investment structure in Ghana is not well developed now, with most financial managers having an asset portfolio comprising of a mix Equities, Fixed Income, Real estate and Economically Targeted Investments (ETI). Table 4.3 shows the representation of historical investment returns in Ghana spanning a period of 10 years Table 4.3: Trend in investment portfolio returns (Mean)

Real Rate of Investment	Mean	Mean	Mean
Years	(2002-2006)	(2005-2009)	(2008-2012)
Nominal Rate	26.1%	19.2%	23.62 %
Average rate	20.2%	13.2%	18.28 %
Real Rate	4.9%	5.3%	4.5 %

Resource: SSNIT annual reports 2002, 2007,2012

(2002-2010)sourced from SSNIT. It is therefore fair to assume that mean investment income rate in Ghana is around 5%, which is one of the assumptions used in the model.

4.6 Forecasting Pension Replacement Ratio(RR)

In order to forecast the pension replacement rate, we simplify defined contribution pension plan. The important parameters are kept retained, including investment income rate/interest rate (i), Retirement Benefit(B), contribution rate (c), contribution years (n), pension paid years (m), present salary, (S) and salary increase rate (g).

Based on the parameters listed above, we can get the accumulated individual account. We assume that the contribution is made at the end of years and investment income rate is not equal to salary increase rate.

Where the basic computation of the replacement ratio can be written as

$$\text{REPLACEMENT RATIO} = \frac{\text{Employer Contribution per Annum} \times \text{Accumulated Value of Annuity}}{\text{Pension Benefits}}$$

$$\text{REPLACEMENT RATIO} = \text{Pension Benefits} \times \text{Annuity Factor}$$

Therefore,

RETIREMENT BENEFITS RR=

SALARY AT RETIREMENT

Where Retirement Benefits(RB) can be simply derived as

Accumulated account = $cS(1+g)(1+i)^{n-1} + cS(1+g)^2(1+i)^{n-2} + \dots + cS(1+g)^n$

(4.13)

$$\text{Accumulated account} = \frac{cS(1+g)[(1+i)^n - (1+g)^n]}{i - g} \quad (4.14)$$

$$\text{Accumulated account} = RB \frac{1 - 1/(1+i)^m}{i} \quad (4.15)$$

According to equation 4.18, the formula of RB is obtained

$$RB = \frac{ciS(1+g)(1+i)^m[(1+i)^n - (1+g)^n]}{(i - g)[(1+i)^m - 1]} \quad (4.16)$$

Finally, the replacement ratio

$$RR = \frac{RB}{S(1+g)^n} = \frac{ci(1+g)(1+i)^m[(1+i)^n/(1+g)^n - 1]}{(i - g)[(1+i)^m - 1]} \quad (4.17)$$

Where the parameters for the computation are; (i)= interest rate / investment income

rate

(PB)= pension benefits

(c)= contribution rate

(n)= number of service years left

(m)= pension paid years

(S)= present salary per annum

(g)= salary increase rate

(RR)= Replacement Ratio

The model is completed by creating a basic "defined contribution plan" spreadsheet model in excel. The relative symbols are as defined above. The analysis is performed using a spreadsheet model, entering the established assumptions as parameters into the model. Using the Input fields, various parameters related to the employees' information are entered. The model is used to calculate Retirement Benefits and subsequently the replacement rate at retirement age for each individual employee's under the scheme of our model.

Table 4.4: Model Calculation Showing Replacement Ratio (RR)

	DATE OF BIRTH	ENTRY AGE	CURRENT AGE	ANNUAL SALARY	RETIRE BENEFITS	RR
1	1/7/1972	9/30/1993	43	10473.78	1436.64	8.23 %
2	10/7/1967	9/30/1991	48	3695.46	370.22	5.13 %
3	2/18/1974	1/7/1991	41	7646.64	1271.83	9.05 %
4	1/1/1972	8/31/1994	43	23722.68	2805.06	8.44 %
5	3/18/1978	1/7/1993	37	8281.62	3914.97	12.24 %
6	1/7/1965	6/30/1994	50	30314.58	1647.60	4.46 %
7	1/7/1966	6/22/1994	49	7621.92	471.92	4.98 %
8	12/6/1965	12/31/1997	50	9076.02	660.25	4.89 %
9	1/7/1969	12/31/1996	46	3699.12	343.66	7.04 %
10	1/5/1965	12/31/1995	50	17062.56	954.06	4.59 %
11	5/7/1965	9/30/1992	50	6154.86	317.96	4.24 %
12	1/9/1976	1/31/1997	39	8031.42	3331.08	12.19 %
13	4/5/1973	8/31/1992	42	1533.9	928.98	8.63 %
14	1/7/1965	9/30/1992	50	5726.34	295.83	4.24 %

