LISBOA SCHOOL OF ECONOMICS & MANAGEMENT

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MASTER OF SCIENCE IN

Actuarial Science

MASTERS FINAL WORK

DISSERTATION

Social Security System Reform: The Case of Malawi

Dziwana Matilda Shawa

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SUPERVISOR(S):

Maria Teresa Medeiros Garcia

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Abstract

This thesis examines the Malawi pension fund reform using an integrated simulation model. The aim is to explore why the Malawi government moved from Pay as you go (PAYG) system to define contribution (DC) system. Malawi is a relatively young country and its pension schemes are deficient in design, financing, execution and administration. Malawi has persistent macroeconomic fluctuations and an unstable financial sector that make effective pension fund management challenging. Also there are high inflation rates and politically motivated low-yield investment loans.

The thesis assumes that in Malawi an average person retires by 50 years and the maximum age of death is 70. The average starting wage ranges from 65,000-75,000 Mk. The contribution rate is 15% of payroll with a transaction cost of 5% of wages. The common investment strategy is a 50-50-0-0-0 approach, i.e. 50% of assets are allocated to bank deposits and government bonds respectively. In addition a risk return analysis is employed to test the portfolio riskiness. The test include the Sharpe ratio, the Jensen measure and the Treynor measure.

It was observed following the simulation tests that replacement rates are higher when retirement age rises to 60 or 65, but retiring at 50 had very low replacement rates. Meaning, pensioner can get favourable retirement income when he/she retires at 65 but this is a problem since life expectancy is 54 years. The portfolio risk test indicated very low results meaning low risks. This is as a result of allocating the funds in less risky assets i.e. government bonds which have low investments yield trickling down to low pensions.

To improve the current pension system, Malawi needs to redesign its pension system to tackle the life expectancy problem, diversify pension fund portfolios to achieve a high and stable return, and invest in the economy in order to have a stable macro-economy that can protect the real value of pension assets.

Keywords: Malawian pension reform, simulation, 50-50-0-0-0 approach

Resumo

Esta tese examina o fundo de pensão de reforma do Malawi usando um modelo de simulação integrada. O objetivo é explorar por que o governo do Malawi passou do sistema Pay as you go (repartição) para um sistema de contribuição definida (capitalização). Malawi é um país relativamente jovem e os seus regimes de pensões são deficientes em design, financiamentos, execução e administração. Malawi tem flutuações macroeconômicas persistentes e um sector financeiro instável que fazem a gestão eficaz de fundos de pensões desafiante. Além disso, existem altas taxas de inflação e politicamente motivadas empréstimos de investimento de baixo rendimento .

A tese parte do princípio de que no Malawi uma pessoa média se aposenta aos 50 anos e de que a idade máxima de morte é de 70 . O salário médio inicial varia de 65,000-75,000 Mk. A taxa de contribuição é de 15% do salário, com um custo de transação de 5% dos salários. A estratégia comum de investimento é uma abordagem 50-50-0-0-0 , ou seja, 50% dos activos são alocados para os depósitos bancários e títulos do governo, respetivamente. Além disso, uma análise de retorno de risco é utilizada para testar o grau de risco da carteira. O teste inclui o índice de Sharpe, a medida Jensen e a medida Treynor .

Observou-se nos ensaios de simulação que as taxas de substituição são mais elevados quando a idade da reforma sobe para 60 ou 65 anos, mas se a reforma for aos 50 anos obtêm-se taxas de substituição muito baixas. Ou seja, o pensionista pode obter uma pensão favorável quando se aposenta aos 65 anos , mas existe um problema, já que a expectativa média de vida é de 54 anos. O teste de risco da carteira dá resultados muito baixos indicando baixo risco. Este é o resultado da alocação dos recursos em ativos de menor risco, ou seja, títulos do governo, produzindo pensões baixas .

Para melhorar o actual sistema de pensões, Malawi precisa redesenhar o seu sistema de pensões para enfrentar o problema da expectativa de vida, diversificar carteiras dos fundos de pensões para conseguir um retorno alto e estável, e investir na economia, a fim de ter uma macroeconomia estável, que pode proteger o valor real dos ativos de pensões.

Palavras-chave: reforma das pensões do Malauí , simulação, 50-50-0-0-0 abordagem

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Acronyms and Abbreviations

DB: Defined Benefit

DC: Defined Contribution

Khs: Kenya Shilling

MK: Malawi Kwacha

NSO: National Statistics Office

PAYG: Pay As You Go

RBM: Reserve Bank of Malawi

USD ($): United States Dollar

Glossary[1]

Accrual rate: The rate at which pension benefits builds up as member service is completed in a defined benefit plan.

Accrued benefits: The amount of accumulated pension benefits of a pension plan member on the basis of years of service.

Accumulated assets (Accumulation): The total value of assets accumulated in a pension fund.

Active member: A pension plan member who is making contributions (and/or on behalf of whom contributions are being made) and is accumulating assets.

Actuarial deficiency: In a situation when the actuarial value of a pension fund's assets is less than the actuarial liability, the measure of this value.

Annuity: A form of financial contract mostly sold by life insurance companies that guarantees a fixed or variable payment of income benefit (monthly, quarterly, half-yearly, or yearly)for the life of a person(s) (the annuitant) or for a specified period of time. It is different than a life insurance contract which provides income to the beneficiary after the death of the insured. An annuity may be bought through instalments or as a single lump sum. Benefits may start immediately or at a pre-defined time in the future or at a specific age.

Annuity rate: The present value of a series of payments of unit value per period payable to an individual that is calculated based on factors such as the mortality of the annuitant and the possible investment returns.

[1]From: OECD (2005) Private Pension: OECD *Classification and Glossary*; World Bank 1994, *Averting the Old Age Crisis* and RBM (2011*) Understanding pensions*.

Asset allocation/ Portfolio: The spread of fund investments among different investment forms.

Asset manager/ Investment manager: The individual(s) or entity (ies) endowed with the responsibility to physically invest the pension fund assets. Asset managers may also set out the investment strategy for a pension fund.

Beneficiary: An individual who is entitled to a benefit (including the plan member and dependants).

Contribution: A payment made to a pension plan by a plan sponsor or a plan member.

Contribution rate: The amount (typically expressed as a percentage of the contribution base) that is needed to be paid into the pension fund.

Contributory pension scheme: A pension scheme where both the employer and the members have to pay into the scheme.

Deferred pension: A pension arrangement in which a portion of an employee's income is paid out at a date after which that income is actually earned.

Deferred retirement: A situation when an individual decides to retire later and draw the pension benefits later than their normal retirement age.

Defined benefit (DB): Occupational plans other than defined contributions plans. DB plans generally can be classified into one of three main types, "traditional", "mixed" and "hybrid" plans.

"Traditional" DB plan: A DB plan where benefits are linked through a formula to the members' wages or salaries, length of employment, or other factors.

"Hybrid" DB plan: A DB plan where benefits depend on a rate of return credited to contributions, where this rate of return is either specified in the plan rules, independently of the actual return on any supporting assets (e.g. fixed, indexed to a market benchmark, tied to salary or profit growth, etc.), or is calculated with reference to the actual return of any supporting assets and a minimum return guarantee specified in the plan rules.

"Mixed" DB plans: DB plans that has two separate DB and DC components but which are treated as part of the same plan.

Defined contribution (DC): Occupational pension plans under which the plan sponsor pays fixed contributions and has no legal or constructive obligation to pay further contributions to an on-going plan in the event of unfavourable plan experience.

Dependant: An individual who is financially dependent on a (passive or active) member of a pension scheme.

Early retirement: A situation when an individual decides to retire earlier later and draw the pension benefits earlier than their normal retirement age.

Fund member: An individual who is either an active (working or contributing, and hence actively accumulating assets) or passive (retired, and hence receiving benefits), or deferred

(Holding deferred benefits) participant in a pension plan.

Funded pension plans: Occupational or personal pension plans that accumulate dedicated assets to cover the plan's liabilities.

Funding: The act of accumulating assets, in order to finance the pension plan.

Indexation: The method with which pension benefits are adjusted to take into account changes in the cost of living (e.g. prices and/or earnings).

Individual pension funds: A pension fund that comprises the assets of a single member and his/her beneficiaries, usually in the form of an individual account.

Mandatory occupational pension plans: Participation in these plans is mandatory for employers. Employers are obliged by law to participate in a pension plan. Employers must set up (and make contributions to) occupational pension plans which employees will normally be required to join. Where employers are obliged to offer an occupational pension plan, but the employees' membership is on a voluntary basis, these plans are also considered mandatory.

Mandatory personal pension plans: These are personal plans that individuals must join or which are eligible to receive mandatory pension contributions. Individuals may be required to make pension contributions to a pension plan of their choice normally within a certain range of choices or to a specific pension plan.

Minimum pension/ benefit: The minimum level of pension benefits the plan pays out in all circumstances.

Mortality table: A chart showing rate of death at each age. Unisex mortality table

Non-contributory pension scheme: A pension scheme where the members do not have to pay into the scheme.

Normal retirement age: Age from which the individual is eligible for pension benefits.

Participant: Fund member

Pay-As-You-Go (PAYG) plan: Funded pension plans usually paid in the recurrent budget of a nation/ firm.

Pensioner/ Retiree: Pension fund member who has retired and is receiving pension benefits

Pension funds: The pool of assets forming an independent legal entity that are bought with the contributions to a pension plan for the exclusive purpose of financing pension plan benefits. The plan/fund members have a legal or beneficial right or some other contractual claim against the assets of the pension fund. Pension funds take the form of either a special purpose entity with legal personality (such as a trust, foundation, or corporate entity) or a legally separated fund without legal personality managed by a dedicated provider (pension fund Management Company) or other financial institution on behalf of the plan/fund members.

Pension Benefit: Payment made to a pension fund member (or dependants) after retirement.

Pension fund administrator: The individual(s) ultimately responsible for the operation and oversight of the pension fund.

Pension fund governance: The operation and oversight of a pension fund. The governing body is responsible for administration, but may employ other specialists, such as actuaries, custodians, consultants, asset managers and advisers to carry out specific operational tasks

Or to advise the plan administration or governing body.

Pension contracts: Contracts that specify pension plans contributions to an undertaking in exchange for which the pension plan benefits will be paid when the members reach a specified retirement age or on earlier exit of members from the plan. Most countries limit the integration of pension plans only into pension funds, as the financial vehicle of the pension plan. Other countries also consider the pension insurance contract as the financial vehicle for pension plans.

Pension plan: A legally binding contract having an explicit retirement objective (or – in order to satisfy tax-related conditions or contract provisions –the benefits cannot be paid at all

or without a significant penalty unless the beneficiary is older than a legally defined retirement age). This contract may be part of a broader employment contract, it may be set forth in the plan rules or documents, or it may be required by law. In addition to having an explicit retirement objective, pension plans may offer additional benefits, such as disability, sickness, and survivors' benefits.

Pension scheme: Pension funds /Pension plan

Pensionable age: Normal retirement age

Personal pension plans: Access to these plans does not have to be linked to an employment relationship. The plans are established and administered directly by a pension fund or a financial institution acting as pension provider without any intervention of employers. Individuals independently purchase and select material aspects of the arrangements. The employer may nonetheless make contributions to personal pension plans. Some personal plans may have restricted membership.