15	11/2/1973	12/31/1994	42	18287.88	1983.23	9.08 %
16	4/6/1970	6/30/1991	45	18626.52	1682.22	6.71 %
17	1/7/1965	6/30/1996	50	8415.42	485.23	4.73 %
18	1/19/1965	5/31/1997	50	8540.82	628.35	4.89 %
19	1/7/1965	1/31/1999	50	3178.32	1940.36	5.27 %
20	9/7/1965	3/31/1997	50	2781.96	165.84	4.34 %
21	1/1/1970	3/31/1994	45	3772.08	3963.00	7.22 %
22	1/1/1975	8/31/1998	40	3736.74	1185.82	11.85 %
23	7/20/1965	7/31/1993	50	2885.52	2609.10	4.34 %
24	1/7/1965	6/30/1998	50	4358.46	269.39	5.07 %
25	1/7/1964	1/31/1991	51	20091.22	881.77	3.67 %

Continuation of Table 4.4

	DATE OF BIRTH	ENTRY AGE	CURRENT AGE	ANNUAL SALARY	RETIRE BENEFITS	RR
26	1/7/1965	4/30/1998	50	3416.82	211.19	5.07 %
27	1/27/1965	7/31/1999	50	12293.58	790.43	5.27 %
28	1/17/1965	7/31/1993	50	6308.82	333.98	4.34 %
29	8/4/1967	8/31/1994	48	18294.9	1279.88	5.25 %
30	1/12/1965	9/30/1994	50	8446.8	676.48	4.64 %
31	1/5/1970	2/13/1995	45	5733.54	573.35	7.43 %
32	1/3/1979	2/28/1997	36	20881.68	7260.56	14.62 %
33	1/9/1971	6/30/1998	44	8353.14	1020.35	8.09 %
34	1/7/1965	7/31/1998	50	2964.66	1295.79	5.07 %
35	4/7/1965	7/31/1999	50	4126.86	265.34	5.27 %
36	1/8/1965	10/31/1998	50	12327.24	761.93	5.07 %
37	1/6/1978	6/30/1994	37	19838.76	3931.59	12.57 %

38	1/12/1978	12/31/1998	37	3332.64	751.08	14.29 %
39	1/1/1967	10/31/1998	48	5087.1	404.72	6.27 %
40	1/17/1965	10/30/1992	50	7785.18	402.19	4.29 %
41	1/10/1965	6/30/1996	50	6505.74	375.12	4.73 %
42	12/29/1972	2/28/1998	43	17463.36	2348.29	9.60 %
43	1/7/1965	8/31/1998	50	2949.18	182.28	5.07 %
44	1/25/1969	5/31/1997	46	26166.12	2513.22	7.28 %
45	1/8/1978	8/31/1998	37	5829.78	1313.87	14.29 %
46	12/11/1970	4/30/1994	45	2541.72	344.25	7.22 %
47	1/7/1965	6/30/1995	50	11699.58	2723.06	4.59 %
48	1/30/1973	12/31/1997	42	10052.52	1430.31	9.96 %
49	1/7/1965	10/31/1995	50	12210.12	682.73	4.59 %
50	1/25/1968	3/31/1997	47	11307.48	973.57	6.66 %
	Average					6.97 %

Resource: Model calculation results

Based on the data, assumptions, and model above, the replacement ratio of all employees are calculated under a defined contribution plan. First, we calculate the expected accumulated individual account at retirement age for each employee. Then, with the annuity factor provided by life table, we estimate the future retirement benefits. Finally, the replacement rate is obtained. The results are summarized in Table 4 below. The results vary from 3.67% (the oldest one aged 51) to 14.62% (the youngest one aged 36). We can almost see that "the younger, the better". The average replacement ratio is 6.67%, far less than the average replacement ratio of 70% ,which according to the Society of Actuaries Pension Section is the rate at which retirement benefits under a supplemental plan will be adequate enough to sustain a living standard equivalent to that of pre- retirement,. In fact, no employees will have a reasonable replacement ratio, over 70% in Ghana.

4.7 Sensitivity Analysis

According to the sample data, employee 1 is chosen for example. The future service year n is 17 years. The fixed contribution rate $c = 5\%$. The salary increase rate $g = 2\%$. According to the life table and Ghanaian pension market, m equals 22 years since retirement is at age 60. Up to now, we find a basic formula relationship between investment return rate (i) and pension replacement ratio. As the investment return rate changes, the replacement ratio will change.

Table 4.5: Forecast Relationship (Partial) using the data of contributor 1

IR	3%	4%	5%	6%	7%	8 %
(RR)	5.77%	6.90%	8.23%	9.77%	11.58%	13.69 %

Table 4.6: Forecast Relationship (Partial) using the data of contributor 1

IR	9%	10%	11%	12%	13%	14%	15 %
(RR)	16.13%	18.97%	22.25%	26.04%	30.42%	35.45%	41.25 %

Resource: Model calculation results

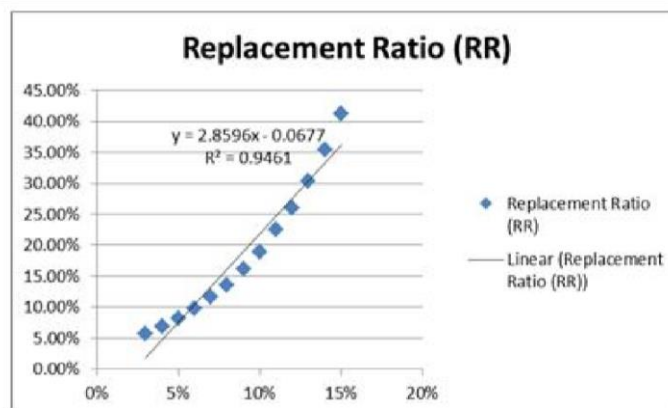


Figure 4.3: Increments in RR as investment rates increase

Based on the results in Figure 4.3 above, it is obvious that the replacement ratio increases as the investment return increase. With linear regression, the relation between them is

presented by excel. It is evident that replacement rate goes up and as such employee's will enjoy an increase in retirement benefits increase when the investment return rate increases by 1% annually.

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CHAPTER 5

Conclusion and Recommendations

5.1 Introduction

This chapter presents a summary of the study through its findings and recommendations are made as per the findings.

5.2 Conclusion

This paper reviews past literature, examines the conceptual and measurement issues when building replacement rates, performs original analysis, and provides guidance on how benefits under a Defined contribution can optimized through the use of the replacement rate measures. Replacement rates have historically been a tool to determine the adequacy of retirement income to maintain an individual's standard of living.

As given by its definition replacement rate should maintain a worker's standard of living after retirement. The model arrived at "real-world" target replacement rate by first identifying our sample who contribute to SSNIT. Lastly, we calculated the replacement rates of those individuals from our sample. The relationship between the adequacy of retirement benefits paid out by a Defined Contribution scheme and the replacement ratio was established based on the data and actuarial assumptions used in the model. A clear enough

relationship was to established the fact that it can be used to determine at what investment rate returns a fund manager should be earning on the accumulated accounts.

The actuarial assumption is used in the calculations, but it will never exactly reflect the plan's experience but the difference between actual and assumed experience creates actuarial gains and losses. Again means the actual experience was more favourable, and less costly, than assumed. A loss means the opposite.

The investment return is not satisfying during recent years. In a word, it is significant for us to think how to increase investment benefits as well as guarantee the security. In the analysis, we just assumed that 5% is the investment return rate. If the investment return can be raised under a secure method, the pension market will have a great improvement. Much more consideration about the pension accumulated accounts investment strategy is necessary.

In establishing the expected value of the accrued liability (where actuarial liability represents the present value of the benefits earned by the member as a result of past service, assuming membership continues in accordance with the actuarial assumptions.) in respect of public sector schemes, the generally accepted principle that, "pension benefits should accrue over the period of employment, during which the benefits were earned" was applied. The models have been used to show that this objective can be established, with the various models and typical scenarios being effectively developed in excel. However actuarial valuation results rely greatly on the assumptions made. The nature and magnitude of the results are such that a small change in the assumptions could significantly affect the valuation results. If these assumptions are not realized in practice, then the results will differ from that shown in our report.