Projected Benefit/Accumulated Pension Benefit: The actuarial present value of vested and non-vested benefits attributed to the plan through the pension benefit formula for service rendered to that date based on employees' future salary levels.

Public pension funds: Pension funds that are regulated under public sector law.

Public pension plans: Social security and similar statutory programmes administered by the general government (that is central, state, and local governments, as well as other public sector bodies such as social security institutions). Public pension plans have been traditionally PAYG financed, but some OECD countries have partial funding of public pension liabilities or have replaced these plans by private pension plans.

Rate of return: The income earned by holding an asset over a specified period.

Replacement rate: The ratio of an individual's (or a given population's) (average) pension in a given time period and the (average) income in a given time period.

Underfunding: The situation when the value of a plan's assets, are less than its liabilities, thereby having an actuarial deficiency.

Voluntary contribution: An extra contribution paid in addition to the mandatory contribution a member can pay to the pension fund in order to increase the future pension benefits.

Wage indexation: The method with which pension benefits are adjusted taking into account changes in wages.

Table of Contents

1. INTRODUCTION

Pension schemes in most African nations; suffer from a series of significant weaknesses reflecting deficiencies in their design, financing and administration. Macroeconomic fluctuations, political interference and the instability of the financial sector negatively affect pension fund management. There is evidence of declining revenue from contributions due to unemployment and insolvency in the private sector as well as retrenchments and budgetary constraints in the public sector. The real value of reserves is eroded through high inflation rates and the channelling of resources into politically motivated low-yield investments and loans. It has become evident that the social security system is not able to provide adequate levels of income at old age. The reform of unsustainable pay-as-you-go (PAYG) pension systems can help reduce the fiscal burden that such schemes place on the population, and indeed avoid burdening future generations. Such concerns are greatest in countries with high levels of labour market informality, as is the case in developing countries in Africa and elsewhere (Stewart and Yermo. 2009). As a result most African nations have decided to reform their public pension system to private pension system. This move may not only provide income at old age but it may develop the capital markets, reduce government pension debt, and encourage financial investment and economic growth.

The current study focuses on the social security system reforms that occurred in Malawi since 2011. Malawi like many countries restructured its pension scheme from a public PAYG to a private mandatory Defined Contribution (DC) pension system with the aim of improving the deficiencies of its pension schemes. The aim is to invest the pension contributions in the capital market with the desire to improve the macroeconomic instability and government pension debt. Financial theory postulates that for an economy to experience macroeconomic stability it must invest in its economy. While this is beneficial to the economy, Welfare Economists argues that investing pension contributions in financial markets exposes the

pensioner to risks (Lange, 2010). The risks can occur when there is poor investment, and poor performance of the financial market. When a loss occurs, fund managers transfer the risks to pensioners who in return receive less than expected and sometimes nothing at all. This thesis aims at analysing the sustainability of the pension reform by examining the advantages and disadvantages of the reform.

Malawi has never conducted a comprehensive study on its pension systems and pension reform. This could be due to lack of knowledge, lack of data and lack of political will. This study aims to provide an understanding into the reasons why the Malawi government has decided to reform its pensions, how it will function and the challenges that it faced in the PAYG pension system. The purpose of this study is not to provide a complete survey of the reform, but to highlight the benefits, limitations, operations and expected performance of the reform in ensuring retirement income, reducing government pension debt and improving macroeconomic instability.

Malawi's move from PAYG to private pension has been greatly influenced by its need to improve its economic performance, social welfare and its pension system that is financially unsustainable. McCarthy and Zheng (1996) point out that pension funds growth could be made more sustainable by increasing GDP, raising contribution rates or gradually reducing benefit rates. But the financial costs and social obstacles of those reform options must be assessed. Fully funded, privately managed pension schemes might be feasible. This study using an integrated simulation model will investigate the cost of supporting the pension reform, and the impact of different reform options and pension arrangements can bring positive economic growth. The goal is to identify the challenges the Malawi government will face in managing pension reform in the long run and whether the reforms are macro economically sound.

This thesis is organized as follows: Chapter 2 will provide a brief literature and empirical review discussing country case studies. The aim is to provide scientific rationale and study significance. Chapter 3 will include the pension framework, Methods and Data. This chapter will represent the empirical model that will be used to analyse the study, relating to the literature review. It will present data available that will be used in the analysis and how it was collected and sampling methods used. Chapter 4 will provide an analysis of the model and the data used with the help of graphs and tables. Lastly Chapter 5 will include the conclusion, contributions, limitations of the empirical study and suggestions for future research.

2. LITERATURE REVIEW

The following literature review considers the theoretical foundations of the study. In discussing the conceptual framework for the study it was necessary to review other similar studies and various theoretical models pertinent to this study. The review will be structured as follows: theoretical models & approaches and similar studies carried out in other countries namely: South Africa, Chile, Kenya, Nigeria and China.

2.1. Theoretical models and approach

This study on pension reforms was underpinned by various theories and approaches that together offer a holistic appraisal. There are many theories and approaches that can potentially guide this area of concern. This study focused on pension reforms in Malawi which is a developing country. Hence the theoretical paradigms adopted to deepen the understanding of the situation include: Welfare economic approach and Theory of Finance.

2.1.1 Welfare economic theory of social security

Lange (2010) states that welfare economic theory is concerned with the conditions which determine the total economic welfare of a community. It is concerned with how economies use policies to improve the wellbeing of its citizens. One way is by ensuring that citizens have financial security at old age and social protection. One of the policies an economy uses is social policy. Hill (1997) argues that social policy is concerned with housing, social security education and health. Social security can be grouped in three categories: contributory benefits, non-contributory benefits which are not means-tested but are contingent upon an individual being in a specific category like a child or disabled and lastly means tested benefits. Pension forms part of the social security that is contributory and it is imperative that the government should establish frame works in which they should operate. Barr (1993) suggests that government can achieve this by using two options. The first is the PAYG system where the government taxes its current workers and uses the proceeds to pay pensioners. The limitations are that, with time the aging community grows at

an exponentially high rate than the working generation. This in return puts a strain on the economy and the working generations end up suffering by paying high taxes while the retirees receive low pension benefits. In addition the PAYG is prone to high political interference especially in developing countries. To improve on this Barr, advocates for governments to increase the retirement age. This approach is however impractical for most developing economies since most of them have very low life expectancies. Secondly, Barr argues for a voluntary private pension, where the working generation contributes a fraction of their salary in a pension fund to fund their retirement. This is ideal for developing economies in that it reduces pressure on government pension expenses, increases economic stability through the fund's investment and it is free of political-interference. Care however should be considered since the financial investments are subjected to financial risk and if pension benefits are not invested in profitable portfolios would lead to income loss. It is therefore important for government to pay attention to its pension system and ensure that its social security system is not eroded and that additional burden should not be placed on the state.

2.1.2 Financial theory of Efficient Markets and Pension Savings

Elton et al (2011) indicates that, efficient markets mean that security prices fully reflect all available information. All riskless investment in the efficient market must have a zero net present value at the time an investment is made. To decrease investing in risky portfolios financial theory argues that we must invest in portfolios with low standard deviation. Markowitz portfolio selection model suggest that this is achievable by diversifying investments and in return leads to portfolios with high expected returns and low standard deviation. It is assumed that investors will invest their saving only in portfolios with high expected returns. The aim is to earn high income in the future. Altman (2008) argues that as economies grow, the population grows with it. The older are living longer and the cost of supporting them is rising. If economies wish to reduce the substantial rise of elderly living in

poverty they must employ policies that focus on ensuring that individuals save more money while they are economically active.

The pension reform of Malawi thus aims at encouraging people to save more as they work. This is characterised by defined contribution. However for it to work members need an extensive knowledge of financial concepts especially risks associated with various asset classes. Members need to understand their risk profiles and savings behaviour. The financial out-come is that firms would offload their contingent liabilities and members would acquire investment risk. Secondly there is need to encourage employers to provide high contribution to occupational pensions. The third need is to spend more public money on pensions and pensioners. The second and third aforementioned needs are normally incorporated in PAYG. However in the case of Malawi, increasing pensions led to high taxes for current workers. Even with the increased taxes poor management of the pension fund led to misallocations of the proceeds. The Nation Online estimated that between 2005-2009, 3.5 thousand pensioners were unpaid. As previously mentioned another strategy would be encouraging individuals to stay in the labour force longer, which would lead to workers saving more before they retire. This is not ideal for Malawi since life expectancy is very low at a rate between 54.14- 55 years (figure 14).

2.2Country pension profiles

The countries that will be looked at are South Africa, Chile, Kenya, Nigeria and China. These countries have been chosen because; according to the World Bank and UNDP when they started their pension reforms, they had similar population structure to that of Malawi in that 50% or more of its citizens lived in rural areas and were poor (World Bank, 2010). Majority of the population were the youth and had high unemployment. They have experienced pension reforms in the past 20 years. Their GDP growth rate was less than 10% and inflation was higher than 4%. They experience similar social security problems i.e. high

unemployment, high income disparities, high birth & mortality rates and low wage levels (UNDP, 2013). Most of their pension system wasn't adequate in providing income to the growing elderly population. They moved from a public PAYG system to a private DC and took similar approaches to reform their pension funds that Malawi is embarking on. Their Pension reform structure is similar to what Malawi is trying to do and in addition South Africa, Nigeria and China have taken a big role in providing experts in improving the pension system and investing in financial market in Malawi.

2.2.1 South African Case

In South African the pension system follow a three pillar regime just like that of Malawi, the first being old age pension, which is the main source of income for 75% of the elderly. The second pillar comprises of various pension designs which are associated with the formal sector employment in either private or public. Between1980-90 South Africa had PAYG pension system. Just like Malawi, South Africa's pension policy was supply driven and served political ends. A qualitative study by the South African financial board in the 90s indicated that large numbers of elderly & pensioners lived in poverty and benefited little from the PAYG system that faced a lot of political inter-ference, corruption and mismanagement. The study recommended a reform from PAYG to a privately owned DC plan. This then produced an additional voluntary occupational pension system and voluntary personal savings arrangements. Barrientos and Sherloc (2008) in their study noted that the Pensions reforms in South Africa had a significant impact on reducing poverty among older people and their households over the years. Analysis of household poverty status between 2002 and 2008 shows a high incidence of movement in and out of poverty among the elderly at 43 per cent in a six-year period. Malawi should draw lessons from the South African phenomenon since the aim of the reform is to reduce poverty among pensioners.

2.2.2 Chilean Case

Between 1980 and 1981 the Chilean government introduced a pensions based on individual capital accounts i.e. the value of the pension depends on funds accumulated and the rate of return. The new regime considers three types of pensions: old age, disability and survivor pension. Just like the pension reform in Malawi, when an individual retires, he has two options: he can buy a life annuity from an insurance company with the accumulated funds or make scheduled monthly withdrawals from his account. Both nations' aim is to reduce old age poverty. In 2006, a diagnosis of the Chilean system revealed that a significant portion of the population lacked sufficient funds to support themselves during old age. There were personal pension gaps, which are closely associated with informal sector and low paid jobs, they're also associated with younger workers, married women and the self-employed. These gaps in coverage will lead to poverty and hardship for the elderly population and inflated future government welfare expenditure. To fix this the government introduced a Pension Reform Law No. 20,255 in 2008. The act indicated the self-employed should have mandatory contribution (Júaregui, 2010). Malawi just like Chile is an economy where 50% or more of its employees are the youth, 54 % of its population have low incomes (World Bank, 2012). Therefore Malawi can use some of the solutions employed by Chile as a guide in developing the pension reform. Malawi should expect that approximately after 25 years of implementation, the pension reform challenges experienced by Chile in 2006 might crop up and thus must be ready to solve them.

2.2.3 Kenyan case

Kenya in 2006 introduced voluntary membership and contributions with the aim of securing pension for the informal sector. The statutory contributions to the National Social Security Fund (NSSF) are set at 15%. The employee pays half and the other half is paid by the employer. A lump sum benefits can be given on retirement at or after age 50, earlier invalidity, on permanent emigration and to survivors on death of a member. In 2003 a study

was conducted to measure the effects of the new pension reform through portfolio weighting in land and property assets. It was noted that the level of contributors rose from 750,000 to 1 million which resulted in economic improvement. However the level of benefits outgo remained static at just over Ksh 2billion, reflecting a combination of a decrease in early withdrawals as well as the impact on benefit outgo of the lower allocation of interest to members' individual accounts (Raichura, 2008).

2.2.4 Nigerian Case

Dostal´s paper on Nigerian Pension Reform 2004-2010 analyses early results of the 2004 Nigerian pension reform. He pointed that in 2010, the pension system was privately managed and funded pension accounts covered around four million Nigerians in the country with a workforce of around 50 million people. The study focuses on shortcomings of the new system. The study demonstrates in a model calculation using GDP per capita and the development of financial markets as indexes in measuring the funded accounts performance. This measure was used because most of the contributions were invested in the financial market. This so far produced negative real returns for pension savers. Most crucially, the reform has failed to contribute to basic social security in old age for the majority of Nigerians employed in the informal sector. Placing these individual accounts in financial markets only increases public debt. Thus, agreeing with academic literature which offers no support for funded pensions in the context of developing countries with low GDP (Davis 1995, ch.11; Barr and Diamond 2008, 94-110, 159-73; Barr and Diamond 2009, 24-25). This should raise concern on the sustainability of the reform in Malawi. The mistake that the Nigerian government did was lack of portfolio diversification, lack of management accountability and pension savers had little knowledge of financial markets.

2.2.5 Chinese Case

Hu (2006) borrowed the model of McCarthy and Zheng (1996), Cairns (2003) and the OECD (2011, 2005), which used empirical simulation investigation of the impacts of several policy options. i.e. changes in contribution rates, alternative pension fund investments, changes in retirement ages and transaction costs. To study China´s move from the public pay as you go pension system which was basically catering to people in cities and towns to private sector managed pension. This was the case because pension contributions were invested in financial Markets by the private pension funds. Malawi is expected to employ the same strategy since the only way for pension savings to grow is to invest them in the Market. Hu found that increase in contribution rate would raise the replacement rate. Raising the retirement age led to an effective impact i.e. enhancing the replacement rate nearly 3 times, if the worker serves 10 more years. This policy, however, is likely to provoke resistance from the public, like in the UK (Turner 2005); therefore, if this option is considered, the increase should consider match demographic changes. The impacts of different transaction costs on the benefits are quite large as well. This was also the same in Malawi in 2010 when the pension bill was being discussed in parliament and the retirement age was increased from 55 to 60. This caused mass demonstrations to the point that the retirement age was then reduced to 50.

This study by making appropriate adjustments will borrow from the model used by Hu. This model is ideal for the study because: the study will use quantitative research methods to make simulation for future pensions Hu also used the same.

A similar methodology was used by OECD in 2011, 2005 and 2001, where they looked at how retirement benefits from mandatory public pensions change with different assumptions, e.g. level of individual earning and return on DC pensions. The model is flexible, easy and simple in that it used different assumption to calculate pension funds.

3. The Frame work of Social Security System in Malawi

3.1 Labour Force Structure

Malawi is a country with a population estimated at 15.38 million as of 2013 (Table II) with a labour force close to 6.71 million (table III). This labour force has gradually been rising from 3.7 million in 1990 to the current rate. The GDP per capita was estimated to be 918 PPP dollars (Table II). To provide an overview of the structure and recent performance of Malawi's economy, Table II shows the distribution of the main economic sectors and their growth rates. By far the largest sector is the agricultural sector accounting for 30% of GDP. This sector provides jobs to about 90% of the work force (86% of which are subsistence farmers). Most of these farmers are self-employed and do not see the importance of investing in a private pension. It is argued that most farmers perceive it as a waste of viable resources which can be diverted to the expansion of their business. This could be due to lack of knowledge, lack of government will and poor execution of pension schemes. This results in 90% of the retired population not having pension schemes (Table III). In this table it can be seen that in 1990 the percentage of retired population with no pension schemes is 91%. The rate slightly decreased in 2009 to 89% and 86% in 2012. This could be attributed to changes in pension regulations and increased political will.

3.2 Pension Structure

Malawi developed its first pension schemes in 1944 under the Malawi Public Service Regulations Act which was later reformed in 1991. With the guidance of this act Malawi developed 3 types of pension schemes which included:

3.2.1 The Public Pension Scheme:

This is a Civil Service Pension Scheme (CSPS) operated by the Government of Malawi. This is a non-contributory defined benefit (DB), pay-as-you-go (PAYG) system paid to employees at the mandatory retirement age of 60 and following 10 years of service or earlier following 20 years of service. Pensions are paid out of a consolidated fund, from recurrent expenditure.

The proportion is normally calculated on the basis of number of pensioners and pension arrears. The pension accrues at a rate of 1/360 of pensionable salary for each completed month of service. The final salary forms the base for calculating pensions. Tax deduction of 2% of total entitlements is levied on early retirees. The Retirement benefit comprised of lifetime pension and lump sum gratuity. The gratuity is paid at a minimum of 5 years in service. The retirement benefit comprised of 75% of total terminal accrued benefits, whereas gratuity consisted of the remaining 25%. In the fund two main contingencies are covered: old age and a death gratuity (Finmark, 2010).

3.2.2 Occupational Mandatory:

This is the second pension scheme that was supported by the Malawi Public Service Regulations Act. This scheme is offered voluntarily through privately managed occupational schemes. The pension schemes are registered with the Commissioner of Taxes of the Malawi Revenue Authority (Kazeze). It was estimated in 2010 that there were around 399 private pension funds offering both DB and defined contribution (DC) pension schemes with total assets of around MK35 billion ($250 million) or more (RBM, Malawi). These pension schemes were handled and managed by private pension administrators. Each used their own formula, contribution & transaction rates plus each had its own regulations.

3.2.3 Malawi Social Cash Transfer Scheme:

The third pension scheme was a pilot Social Cash Transfer Scheme (SCTS). This began in Mchinji District in 2006 and was later extended to 6 more districts by the end of 2008. By 2009 the scheme covered 14.5 thousand households of the elderly who received on average MK 1800 ($13) a month. This however was not sufficient since the total elderly population is approximated at 520 thousand (Finmark, 2010).

3.2.4 Limitations of the old pension scheme

This public pension had two main problems. Firstly, decline in revenue contributions due to unemployment, retrenchments and budgetary constraints in the public sector. Secondly, the real value of the reserves has been eroded through high inflation rates and the channelling of resources into politically motivated low-yield investment and loans under the previous government. The amount of benefit payout had been rising over the years and this inflated government debt and caused a strain on the economy. Table I below shows the defined-benefit schemes for public sector employees were running high actuarial deficits and had accumulated substantial arrears in benefit payments. The highest deficit was of MK 3 billion in 2012/2013 financial year. Table II indicates how macro economically unstable the economy was with high government spending of MK 49 million ($147.5 thousand), low GDP of $5.7 billion, high inflation and negative balance of trade trends etc. Additionally Figure 1 brings into picture how GDP levels were fairing with the highest being 9.8 in 2009 and the lowest 3.3 in 2006. Instability of the financial sector also negatively affected pension fund management. Insolvency in the private sector as well as retrenchments and the real value of the reserves has been eroded through high inflation rates of up to 44.759% in 1999 (Table VIII). The real rate of return was highly negative during 1998-2004, as low as -25% for members' balances and somewhat less negative on fund assets (Dick & Mussa, 2010). The income ceilings applied in the calculation of pension contributions had not been adjusted regularly for inflation. Because of high inflation rates, the ceiling fell to the equivalent of US$20 in 2000. This resulted in very low, practically flat-rate contributions of only MK. 1,500 or US$4 per month to members' accounts. There was poor participation in the pension schemes in the all sectors namely the public sector, private sector and informal sector. Table III illustrates the distribution of the labour force how the number of pensioners in the civil service and private sector is unbalanced. The table shows that a large number of the labour force is employed in the private sector compared to the civil service. The main phenomenon

is that Malawi is an agricultural dependent country and 75% of the population is employed in the informal agricultural market. This has trickled down to a large percentage of retirees with no pension with the highest being in 1996 of 92.02%. This is a big challenge for Malawi. Figure II illustrates this issue better through a chart with the average percentages of retirees without pension at a high rate of 90%. This indicated inadequate management of pension fund operations and lack of pension regulations means most employees in the agricultural sector do not have proper pension coverage. Hence a reform was needed to help reduce the pension debt.

3.2.5 Pension Reforms

Pension reforms started to occur in 2004 when the basic wage rose by 100%. Pension accrual rate was then adjusted from 1/360 (3.3%) to two differing rates of 2.2% for senior staff and 2.5 % for junior staff. Prior to 2004, every employee was paid a lump sum gratuity and a reduced pension. The new system allowed employees to opt to get a full pension without gratuity or get a gratuity of up to 25% plus a reduced pension, but with interest of 4%. In 2009, this 4% discount rate was reduced to 2%. Pension benefits were adjusted to an inflation rate of 10%. The government revised the mandatory retiring age for Civil servants from 55 years to 60 years in 2006 (Finmark, 2010). However this did not solve the pension deficit problem. The participation level of individuals in pension systems was still erratic and government was still in pension debt.

By 2010 the government decided to move from a public PAYG to a private mandatory defined contribution pension scheme.

In 2011 Malawi pension act was established and it categorised pension into three basic pillars: a poverty prevention pillar where the Malawi Social Cash Transfer Scheme lies. A mandatory contribution pillar and a voluntary savings pillar where public and private employees can use. The act stipulates that, a National Pension fund (NPF) and a National

pension administrator (NPA) operating as independent bodies are to be established. Employees and employers can make mandatory contributions to the NPF and it will receive, monitor and disperse the pension benefits. The NPA will act as a regulatory board and controlling body of pension fund providers. The NPF will offer limited administration, investment, and other auxiliary services to private pension funds administrators and investment managers.

Pension schemes will be of defined contribution, defined benefit, or a hybrid of the two. Under the new law, all defined benefit schemes have to be fully funded. Currently all pension schemes are defined contribution.