5.3 Recommendations

Pension reforms have barely made it possible for contributors to benefit from their contributions while alive - during their economic and active lives. The only provision is found in section 103 (2) of ACT 766, which allows members to secure a primary mortgage with their accrued second-tier DC benefits; this is however yet to be implemented and of no benefit to members currently. There is doubt about the feasibility of this provision as well because accumulated benefits could be very low due to low contribution rate (5.5% of salary). This is worsened by the fact that a chunk of contributions are invested in Defined Benefit plans managed by the SSNIT.

As such a key proposal in this thesis is the need for workers to supplement their social security pension with a supplemental pension scheme since the pure pension benefits paid out by SSNIT under the Defined Benefit scheme is woefully inadequate and can't provide appropriate benefits coverage.

The lump sum benefits promised by a second-tier Defined Contribution scheme could partially mitigate this intrinsically, but the extrinsic benefit of the DC scheme is meagre just by the simple reason that the promised lump sums are likely to be small because the contribution rate of 5.5% is insignificant for investment purposes. This is worsened by the fact that each member's contributions in the DC scheme is ring-fenced and invested individually; thus, it lacks the benefit of risk and fund pooling as well as investment diversification.

Pension contributors' best bet in the face of this, is to have more control over the investment of their contributions through the DC scheme. In other word, dealing with the design risk of the new scheme requires that the chunk of contributions should be in the Defined Contribution scheme for maximum benefits economically. There is a high likelihood that a higher second tier DC contribution rate than the first tier DB could lead to

higher accumulation rates and the insufficiency of investible funds problem addressed. They also constitute a tax efficient way of increasing employee benefits and remuneration.

Two non-mutually exclusive approaches are spearheaded in this paper. First, In effect, risk reduction, diversification and return maximization is more likely for pension contributors in Ghana in this proposed framework.

Also this paper strongly recommends the introduction annuitization on to the pension market in Ghana, whereby the lump sum paid out as a retirement benefit under the DC scheme can be used to purchase an annuity that will provide the desired level of retirement income.

An actuarial valuation must be done periodically to determine the financial position of the Scheme as at the valuation date, and also to establish the Future Service Cost of the benefits in view of future service (future employer contribution) requirements.

Reviews must be made from time to time to determine whether the policy objectives are being achieved and appropriate action taken if they are not being achieved.

To help maintain a high level of integrity and reliability, the scheme's database should always be up to date with the corresponding details of employees and how many contributions their accounts have been credited with and the number of years in service. Database cleaning exercise could be launched periodically in order to amend contribution records and also to remove ghost names.

There must be continuous monitoring of investment portfolio so as to generate more returns to sustain the investment of the funds. There should be regular meetings with the representatives of the various stakeholders of the pension scheme to keep them abreast with developments in relation to their investments. This will also improve accountability and transparency, thereby influencing corporate governance.

It is worth mentioning that it may be practically impossible to incorporate all the suggestions into the scheme at the same time. The varied suggestions are to offer fund managers several options to consider in attempts to make the scheme more attractive to the working population of the public sector of Ghana.

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APPENDIX A

Table 5.1: SSNIT Data

Date of Birth	Entry Age	Current Age	Annual Salary
1/11/1971	9/30/1996	44	73691.22
1/1/1978	9/30/1999	37	13871.88
1/7/1965	1/3/1991	50	5584.56
1/11/1966	12/31/1992	49	5359.02
1/7/1973	9/30/1993	42	7142.16
1/3/1968	9/30/2003	47	8467.56
1/12/1965	2/28/2005	50	7864.8
1/11/1976	12/31/1995	39	6187.5
1/1/1969	12/31/1998	46	8772
1/1/1972	12/31/1993	43	5368.14
1/7/1975	10/31/1994	40	3771.54

1/7/1965	9/1/1995	50	4377.12
1/7/1965	8/31/1996	50	59.1
1/7/1965	8/31/2000	50	4529.22
1/11/1977	1/6/1994	38	89.46
1/12/1971	3/31/1999	44	19156.38
1/12/1968	1/5/1991	47	4408.98
1/1/1971	6/30/1995	44	1474.14
1/3/1974	2/28/1997	41	2314.38
1/4/1975	11/30/1997	40	2219.7
1/7/1965	9/30/1994	50	44.82
1/1/1978	12/31/1993	37	3068.82
Date of Birth	Entry Age	Current Age	Annual Salary
1/11/1981	7/31/2004	34	11046.6
1/4/1974	12/31/1997	41	5762.16
1/3/1968	7/31/2005	47	489.96
1/8/1966	10/31/2005	49	257.28
1/9/1970	3/31/2006	45	794.16
1/11/1973	11/30/2001	42	2068.92
1/4/1971	8/31/2006	44	626.4
1/3/1971	2/28/2002	44	29.58
1/5/1972	6/30/2001	43	3267.3
1/7/1965	5/31/1993	50	2204.4
1/10/1973	9/30/1994	42	9790.2
1/7/1965	5/14/1991	50	2310.24
1/4/1966	4/30/1999	49	909.3
1/7/1965	10/15/1991	50	708.24
1/3/1968	12/1/1992	47	2438.46
1/4/1966	4/30/1993	49	3266.94
1/8/1965	9/30/1995	50	2992.62
1/7/1965	8/31/1994	50	4347.48