The act indicates that employer´s contribution would be 10% of the pensionable salary while the employee´s contribution is 5% of the pensionable salary. Employers with less than five employees and with a minimum annual income of less than MWK 120,000 (USD 300-500) are exempted. The retirement age is now 50 from 55 and the minimum years of service is now 20 from 25. On retirement, members may access 40% of their benefits as a lump sum while the rest should be used to buy an annuity or arrange a programmed withdrawal with a pension fund. There are approximately, 337,000 people in the Malawian civil service and around 30,000 retirees (Finmark Malawi, 2010). With the pension act in place pension funds have grown tremendously. Tables IV to VII provide a detailed outlook of private pension funds. In the figures 2011 saw an increase in pension funds of 55.6%, pension members increased by 39.9%, contributions by 47.3% and pension assets rose from Mk 59512.8 to Mk 67666.4

3.2.6 Structure of the Pension Reform Portfolio and its Financing Vehicle

The insurance industry plays an important role in the administration of pension fund investments in Malawi. Table IV shows the composition of those administrators with Old mutual life holding the highest value. Most of the government pension systems are also

expected to be managed by these firms. The capital market in Malawi is not well developed and it has been faced with poor economic performance, lack of sophistication and expertise. All pension funds are closed ended. The aim of the pension reform is to boost the economy and financial sector of Malawi, and with that in mind most fund managers are only willing to invest in portfolios that are considered to provide guaranteed return. Hence most portfolios are 50% bonds and 50% bank deposits and sometimes 100% bonds.

3. 3 Methods and Data

3.3.1 Research design

In this section, reports on the empirical simulation investigation of the impacts of several policy options on the pension system. The policy options include changes in contribution rates, alternative pension fund investments, changes in retirement ages and transaction costs. By employing a stochastic simulation technique, it is hoped to demonstrate the quantitative extent to which the changes in those variables impact on the pension benefits. The analysis is based on the purely funded model. In addition the study will examine the investment performance and risk measures associated with the investment portfolios using total returns. The aim is to calculate the profitability of the pension investment portfolio.

3.3.2 Methodology

3.3.2.1 Simulation Model

The model used is the same as the one used by Hu (2006), Cairns (2003) and McCarthy and Zheng (1996) and it is as follows:

$$P_{y2} = \sum_{t=y1}^{y2}[(cW_\gamma - Tc_\gamma)\prod_{\gamma=t}^{y2}(1+r_\gamma)] \quad (1)$$

$$P_t = (1+r_t)P_{t-1} - A\prod_{\gamma=y2+1}^{t}(1+\pi_\gamma), \;\; t \in [y2+1, y3] \quad (2)$$

In Equation 1, P is the balance of pension fund accumulation, C is the contribution rate, W income or wage, TC the transaction cost and r the annual rate of investment returns. A is the pension payment and л the inflation rate in Equation 2.

The study assumes a person starts working at the age of y1, retires at y2 and dies at y3, *t* and γ denote the time dimension. The average age a person starts working is assumed to be 22 in Malawi. A similar methodology was used by OECD (2005d), where they looked at how retirement benefits from mandatory public pensions change with different assumptions, e.g. level of individual earning and return on DC pensions. In addition, their simulation analysis included work relating to both DC and DB components (Hu 2006).

Equation 1 above mathematically describes the asset accumulation process of a person from the time he/she starts working at y1 to the time he/she finishes working at y2. Equation 2 is concerned with pension fund decumulation during the postretirement period from y2+1 to y3. We assume that pension payment is linked to inflation; therefore an inflation variable л is included into the equation. To be consistent with the fully funded nature of the pension scheme our model in the end year assumes a balance of pension assets should not be greater than zero and ideally equal to zero. Therefore the interest of pensioners is maximised if the account balance is zero, i.e. $P_{y3} = 0$ when the person dies. In order to derive the function of P_{y3}in terms of variables we are interested in, we expand Equations 1 and 2, by undertaking the mathematical manipulations as follows:

Substituting t = y2 +1and t = y2 + 2 into Equation 2 respectively, we have

$$P_{y2+1} = (1 + r_t)P_{y2} - A\prod_{\gamma=y2+1}^{y2+1}(1 + \pi_\gamma), \quad t: y2 + 1 \tag{3}$$

$$P_{y2+2} = (1 + r_t)P_{y2+1} - A\prod_{\gamma=y2+1}^{y2+2}(1 + \pi_\gamma), \quad t: y2 + 2 \tag{4}$$

Substituting equation 3 into 4 we get the following:

$$P_{y2+2} = \left(1 + r_{y2+2}\right)[\left(1 + r_{y2+1}\right)P_{y2} - A\prod_{\gamma=y2+1}^{y2+1}(1 + \pi_\gamma)] - A\prod_{\gamma=y2+1}^{y2+2}\left(1 + \pi_\gamma\right) \tag{5}$$

$$P_{y2+2} = \left(1 + r_{y2+2}\right)\left(1 + r_{y2+1}\right)P_{y2} - \left(1 + r_{y2+2}\right) \times A\prod_{\gamma=y2+1}^{y2+1}(1 + \pi_\gamma) - A\prod_{\gamma=y2+1}^{y2+2}(1 + \pi_\gamma) \tag{6}$$

Based on Equations 3 and 6 we can identify that both equations are a geometric series with the number of terms determined by time t. Therefore we write down equations of P*t* when t = *y*2 + 3 and t = *y*3 accordingly

$$P_{y2+3} = (1 + r_{y2+3})(1 + r_{y2+2})(1 + r_{y2+1})P_{y2} - (1 + r_{y2+3})(1 + r_{y2+2}) \times A \prod_{\gamma=y2+1}^{y2+1}(1 + \pi_\gamma) - A \prod_{\gamma=y2+1}^{y2+2}(1 + \pi_\gamma), \quad t: y2 + 3 \tag{7}$$

$$P_{y3} = (1 + r_{y3})(1 + r_{y3-1})(1 + r_{y3-2}) \dots (1 + r_{y2+1}) \times P_{y2} - (1 + r_{y3})(1 + r_{y3-1}) \dots (1 + r_{y2+2}) \times A \prod_{\gamma=y2+1}^{y2+1}(1 + \pi_\gamma) - (1 + r_{y3})(1 + r_{y3-1}) \dots (1 + r_{y2+3}) \times A \prod_{\gamma=y2+1}^{y2+2}(1 + \pi_\gamma) \dots - (1 + r_{y3}) \times A \prod_{\gamma=y2+1}^{y3-1}(1 + \pi_\gamma) - A \prod_{r=y2+1}^{y3}(1 + \pi_\gamma), \quad t: y3 \tag{8}$$

If we set Equation 8 equal to zero and undertake some manipulation, the value of A could be calculated as follows:

$$A = \frac{(1+r_{y3})(1+r_{y3-1})(1+r_{y3-2})\times\dots\times(1+r_{y2+1})\times P_{y2}}{(1+r_{y3})(1+r_{y3-1})\dots(1+r_{y+2})\times\prod_{\gamma=y2+1}^{y2+1}(1+\pi_\gamma)+\dots+\prod_{\gamma=y2+1}^{y3}(1+\pi_\gamma)} \tag{9}$$

Given the value of A we can easily compute replacement rates by dividing A by wages of the year before retirement.

3.3.2.2 Returns

In the portfolio the returns are analysed using annual pension returns as follows:

$$R_p = ln\left(\frac{R_t}{R_{t-1}}\right)$$

The Market return is calculated in a similar way as follows:

$$R_m = ln\,(\frac{R_{mt}}{R_{mt-1}})$$

The risk free rate for assets will be calculated using the RBM annual return data bank and using the formula Elton et al used in his book which is:

$$R_f = \frac{E(R_p)-\beta_p * E(R_m)}{(1-\beta_p)}$$ where; $\beta p\ is\ beta\ of\ the\ portfolio\ over\ time$

$E(R_m)$ *is expected market return over time*

$$\beta_p = \frac{\sum[R_p - E(R_p)] * [R_m - E(R_m)]}{\sum[\![R_m - E(R_m)]\!]^{\,2}}$$

$E(R_p)$ *is expected portfolio return over time*

3.3.2.3 Risk

In order to understand the performance of investment portfolios, Modern portfolio theory argues that there is need to measure the risks associated with the portfolio returns. The theory points two risk measures and one diversification measure. These are:

Systematic Risk - These are market risks that cannot be diversified away. Interest rates, recessions and wars are examples of systematic risks and it is measured by the beta of each scheme. This is calculated as indicated above.

Unsystematic Risk - Also known as "specific risk", this risk is specific to individual investments and can be diversified away as you increase the number of investments in your portfolio. This is measured by standard deviation computed as

$$\sigma_i = \sqrt{\frac{\sum_{i=1}^{n}\{R_i - E(R_i\}^2}{n-1}}$$ σ_i *is the standard deviation*

Diversification measure- portfolio diversification is important and it improves the performance of a portfolio. This is measured through a coefficient of determination which is R^2.

3.3.2.4 Performance Measures

3.3.2.4.1 Sharpe Ratio

The Sharpe ratio characterizes how well the return of an asset compensates the investor for the risk taken. When comparing two assets versus a common benchmark, the one with a higher Sharpe ratio provides better return for the same risk. This is measured as the excess return (or risk premium) per unit of deviation in an investment asset or a trading strategy,

typically referred to as risk. This is computed as: $S_p = \frac{R_p - R_f}{\sigma_p}$

S_p *is sharpe ratio for a portfolio*

σ_p *is standard deviation for a portfolio*

3.3.2.4.2 Treynor Ratio

This is the measurement of the returns earned in excess of that which could have been earned on an investment that has no diversifiable risk (e.g., Treasury Bills or a completely diversified portfolio), per each unit of market risk assumed. This is computed as:

$T_p = \frac{R_p - R_f}{\beta_p}$ T_p *is the Treynor ratio of a portfolio*

3.3.2.4.3 Jensen Measure

This is a risk-adjusted performance measure that represents the average return on a portfolio over and above that predicted by the capital asset pricing model (CAPM), given the portfolio's beta and the average market return. Hence it measures the relationship between portfolio returns and its expected returns. This is computed as follows:

$$J_p = \left[E(R_p) - \left[\!\left[R_f + \beta_p * \langle E(R_p) - R_f \rangle \right]\!\right]\right]$$

3.4 Data Collection

All data of asset returns, inflation rates and GDP are given in Table VIII. This simulation work, uses 5 different assets, i.e. bank deposits, government bonds, T bills, domestic equities and global investments. Regarding data source and observation period regarding inflation rates and Rates of returns on bank deposits were from RBM database (2013), Government bond yields from IMF, Returns on domestic equity from Malawi stock exchange. Returns on global investment were derived from returns on global equity yields and global bond yields with a 50-50 split, as in Davis (2002a, 2002b). Global returns were corrected by allowing for currency risk. Table IX provide wage averages for 2011/2012 obtained from ministry of labour and NSO.

3.5 Data Analysis and Verification

Looking at figure 3 domestic equities have been rising this is due to the persistent devaluation of the Malawi kwacha by the government. In figure 4 global investments are fluctuating and performing poorly. This can be attributed to the financial crisis. Wages (W) are defined as the annual real income after inflation rates are considered. The inflation rate is proxied by the consumer price index (CPI). The transaction cost (TC) is defined as a proportion of wages. In the paper, in order to assess the impacts of different rates of transaction costs on the contributions, we used 5%, 10% and 15% respectively. The rates are chosen based on the operations of the pension fund markets and the median rate of 10% is taken from the paper by (Whitehouse 2000) where administrative charges are compared across both OECD and developing countries. The contribution rates are assumed to be at the level of 10%, 15% and 20%. These contribution rates are used to determine how current pension system can perform if contribution rates change and the median rate is taken from the according to the requirements of the pension act. The study uses return data for seven different portfolios, which are constructed from our historical and simulated data series. Portfolio 1 refers to a portfolio consisting of bank deposits only, portfolio 2 government bonds only, portfolio 3 T bills only, portfolio 4 domestic stocks only and portfolio 5 global investments only. Portfolio 6 is a "naïve" portfolio with five types of assets allocated equally (20-20-20-20-20), i.e. bank deposits 20%, government bonds 20%, T bills 20%, domestic stocks 20% and global investment 20%. Portfolio 7 consists of 50% bank deposits and 50% government bonds[2], which is consistent with pension fund investment practice in Malawi. In the simulation work, we assume that a representative person starts working at the age of 22 in 2011[3]. 2011 is the year pension reform started. We also assume that the person maximum years to live is 2059

[2]Malawi pension funds are heavily invested in bank deposits and government bonds. This is for two reasons. One is the investment mandate of pension funds where low risk assets are always recommended to be the main investment vehicles, the other is because of underdeveloped financial markets.

[3]In Malawi a person usually starts school at 6 years old and attends primary for 8 years, then 4 years of high school and may continue to 4 years of university study and by the time they finish university they are usually 22 years old.

making the maximum age of death 70. Given that we only have data observations up to 2013, observations from 2013 to 2059 have to be simulated first. As for wages, the annual growth rate is estimated to be 3%. The simulation of inflation rates is based on the assumption that these rates are normally distributed; therefore we simulate the data from 2014 to 2059 by using the historical mean and standard deviation. The simulation of rate of returns on all seven portfolios are conducted in the same way as that in the inflation rates, i.e. using historical mean and standard deviation to simulate observations from 2014 to 2051. For the simulations, we used the full sample of these variables as shown in Table VIII. All simulations were programmed and conducted with R i386 3.0.1

3.6 Limitations of the study

The present study has the following limitations:

All the data used to determine the sustainability of the reform is simulated data because comprehensive data is not yet available. This means the future data might not necessarily be the same as the simulated data.

This study considered schemes with the same goal, risk profile and similar investments this may generate misleading results. Many of the pension plans favour T bill and bonds since they consider them risk free[4].

The observed data doesn't include effects of subscription and withdrawal commissions of portfolio's return and in some years data is not available this present a problem in data consistency.

The study only looked at themes that are currently tradable. Meaning it ignored liquidated or absorbed funds. This may present sample bias.

[4]Economic theory and macro finance favour government bonds and T bills arguing that they are AAA rated and are free of risk. However over the years a couple of governments have defaulted in bond payments e.g. Russia 1998 and Zimbabwe 2008 to date.

4. Results and Analysis

In this chapter an analysis of the data employed will be described, with the aim of illustrating and condensing the data used. This section will report on all the policy options used and how the impact pension benefits. Before discussing the results a report on the benchmark will be presented first, which will serves as the basis of the Malawi pension. The assumption is that in Malawi an average person retires by 50 years and the maximum age of death is 70. The average starting wage ranges from 65,000-75,000 Mk. The contribution rate is 15% of payroll with a transaction cost of 5% of wages. The common investment strategy is a 50-50-0-0-0 approach, i.e. 50% of assets are allocated to bank deposits and government bonds respectively. In addition we will look at the deccummulation model by using market inflation and interest rates to determine the monthly benefits expected to be received upon retirement. Two scenarios will be in place. One is where a lump-sum of 40% is paid and 60% is paid to an annuity. The second is where a 100% is invested in a pension annuity. Also the risk return analysis will be used by looking at performance of the portfolio's riskiness. The following test will be used to measure risks; the Sharpe ratio, the Jensen measure and the Treynor measure.

4.1 Simulation Results in the Basic Model

This is the model discussed above with 15% contribution and 50-50-0-0-0. Table XI gives the simulation results of replacement rates with the basic model. The mean of our simulated replacement rates is 1.31%, with a standard deviation at 0.6% when the contribution rate is 10%. When the contribution rate rises to 15% and 20% the replacement rates falls to 1.19% the replacement rate is low due to our assumptions that the 50% of the assets are allocated to banks and government assets. 1,000 replications are computed, since simulations generated random results by the computer, and thus we seek to obtain results as representative and/or accurate as possible. Despite the increase in contribution rates or transaction cost the replacement rate still is low. The only time the replacement rate is favourable is when the

retirement age rises and this is favourable at retirement ages 60 and 65 where we have replacement rates of 27.29% and 22.80% with standard deviations of 12.06% and 15.12% respectively. Figure 6 clearly shows the distribution and gives us a visual image of how dispersed the results are of the replacement rate. The 1.2% replacement rate found above is very low, and apparently not sufficient to support a typical retiree's post-retirement life. The deccumulation also favours the same result showing that a retiree at age 50 will not get enough monthly benefits that are just $43.20 while a retiree at 65 is likely to get $1441. Table XII indicates the results.

4.2 Simulations Results for the Rest of the Portfolios

4.2.1 Simulation Results Portfolio 1

In this section we quantitatively measure the extent to which replacement rates respond to changes in three variables, i.e. the contribution rate, retirement age and transaction costs. In the first portfolio simulation, we change the contribution rates to a lower level at 10%, and a higher level at 20% respectively. The portfolio is still replicated the results of the 50-50-0-0-0 investment approach, i.e. 50% in bank deposits and 50% in bonds. The results indicated in Table XIII show that the replacement rate at 10% and 15% is just 1.26% with a coefficient of variation 2.155 and 2.229 respectively. While at 20% contribution rate the coefficient of variation is 2.229 with a replacement rate of 1.31%. As the retirement age changes to 55, 60 and 65 with contribution rate of 15%. The replacement rates rises to 7.37%, 33.62% and 45.78%, with corresponding coefficient of variation of 1.829, 1.607 and 0.694 respectively. Just like the basic model the replacement rates are higher at age 60 and 65. Figure 7 shows just how the replacement rates are distributed with most of the clustering at 0.0-0.1 and 0.3-0.5

4.2.2 Simulation Results Portfolio 2

In portfolio 2 the simulation, at contribution rates of 10% to 20%. The portfolio is still replicated the results of the 50-50-0-0-0 investment approach. The results indicated in Table XV show that the replacement rate are just 1.31% with the coefficient of variation 0.317665146. When the retirement age rose to 55, 60 and 65 the replacement rates rises to 7.72%, 24.94% and 21.84%, with corresponding coefficient of variation of 0.28047014, 0.315620071 and 2.286851845 respectively. Just like the basic model the replacement rates are higher at age 60 and 65. Figure 8 indicates how the replacement rates are distributed with most of the clustering at 0.0-0.1 and 0.2-0.3 with corresponding frequencies of 8 and 2.

4.2.3 Simulation Results Portfolio 3

Portfolio 3 of the simulation, at contribution rates of 10%, 15% and 20%. The portfolio still replicates the results of the basic investment approach. The results are indicated in Table XVII and it shows that the replacement rate is just 1.32% with the coefficient of variation 0.30405129 for all rates. When the retirement age changes to 55, 60 and 65 the replacement rates rises to 7.83%, 35.37% and 38.73%, with corresponding coefficient of variation of 0.187706805, 0.310222723 and 0.563886378 respectively. Just like the basic model the replacement rates are higher at age 60 and 65. Figure 9 indicates the frequency of the replacement rates are with most of the clustering at 0.0-0.1.

4.2.4 Simulation Results Portfolio 4

In this simulation when contribution rates are 10%, 15% and 20%. The portfolio is still replicating the results of the basic investment approach. The results are indicated in Table XIX and it shows that the replacement rate is just 1.35% with the coefficient of variation 0.218036416 for all rates. When the retirement age changes to 55, 60 and 65 the replacement rates rises to 3.64%, 35.83% and 19.10% with corresponding coefficient of variation of 0.280660206, 0.300379866 and 4.1044647 respectively. The replacement rates

are highest at age 60 and 65 but the rest of it is very low. Figure 10 indicates the frequency of the replacement rates are with most of at low rates of 0.0-0.05 and the highest at 0.35-0.4.

4.2.5 Simulation Results Portfolio 5

With contribution rates of 10%, 15% and 20%, the results are indicated in Table XXI and it shows that the replacement rate is just 1.28% for all rates with the coefficients of variations 3.142317367, 20.13593547 and 3.142317367 respectively. When the retirement age changes to 55, 60 and 65 the replacement rates rises to 7.45%, 34.30% and 25.37% with corresponding coefficient of variation of 2.839548698, 2.612720892 and 3.1619790 respectively. The replacement rates are highest at age 60 and 65 but the rest of it is very low. As for the frequency of the replacement rates Figure 11 indicates the frequency of the replacement rates are with most of at low rates of 0.0-0.1 and the highest at 0.2-0.4.

4.2.6 Simulation Results Portfolio 6

At contribution rates are 10%, 15% and 20%, the results indicated in Table XXIII show that the replacement rate is just 1.29% for all rates, with the coefficients of variations 0.543913352, 0.218036416 and 0.543913352 respectively. When the retirement age changes to 55, 60 and 65 the replacement rates rises to 7.28%, 35.27% and 45.78% with corresponding coefficient of variation of 0.226287954, 0.325636759 and 1.207584452 respectively. The replacement rates are highest at age 60 and 65 but the rest of it is very low. As for the frequency of the replacement rates Figure 12 indicates the frequency of the replacement rates are with most of at low rates of 0.0-0.1 and the highest at 0.3-0.5.

4.3 Conclusion of the Simulations

When we specify a higher contribution, i.e. 20% contribution rate, the person is expected to have would have a wealthier retirement life, but according to our findings the replacement rate doesn't rise in most cases it remains constant. The simulation results here are mainly used to demonstrate the quantitative effects of changing a particular variable on

replacement rates, thus serving as empirical evidence supporting any potential policy modifications. But in our case this doesn't support potential policy modifications meaning that the rise in contribution rates is not ideal for Malawi.

The second simulation relates to changes in the retirement age or the pensionable age and it presents same results as in the OECD (2005d) study. For this work we considered 3 cases; with retirement at the age of 55, 60 and 65. Rising the retirement age further to 65 and even more is highly debated in many countries, mainly in OECD countries. The justification is that since people live longer due to medical improvement, it is natural to require people to retire later, and it is indeed one of most effective ways to tackle the issue of an ageing population (PPI 2003; Turner 2005). By rising the retirement age in Malawi, the person could have a higher replacement rates with a 15% contribution rates and is expected to have a wealthier life upon retirement. The results are consistent with findings in Friedman et al (1996), Hu (2006) and the OECD (2005). This is attributed mainly to the long term horizon of pension fund management and planning, but the problem arises to the issue of average mortality rate in Malawi being 54.14 (figure 14). This means that most retiree will not receive high returns from their pension benefits, when they retire at 50 and unfortunately most retire at that age. This then raises the issue of what is the appropriate measure to deal with the issue of early mortality.