Date of Birth	Entry Age	Current Age	Annual Salary
1/4/1973	6/30/2001	42	53.34
1/3/1967	12/31/1998	48	1799.7
1/7/1977	2/29/2000	38	1709.7
1/7/1965	8/31/1993	50	4484.64
1/7/1965	11/30/1999	50	181.44
1/7/1965	9/30/1994	50	3301.74
1/1/1968	2/28/1997	47	7021.32
1/7/1965	9/30/1992	50	1240.2
1/7/1970	2/28/2003	45	2869.08
1/7/1965	12/31/1993	50	64083.66
1/11/1968	5/31/1991	47	49827.36
1/7/1965	12/29/1995	50	48270.78
7/14/1970	5/31/1995	45	51347.76
1/11/1974	12/31/1998	41	53004.6
1/3/1970	12/31/1993	45	43261.8
1/10/1976	2/28/2001	39	79369.8
1/1/1968	1/8/1991	47	51138.96
1/10/1965	1/8/1993	50	48275.1
1/7/1965	9/30/1994	50	367.74
1/7/1965	12/31/1995	50	3772.02
1/12/1976	3/31/1998	39	4686.72
1/11/1966	7/31/1997	49	4184.52
1/7/1965	4/30/1996	50	994.92
Date of Birth	Entry Age	Current Age	Annual Salary
12/3/1976	12/31/1997	39	877.32
1/7/1965	7/31/1991	50	1261.2
1/7/1965	5/31/1993	50	780.6
1/7/1965	9/30/1995	50	4740.12
1/7/1967	6/30/1997	48	3643.8

1/7/1965	10/31/1995	50	5161.38
1/8/1972	8/31/1992	43	737.52
1/4/1977	9/30/1993	38	4321.44
6/8/1972	6/30/1994	43	331.32
1/1/1977	8/31/1994	38	1686.3
1/1/1976	7/31/1995	39	1686.3
1/7/1965	10/31/1995	50	4002.06
1/7/1968	1/30/1997	47	710.22
1/3/1969	4/30/1997	46	3299.34
1/7/1965	12/31/1998	50	757.98
1/9/1966	2/28/1999	49	5915.16
1/9/1967	9/30/1997	48	3265.26
1/6/1972	12/31/1997	43	1126.86
1/9/1984	9/30/1996	31	1308.18
1/7/1965	10/31/1995	50	12579.42
1/7/1965	7/31/1994	50	843.78
Date of Birth	Entry Age	Current Age	Annual Salary
1/7/1965	3/31/1998	50	7122.06
1/7/1965	6/30/1995	50	2251.14
1/7/1971	6/30/1997	44	51579.66
1/7/1965	5/31/1998	50	54691.56
1/7/1965	12/31/1992	50	48271.74
10/19/190	6/30/1993	45	52153.98
5/22/1972	12/31/1997	43	55343.64
7/15/1971	8/31/1997	44	18516.36
1/7/1965	11/30/1992	50	55896.66
7/11/1967	4/30/1994	48	54703.98
1/10/1966	10/31/1998	49	32099.4
1/7/1965	5/31/1995	50	54271.86
1/7/1965	12/31/1995	50	51170.58