4.4 Results of the Pension Annuity Benefits

A Pension Annuity provides a person with a guaranteed income for the rest of your life upon retirement. The benefits are that the retiree is guaranteed prosperous life when one retires. This however can be affected by poor investment strategies and low annuity rates. This study uses inflation adjusted annuity with interest rate of 20% and inflation rate of 25%. These rates are chosen since they are the current average interest and inflation rates in Malawi. These gives the following results: in portfolios 1 an individual at age 50 accumulates

total pensions that correlate to the findings of the simulated results. Portfolio 1 is represented in table XIV. In the table the expected benefits at age 50 are low with monthly annuities of MK 20,565.15 (USD 55.48) and maximum at age 65 of MK268,908.26 (USD 726.78) when pensions are invested at 100%. Meaning that the only age with higher earning is age 65. Table XVI gives the expected annuity result for portfolio 2. This table performed better. With monthly benefits of MK41,231.64 ($111.44), MK54,782.32 ($148.06), MK290,130.65 ($784.14) and MK568,400.00 ($1,536.22) for ages 50,55,60 and 65 respectively. These results are higher than the low replacement rate at age 50 and 55. This could be attributed to the fact that this portfolio invests in government bonds that are considered riskless. Table XVIII includes results for portfolio 3 in this table annuity incomes for age 50, 55, 60 and 65 are MK228,500.67, MK351,249.90, MK523,444.22 and MK636,332.24 respectively. This portfolio performed better as well due to the fact that the investment is in T bills which are administered by governments and are mostly risk free and have high returns with low risk. The results for portfolio 4 are presented in table 20. This portfolio doesn't provide desirable annuities for early retirement with low values of MK8,986.67 ($24.29) at age 50 and high values at age 65 of MK148,810.15 ($402.19). These low results could be attributed to that fact that the investment is made in the local market and this market is characterised by overall poor economic performance as indicated in chapter 3. For portfolio 5, table XXII records the results. The results are low at age 50 of MK14,099.36 ($38.11) and highest being age 65 with values of MK143,193.66 ($387.01). This portfolio is not ideal for investment since it provides low pension benefits. This can be attributed to low international investment allocation in the economy due economic regulations put in place on global investments. Lastly table XXIV records the annuity results for portfolio 6 which is a naïve portfolio which invest 20% in each portfolio presenting investment diversification. The values are as follows

the lowest being at age 50 is MK30,551.38 ($82.57) and the highest at age 65 is MK658,709.62 ($1,780.30).

4.5 Risk Return Analysis Results

Since aim of this study is to find out if the pension reform is ideal for Malawi. One way of identifying this is by looking at the asset allocation schemes of a policy. Modern portfolio theory(MPT) argues that if we treat single-period returns for various securities as random variables, we can assign them expected values, standard deviations and correlations. Based on these, we can calculate the expected return and volatility (standard deviation) of any portfolio constructed with those securities. We may treat volatility and expected return as proxies for risk and reward. That is a portfolio with high returns and ultimately low risks. Hence for each portfolio it is necessary to study return risk on pension funds. Table XXV provides the statistical properties of all seven portfolios with 44 observations each, representing the maximum amount of years one is expected to work. The first two columns provide estimated portfolio returns and as expected they underperformed. In addition all funds registered a lower volatility. This is not surprising since majority of the portfolios are invested in low risk assets (i.e. bonds, tbill ….) while the market risk is composed of other risky assets like stocks and shares which add more risk due to constant fluctuations. This implies that retirement saving don't provide significant retirement wealth nor need large investments amounts. As a consequence retirement saving need to apply their investment elsewhere like the in pension certificates and capital guaranteed contracts.

More technically, MPT models an asset's return as a normally distributed function with the risk and the mean being the determinants. By looking at the mean and the risk it is hard to determine if the portfolios are normally distributed. We are only able to test normality if the 3^{rd} and 4^{th} moments are calculated. This is presented in table XXV in columns 9 records

the skewness[5] which is a measure of symmetry and 10 records the kurtosis which is a measure that looks at the extent of outliers, where very high and low returns occur. In the table portfolio 2,3,4, 6 and 7 have very high kurtosis. This indicates that the models with high kurtosis will give either very high or very low returns in the long run. While 1 and 5 have low kurtosis indicating investments with very few high and low returns. Financial theory indicates that investors are risk averse and would want to invest in portfolios that provide a sure return. As a result investors would invest in portfolios with low to negative kurtosis that would provide better returns and in our case 1 and 5 are those portfolios however as shown in the annuity table these portfolios do not provide adequate income.

To test for normality the JarqueBera test[6], the Augmented Dickey-Fuller test statistic[7] (ADF test) and the Durbin-Watson stat[8] are calculated. The JB test for normality of the portfolio returns in this thesis uses an α equal to 0.05 the critical value is 5.99. In our results our calculated statistics are higher than the critical value for all portfolios, the study then fails to accept the null hypothesis of normality. This is supported by figure 13 which gives the returns of the distribution and each has a defining distribution.

To earn returns that are less risky or volatile it is important to have returns that are stationary; this will imply that the returns will provide positive earnings in the long run. The ADF test reveals that all portfolios are stationary when considering at 5% significant level

[5]Positive skewness indicates a portfolio is skewed to the right of the mean and negative skewness indicates a portfolio is skewed the left of the mean. Investor and investment managers are often willing to invest in portfolios with negative returns so long as it has positive skewness. Since this implies that the return is clustered to the right of the mean indicating high returns in the long term.

[6]The JarqueBera test is calculated as JB=$JB = \frac{n}{6}[(Skew_{xs})^2 + \frac{(Kurt_{xs})^2}{4}]$. It´s test statistic can be compared with a χ (chi-square) distribution with 2 degrees of freedom.

[7] The augmented Dickey–Fuller test (ADF) is a test for a unit root in a time series sample. The statistic, used in the test, is a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit roots at some level of confidence.

[8]Durbin–Watson statistic is a test statistic used to detect the presence of autocorrelation (a relationship between values separated from each other by a given time lag) in the residuals (prediction errors) from a regression analysis.

what this means is that all returns are derived from the same distribution and can provide positive returns in the long run.

It is important to test if there is existence of autocorrelation in the portfolio returns. This is the case because if returns are auto correlated what it implies is that poor current returns will leads to poor future returns and vice versa. In table XXV, column 15 presents the results of the Durbin-Watson test. In the test we reject the null at 5% confidence level indicating that a portfolio that performs well today is likely to perform well in the long run.

4.5.1 Analysis of Jensen, Sharpe ratio and Treynor ratios

Table XXV shows that, the portfolios have positive Jensen measures, Sharpe and Treynor ratios. However these values are extremely low and somewhat negative in portfolio 5. What this means is that the majority of the portfolios will perform well in the future and provide positive returns. However these returns will be extremely low and will not provide maximum benefits due to their poor ratios/measure. What this implies is that investment managers hold risk free assets, and this leads to portfolios that provide guaranteed returns to the firms while providing low returns to the beneficiaries.

4.7 Problems with the Portfolio Measures

Investors and investment manager´s aim is to earn superior returns. However experience shows that high returns doesn't necessarily mean high pension benefits. This is the case because fully funded pension plans do not provide pension benefits to pensioners alone, but also provide strong externalities that benefit the overall economy (Reisen, 2000).

Pension benefits are aimed at providing income upon retirement. In this thesis we observed that despite investing in high earning returns the overall accumulation wasn't so favourable for other portfolio. This could be due to other risk that the portfolios didn't look at like management risk, mortality risk, inflation risk and interest rate risk. Positive movements of the portfolio returns may affect the schemes investment strategy as well as overestimate

the performance of a portfolio. Contractual savings can improve the mitigation of firms' and banks' financial risks by increasing the availability of long term funds to them. Firms tend to supply more long term debt and banks tend to engage in more maturity transformation. In capital market based financial systems firms tend to overestimate returns to attract more businesses with the aim earning more funds for long term loans and this may lead poor portfolio performance since it doesn't reflect reality of the market.

Performance measures follow a normal distribution function. It assumes that portfolios riskiness and performance can be determined by the standard deviation and mean. This may lead to results that are biased in this study all the portfolios had very low standard deviation and positive returns. For a risk adverse investor this may indicate that the portfolio returns would be positive and guaranteed. But calculating the expected future annuity most of the portfolios performed poorly with low benefits close to $44 a month. The Sharpe ratio hence fails to actually estimate the true level of risk, since it only focuses on a mean variance analysis. The evidence of the Durbin Watson tests suggest that the portfolios are correlated that once a portfolio performs well today it will perform well in the future. But this may lead to underestimation of the standard deviation of returns.

Lastly risk free assets may lead to misleading assumptions and results. The average returns from bond and T bill investments have also been historically lower, than average stock market returns. This allows investment managers to earn high returns. However not all government bonds are risk free. Some government bonds suffer from default risk.

5. Conclusions

This thesis studied the benefits, limitations, operations and expected performance of the pension reform in ensuring retirement income, reducing government pension debt and improving macroeconomic instability. Malawi recently moved from a PAYG pension system to a private mandatory DC. The aim of this is to provide retirement income and improve macroeconomic stability. However this is hampered by macroeconomic fluctuations and the instability of the financial sector which negatively affected pension fund management. The real value of their reserves has been eroded through high inflation rates and the channelling of resources into politically motivated low-yield investment and loans. With this in mind the study indicated the following:

1. The performance of the pension accumulating was only adequate in portfolios that are risk free i.e. bonds and T bills. These portfolios are sure to provide adequate retirement income. However the rest did not do well when it came to pension income. This is because all pension schemes in Malawi suffer from a series of significant weaknesses reflecting deficiencies in their design, in their financing and in their administration. These deficiencies have not only been exposed but aggravated by the economic crisis and the radical measures necessary to face its structural causes.

2. The replacement rates for all portfolios were very low below the increasing the contribution rate did nothing to increase the replacement rates rather increasing the retirement age to 60 or 65 did. This is a problem for Malawi since the average life expectancy is 54.14 years (figure 14). Meaning that when the pension reform was being considered they overestimated the life expectancy, assuming that the Malawi population will live longer in the future. This then would only beneficial to late retiree and detrimental to early ones. Malawi needs to restructure its social protection system to correspond and complement both issues.

3. Risk analysis generated low returns which corresponded to low future income benefits. Despite their positive performance in the end they do not provide adequate income. This is the result of a combination of factors: low contributions due to the failure to adjust the ceiling, high inflation rates, and low-yielding investments guided mostly by political considerations, and an interest rate policy which gave members negative real rates of return over an extended period of time.

4. There was lack of enough information on the market data and pension data. This hence could have affected the pension findings.

5. State policy seems in favour of the reform aims to improve macroeconomic stability. This may bias individual's savings as they may be forced to invest in portfolios that are less diversified and provide low yields i.e. T bills while providing financial resources to governments.

6. The contribution rate is usually fixed but because the final balance and the annuity depend on financial markets there is some uncertainty as to the final level of the pension benefit. In Malawi, a defined contribution system cannot by itself be expected to produce an adequate pension for those with low life-time earnings or for those who have broken periods of employment. If a minimum benefit level is to be achieved, the system would have to be complemented by a government backed minimum pension guarantee.

The main problems affecting the management of occupational pension schemes in general are lack of legislation, regulation and supervision of occupational pension schemes, a lack of secure and profitable investment opportunities which explains why the portfolios of all private pension funds consist only of Treasury Bills and real estate, and a lack of qualified management personnel. If the pension reform is to prosper Macroeconomic stability is a

crucial condition for the functioning of any pension scheme or social security system. Under the circumstances of strong macroeconomic fluctuations and high or volatile inflation rates, it is extremely difficult to maintain the financial stability of a pension system. The study therefore was biased since it was working with returns that were affected by these flaws.

What is required for the Pension funds in Malawi to perform well with the low life expectancy and poor financial markets is to encourage an open ended pension portfolio scheme. So that the pensioners can benefit from better performing and sophisticated financial markets e.g. the international market. Another option can also be investing the local stock market that is managed by the Malawi stock exchange. This would help diversify the pension fund portfolio more and also increase the pension benefits, such that retiring early could be possible.

Financial markets in countries which are macro economically unstable, and have a low level of development typically do not offer adequate investment instruments to protect against such fluctuations. Whether benefits are paid out as pensions, lump-sums or annuities, they are eroded quickly. Without macroeconomic stability, pension systems can neither offer old age income security nor contribute to the mobilization of long-term savings.

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Annex 1: List of Tables

Table I: Pension Fund deficit in Malawi

Financial Year	Amount Approved for Pensions Benefits in the Budget (MK)	Revised amount for pensions benefits In the Budget (MK)	Actual Amount Dispersed for Pension Funding (MK)	Deficit (MK)	Percentage Dispersed %
2004/05	2,106,220,000	2,106,220,000	2,106,220,000	-	100
2005/06	3,208,000,000	3,208,000,000	3,208,000,000	-	100
2006/07	4,763,000,000	4,763,000,000	4,763,000,000	-	100
2007/08	5,500,000,000	5,500,000,000	5,500,000,000	-	100
2008/09	6,450,000,000	5,450,000,000	5,500,000,000	950,000,000	84
2009/10	7,400,000,000	6,900,000,000	6,900,000,000	500,000,000	93
2010/11	7,400,000,000	7,600,000,000	9,721,341,887	- 2,321,341,887	103
2011/2012	12,000,000,000	11,000,000,000	10,446,573,605	1,553,426,395	92
2012/2013	18,698,419,430	15,698,419,430	15,698,419,430	3,000,000,000	84

Data source Ministry of finance Malawi

Table II: Malawi National Statistics

MARKETS	LAST	PREVIOUS	TREND	UNIT	REFERENCE	FREQUENCY
CURRENCY	329	330			Jun-13	Monthly
GDP	**LAST**	**PREVIOUS**	**TREND**	**UNIT**	**REFERENCE**	**FREQUENCY**
GDP	5.7	5.05		USD Billion	Dec-11	Yearly
GDP ANNUAL GROWTH RATE	5	5.8		Percent	Dec-12	Yearly
GDP PER CAPITA	187.42	185.12		USD	Dec-11	Yearly
GDP PER CAPITA PPP	918.3	882.89		USD	Dec-11	Yearly
LABOUR	**LAST**	**PREVIOUS**	**TREND**	**UNIT**	**REFERENCE**	**FREQUENCY**
POPULATION	15.38	14.9		Million	Dec-11	Yearly
UNEMPLOYMENT RATE	3	3		Percent	Dec-11	Yearly
PRICES	**LAST**	**PREVIOUS**	**TREND**	**UNIT**	**REFERENCE**	**FREQUENCY**
CONSUMER PRICE INDEX (CPI)	127.2	129.9		Index Points	Apr-13	Monthly
INFLATION RATE	35.8	36.4		Percent	Apr-13	Monthly
MONEY	**LAST**	**PREVIOUS**	**TREND**	**UNIT**	**REFERENCE**	**FREQUENCY**
INTEREST RATE	25	25		Percent	Jun-13	Monthly
TRADE	**LAST**	**PREVIOUS**	**TREND**	**UNIT**	**REFERENCE**	**FREQUENCY**
BALANCE OF TRADE	-34041.3	-26808.4		million MWK	Sep-12	Monthly
CURRENT ACCOUNT	-119687.5	-136214.8		million MWK	Dec-11	Yearly
CURRENT ACCOUNT TO GDP	-18.5	-18.1		Percent	Dec-12	Yearly
EXPORTS	41926	35918		million MWK	Sep-12	Monthly
IMPORTS	75958.1	62718		million MWK	Sep-12	Monthly
GOVERNMENT	**LAST**	**PREVIOUS**	**TREND**	**UNIT**	**REFERENCE**	**FREQUENCY**
GOVERNMENT BUDGET	0.4	1.9		Percent of GDP	Dec-11	Yearly
GOVERNMENT DEBT TO GDP	16.3	16.9		percent	Dec-11	Yearly
GOVERNMENT SPENDING	48679.5	35466.3		MWK Million	Jun-07	Yearly
CREDIT RATING	15					
BUSINESS	**LAST**	**PREVIOUS**	**TREND**	**UNIT**	**REFERENCE**	**FREQUENCY**
INDUSTRIAL PRODUCTION	25.28	55.19		percent	Dec-11	Monthly

Source: Trading economics and RBM

Table III: Population of Labour Force

Year	labour force Total	Civil Servise labour employees	Percentage of increase in civil service to labour fore	Private and informal sector employees	Percentage increase in private over labour force	Retired population	Pension members total	Percentage of pension members	Retired member with no pension benefit	Percerentage with no pension
1990	3737000	171035	0.12%	3565965	2.43%	583911	52087	8.92%	531824	91.08%
1991	3832000	175383	0.06%	3656617	1.17%	607950	53411	8.79%	554539	91.21%
1992	3879000	177534	0.02%	3701466	0.49%	629452	54066	8.59%	575386	91.41%
1993	3899000	178449	0.02%	3720551	0.47%	648853	54345	8.38%	594508	91.62%
1994	3918000	179319	0.05%	3738681	0.95%	666990	54610	8.19%	612380	91.81%
1995	3957000	181104	0.07%	3775896	1.54%	684586	55153	8.06%	629433	91.94%
1996	4021000	184033	0.10%	3836967	2.02%	701442	56045	7.99%	645397	92.01%
1997	4106000	187923	0.11%	3918077	2.30%	717543	57230	7.98%	660313	92.02%
1998	4205000	192454	0.17%	4012546	3.59%	734031	58610	7.98%	675421	92.02%
1999	4363000	199686	0.93%	4163314	19.30%	752398	60812	8.08%	691586	91.92%
2000	5245561	240079	0.17%	5005482	3.54%	773641	73114	9.45%	700527	90.55%
2001	5440188	248987	0.17%	5191201	3.65%	798349	75826	9.50%	722523	90.50%
2002	5648198	258507	0.18%	5389691	3.72%	826084	78726	9.53%	747358	90.47%
2003	5868583	268593	0.18%	5599990	3.73%	855545	81797	9.56%	773748	90.44%
2004	6097967	279092	0.18%	5818875	3.68%	884847	84995	9.61%	799852	90.39%
2005	6332984	289848	0.14%	6043136	3.01%	912638	88270	9.67%	824368	90.33%
2006	6532976	299001	0.09%	6233975	1.92%	938454	91058	9.70%	847396	90.30%
2007	6664520	305022	0.19%	6359498	3.96%	962748	92891	9.65%	869857	90.35%
2008	6940911	317672	0.13%	6623239	2.71%	986182	84056	8.52%	902126	91.48%
2009	7137848	326685	0.14%	6811163	2.91%	1009810	101793	10.08%	908017	89.92%
2010	7355454	336644	0.14%	7018810	2.86%	1034380	105837	10.23%	928543	89.77%
2011	7575758	346727	-0.52%	7229031	-10.93%	1060066	137505	12.97%	922561	87.03%
2012	6708275	307024	-4.58%	6401250	-95.42%	1084550	148789	13.72%	935761	86.28%

Table IV: Private Pension Funds

Total Pension Funds			
administrator	2011	2010	2009
Nico Life	302	113	108
Old mutual Life	401	154	167
Vanguard Life	52	30	35
Inde Trust	102	90	96
Segredated funds	13	12	12
Other	20	0	0
Total	899	399	218

Source RBM Annual Report 2011

Table V: Private Pension members

Pension members			
administrator	2011	2010	2009
Nico Life	26343	18012	15875
Old mutual Life	44558	27352	26916
Vanguard Life	1791	1127	1173
Inde Trust	15716	15067	14314
Segredated funds	13311	12279	12515
Other	786	0	0
Total	102505	73837	70793

Source RBM Annual Report 2011

Table VI: Private Pension Contributions

Pension contributions MK millions			
administrator	2011	2010	2009
Nico Life	2083.1	1768.9	1191.1
Old mutual Life	3358	2020.2	2048.4
Vanguard Life	65.3	30.4	26.6
Inde Trust	682.7	558.8	443.9
Segredated funds	2394.7	1454.1	1776.5
Other	7	0	0
Total	8590.4	5832.4	5486.5

Source RBM Annual Report 2011

Table VII: Private Pension Assets

Pension Asset MK millions			
administrator	2011	2010	2009
Nico Life	16538.9	18043.7	15126.5
Old mutual Life	17059.7	13412.8	11160.5
Vanguard Life	222	179.2	150.5
Inde Trust	6852.4	6052.2	5434.5
Segredated funds	26986.4	21824.9	20120.9
Other	7	0	0
Total	67666.4	59512.8	51992.9

Source RBM Annual Report 2011

Table VIII: Macroeconomic Returns

Year	Inflation rate	rate of return	Governm ent bond	return on T bills	returns on equity (MK)	returns global investment (MK)	GDP US$ PPP bn
1981	0	2.75	9.3	0	0	0	0
1982	0	2.75	9.7	0	0	0	0
1983	0	2.75	10.3	0	0	0	0
1984	0	2.75	10.6	0	0	0	0
1985	0	2.75	11.5	0	0	0	0
1986	0	2.75	11.5	0	0	0	0
1987	0	2.75	11.5	0	0	90549.30	0
1988	0	2.75	11.5	15.8	0	17440000.00	0
1989	0	2.75	11.5	15.8	0	9290000.00	0
1990	11.857	2.75	11.5	12.9	0	23300000.00	3.935
1991	8.227	2.75	11.5	11.5	0	-28700000.00	4.43
1992	23.236	2.75	12	15.6	0	-7100000.00	4.203
1993	22.77	2.75	20.9	23.5	2014392000.000	8000000.00	4.712
1994	34.657	2.75	23.5	27.7	2714458000.000	24992617.90	4.315
1995	83.148	2.75	38.6	46.3	2645921000.000	5643045.60	5.014
1996	37.733	2.75	42.7	30.8	3078744000.000	15797661.10	5.619
1997	9.137	2.75	39.3	18.3	3449381000.000	14868714.40	6.095
1998	29.779	2.75	39.5	33	3400685000.000	12104230.40	6.23
1999	44.759	2.75	39.5	42.9	5029547000.000	58528206.30	6.545
2000	27.247	2.75	0	39.5	8028999000.000	25999996.40	6.739
2001	17.43	2.75	0	42.4	13175489000.000	19299991.10	6.605
2002	9.586	2.75	0	41.7	23754467000.000	5899999.40	6.826
2003	11.424	2.75	0	39.3	28782933000.000	83151292.60	7.355
2004	15.464	2.75	0	28.6	36549563884.000	129706673.00	8.118
2005	13.904	2.75	0	24.4	41209791708.000	139696707.40	8.268
2006	7.961	2.75	0	19.3	47099914232.000	35561531.60	8.712
2007	8.71	2.75	38.75	13.9	56996678985.000	124388838.70	9.815
2008	8.427	2.75	38	11.3	157106818700.000	195424461.10	10.869
2009	7.41	2.75	38	10.1	213802305760.000	49130854.80	11.976
2010	7.6	2.75	38	10.93	243612590260.000	97010028.40	13.403
2011	7.8	2.75	0	12.15	334319714010.000	92407703.50	13.98
2012	18.6	2.75	0				14.58
Mean	20.2985	2.75	16.53594	18.95742	39573303017	37159132.35	5.57325
Median	13.904	2.75	11.5	15.8	3078744000	15797661.1	5.857
std deviatio	17.494	0	15.57464	14.93739	82294573350	52723849.18	4.474283