1/10/1965	10/31/1992	50	50756.16
1/7/1965	3/31/1997	50	79565.04
1/7/1965	2/28/1999	50	53249.94
1/7/1965	3/31/1994	50	74112.6
1/7/1965	7/31/1999	50	48284.16
1/7/1965	2/28/1999	50	48281.4
1/7/1965	12/31/1994	50	71516.52
12/15/1978	3/31/1996	37	65090.04
1/7/1965	2/27/1998	50	48271.74
1/7/1965	6/30/1995	50	58171.2
1/7/1965	3/31/1998	50	38925.12
1/3/1966	7/31/1999	49	48271.74
1/8/1965	6/30/1992	50	53623.26
1/9/1965	12/31/1997	50	67313.7
1/7/1969	10/31/1995	46	55684.92
1/1/1979	9/30/1999	36	48263.64
Date of Birth	Entry Age	Current Age	Annual Salary
1/7/1965	12/31/1993	50	48271.74
1/7/1965	12/31/1997	50	42595.08
1/7/1965	12/31/1998	50	49964.94
5/7/1965	7/31/1999	50	48823.38
1/1/1982	5/31/1999	33	48271.74
1/7/1973	8/31/1998	42	56610.84
1/7/1966	12/31/1996	49	48257.22
7/2/1975	12/31/1997	40	49027.74
1/4/1970	12/31/1996	45	47492.28
1/8/1966	4/30/1998	49	43777.5
1/12/1965	11/30/1995	50	47475.24
1/2/1969	2/28/1996	46	37724.58
6/1/1971	7/31/1991	44	40233

1/1/1966	11/30/1997	49	54099.78
1/6/1970	5/31/1997	45	43770.84
1/1/1985	8/31/1995	30	55690.32
1/5/1976	10/31/1997	39	61265.04
1/9/1977	4/30/1994	38	48294.96
1/9/1972	11/30/1991	43	48288.96
8/13/1973	5/31/1997	42	58806.66
1/12/1984	12/31/1998	31	48286.14
1/4/1969	1/31/1995	46	50170.68
Date of Birth	Entry Age	Current Age	Annual Salary
1/7/1965	6/30/1991	50	36830.52
1/7/1965	7/31/1997	50	24082.86
1/7/1965	6/30/1999	50	12812.22
1/9/1970	10/31/2000	45	58895.94
1/3/1968	3/31/2000	47	8886.42
1/7/1965	12/15/1994	50	9099.3
12/7/1965	7/31/1999	50	24168.72
1/7/1965	10/31/1998	50	34304.46
1/10/1980	5/31/1998	35	8752.92
1/7/1965	9/30/1997	50	10318.86
1/7/1965	12/31/1997	50	31000.26
1/1/1982	9/30/1998	33	9506.94
1/7/1965	11/30/1998	50	8277.54
1/7/1965	7/31/1997	50	14054.16
1/12/1965	8/31/2002	50	20966.34
1/7/1965	1/8/1993	50	8267.64
1/7/1965	5/30/1991	50	23711.76
8/27/1971	1/31/1991	44	16001.28
1/7/1965	2/28/1998	50	8810.76
1/7/1965	1/11/1991	50	28233.66

1/3/1972	5/31/1996	43	66285.9
1/2/1971	6/30/2001	44	15311.52
Date of Birth	Entry Age	Current Age	Annual Salary
1/11/1971	9/30/1996	44	73691.22
1/1/1978	9/30/1999	37	13871.88
1/7/1965	1/3/1991	50	5584.56
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1/8/1966	10/31/2005	49	257.28

1/9/1970	3/31/2006	45	794.16
1/11/1973	11/30/2001	42	2068.92
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1/5/1972	6/30/2001	43	3267.3
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1/4/1966	4/30/1999	49	909.3
1/7/1965	10/15/1991	50	708.24
1/3/1968	12/1/1992	47	2438.46
1/4/1966	4/30/1993	49	3266.94
1/8/1965	9/30/1995	50	2992.62
1/7/1965	8/31/1994	50	4347.48
1/4/1973	6/30/2001	42	53.34
1/3/1967	12/31/1998	48	1799.7
1/7/1977	2/29/2000	38	1709.7
1/7/1965	8/31/1993	50	4484.64
1/7/1965	11/30/1999	50	181.44
1/7/1965	9/30/1994	50	3301.74
1/1/1968	2/28/1997	47	7021.32
1/7/1965	9/30/1992	50	1240.2
1/7/1970	2/28/2003	45	2869.08
1/7/1965	12/31/1993	50	64083.66
1/11/1968	5/31/1991	47	49827.36
1/7/1965	12/29/1995	50	48270.78
7/14/1970	5/31/1995	45	51347.76
1/11/1974	12/31/1998	41	53004.6
1/3/1970	12/31/1993	45	43261.8
1/10/1976	2/28/2001	39	79369.8

1/1/1968	1/8/1991	47	51138.96
1/10/1965	1/8/1993	50	48275.1

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