Source: IMF, RBM and Malawi stock exchange

Table IX: Average salaries 2011/2012 Financial year

Level	Average salaries 2011/2012 MK	USD Equivalent
Blue Color	15479	44.22571429
Blue Color	17618.04	50.33725714
Blue Color	18499.14	52.85468571
Blue Color	19380.24	55.37211429
Blue Color	21225.6	60.64457143
Blue Color	21756	62.16
Blue Color	25798	73.70857143
Blue Color	27719.34	79.19811429
Blue Color	28407.72	81.16491429
Blue Color	29118	83.19428571
Blue Color	36455.2	104.1577143
Blue Color	37637	107.5342857
Blue Color	38619.36	110.3410286
Blue Color	45541	130.1171429
Blue Color	48157	137.5914286
Blue Color	50338.08	143.8230857
Blue Color	51680.64	147.6589714
Blue Color	53559	153.0257143
Blue Color	61226	174.9314286
Entry Level Graduate	65972	188.4914286
Entry Level Graduate	70802.16	202.2918857
Entry Level Graduate	83896.8	239.7051429
Entry Level Graduate	85994	245.6971429
Entry Level Graduate	98997.36	282.8496
Entry Level Graduate	122908	351.1657143
Entry Level Graduate	161920	462.6285714
Entry Level Graduate	165968	474.1942857
Entry Level Graduate	228808.8	653.7394286
Entry Level Graduate	234529	670.0828571
Entry Level Graduate	251689.2	719.112
Senior Position	296604	847.44
Senior Position	304019	868.6257143
Senior Position	373669	1067.625714
Management	401010.72	1145.744914
Management	455377	1301.077143
Management	1650100	4714.571429
Management	2,750,166	7857.617143
Management	2750168	7857.622857
Management	3850233	11000.66571
Management	3850234	11000.66857
Management	4950300	14143.71429
Management	4950301	14143.71714
Management	6050366	17286.76
Management	6050367	17286.76286
Management	7150433	20429.80857
Management	7150434	20429.81143
Management	8250500	23572.85714
Management	9350566	26715.90286

Source: ministry of Labour

Table XI: Changes in Contribution rate, transaction rates and retirement age

Portifolio 7 changes in contribution, transaction and retirement age

contribution rate				retirement age				Transaction cost		
retirement age	50	50	50	50	55	60	65	50	50	50
contribution rate	0.1	0.15	0.2	0.15	0.15	0.15	0.15	0.15	0.15	0.15
investment strategy	50-50-0-0-0	50-50-0-0-0	50-50-0-0-0	50-50-0-0-0	50-50-0-0-0	50-50-0-0-0	50-50-0-0-0	50-50-0-0-0	50-50-0-0-0	50-50-0-0-0
Transaction cost	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.15
Replacement rates										
mean	1.31%	1.19%	1.19%	1.19%	5.46%	27.29%	22.80%	1.19%	1.19%	1.19%
std dev	0.60%	0.60%	0.60%	0.60%	3.15%	12.06%	15.12%	0.60%	0.60%	0.60%
coefficient of variation	2.18	2.00	2.00	2.00	1.74	2.26	3.4463152	2.00	2.00	2.00

Table XII: Annuity benefits

Retirement age	Pension	Benefits monthly (100%)	USD	Benefits Monthly (60%)	USD
Py50	148075684.1	15,985.50	43.20	9,591.30	25.92
py55	696910957.6	75,234.98	203.34	45,140.99	122.00
Py60	785248108.9	84,771.41	229.11	50,862.85	137.47
Py65	4939212272	533,212.38	1,441.11	319,927.43	864.67

Table XIII: Changes in Contribution rate, transaction rates and retirement age portfolio 1

Portifolio 1 changes in contribution, transaction and retirement age

contribution rate				retirement age				Transaction cost		
retirement age	50	50	50	50	55	60	65	50	50	50
contribution rate	0.1	0.15	0.2	0.15	0.15	0.15	0.15	0.15	0.15	0.15
investment strategy	100-0-0-0-0	100-0-0-0-0	100-0-0-0-0	100-0-0-0-0	100-0-0-0-0	100-0-0-0-0	100-0-0-0-0	100-0-0-0-0	100-0-0-0-0	100-0-0-0-0
Transaction cost	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.15
Replacement rates										
mean	1.26%	1.26%	1.31%	1.26%	7.37%	33.62%	45.78%	1.26%	1.31%	1.31%
std dev	2.72%	2.68%	2.92%	2.68%	13.44%	54.03%	31.79%	2.68%	2.87%	2.87%
coefficient of variation	2.15488884	2.11740966	2.22879758	2.117409658	1.82440428	1.60721408	0.694362886	2.117409658	2.1886358	2.18863578

Table XIV: Annuity benefits portfolio 1

Retirement age	Pension	Benefits monthly (100%)	USD	Benefits Monthly (60%)	USD
Py50	7731495	20,565.15	55.58	12,339.09	33.35
py55	10916234.2	42,518.03	114.91	25,510.82	68.95
Py60	15144566.9	94,674.99	255.88	56,804.99	153.53
Py65	22085115.6	268,908.26	726.78	161,344.96	436.07

Table XV: Changes in Contribution rate, transaction rates and retirement age portfolio 2

Portifolio 2changes in contribution, transaction and retirement age

contribution rate				retirement age				Transaction cost		
retirement age	50	50	50	50	55	60	65	50	50	50
contribution rate	0.1	0.15	0.2	0.15	0.15	0.15	0.15	0.15	0.15	0.15
investment strategy	0-100-0-0-0	0-100-0-0-0	0-100-0-0-0	0-100-0-0-0	0-100-0-0-0	0-100-0-0-0	0-100-0-0-0	0-100-0-0-0	0-100-0-0-0	0-100-0-0-0
Transaction cost	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.15
Replacement rates										
mean	1.31%	1.23%	1.31%	1.23%	7.72%	24.94%	21.84%	1.23%	1.23%	1.23%
std dev	0.42%	0.42%	0.42%	0.42%	2.17%	7.87%	49.95%	0.42%	0.42%	0.42%
coefficient of variation	0.317665146	0.342060597	0.317665146	0.342060597	0.28047014	0.31562007	2.28685185	0.342060597	0.3420606	0.3420606

Table XVI: Annuity benefits portfolio 2

Retirement age	Pension	Benefits monthly (100%)	USD	Benefits Monthly (60%)	USD
Py50	2,719,667.37	41,231.64	111.44	24,738.98	66.86
py55	34,520,578.20	54,782.32	148.06	32,869.39	88.84
Py60	357,773,040.31	290,130.65	784.14	174,078.39	470.48
Py65	986,804,690.20	568,400.00	1,536.22	341,040.00	921.73

Table XVII: Changes in Contribution rate, transaction rates and retirement age portfolio 3

portifolio 3 changes in contribution, transaction and retirement age

contribution rate				retirement age				Transaction cost		
retirement age	50	50	50	50	55	60	65	50	50	50
contribution rate	0.1	0.15	0.2	0.15	0.15	0.15	0.15	0.15	0.15	0.15
investment strategy	0-0-100-0-0	0-0-100-0-0	0-0-100-0-0	0-0-100-0-0	0-0-100-0-0	0-0-100-0-0	0-0-100-0-0	0-0-100-0-0	0-0-100-0-0	0-0-100-0-0
Transaction cost	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.15
Replacement rates										
mean	1.32%	1.32%	1.32%	1.32%	7.83%	35.37%	38.73%	1.32%	1.32%	1.32%
std dev	0.40%	0.40%	0.40%	0.40%	1.47%	10.97%	21.84%	0.40%	0.40%	0.40%
coefficient of variation	0.30405129	0.30405129	0.30405129	0.30405129	0.187706805	0.310223	0.563886	0.30405129	0.304051	0.30405129

Table XVIII: Annuity benefits portfolio 3

Retirement age	Pension	Benefits monthly	USD	Benefits Monthly (60%)	USD
Py50	85905122.55	228,500.67	617.57	137,100.40	370.54
py55	90181187.66	351,249.90	949.32	210,749.94	569.59
Py60	115724856.8	523,444.22	1,414.71	314,066.53	848.83
Py65	134390020.8	636,332.24	1,719.82	381,799.35	1,031.89

Table XIX: Changes in Contribution rate, transaction rates and retirement age Portfolio4

portifolio 4 changes in contribution, transaction and retirement age

contribution rate				retirement age				Transaction cost		
retirement age	50	50	50	50	55	60	65	50	50	50
contribution rate	0.1	0.15	0.2	0.15	0.15	0.15	0.15	0.15	0.15	0.15
investment strategy	0-0-0-100-0	0-0-0-100-0	0-0-0-100-0	0-0-0-100-0	0-0-0-100-0	0-0-0-100-0	0-0-0-100-0	0-0-0-100-0	0-0-0-100-0	0-0-0-100-0
Transaction cost	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.15
Replacement rates										
mean	1.35%	1.35%	1.35%	1.35%	3.64%	35.83%	19.10%	1.35%	1.35%	1.35%
std dev	0.30%	0.30%	0.30%	0.30%	1.02%	10.76%	78.41%	0.30%	0.30%	0.002953944
coefficient of variation	0.218036416	0.218036416	0.218036416	0.218036416	0.280660206	0.300379866	4.1044647	0.218036416	0.21803642	0.218036416

Table XX: Annuity benefits portfolio 4

Retirement age	Pension	Benefits monthly (100%)	USD	Benefits Monthly (60%)	USD
Py50	3,378,550.62	8,986.67	24.29	5,392.00	14.57
py55	5,806,873.08	22,617.40	61.13	13,570.44	36.68
Py60	8,790,479.90	54,952.95	148.52	32,971.77	89.11
Py65	12,221,600.85	148,810.15	402.19	89,286.09	241.31

Table XXI: Changes in Contribution rate, transaction rates and retirement age portfolio 5

portifolio 5 changes in contribution, transaction and retirement age

contribution rate				retirement age				Transaction cost		
retirement age	50	50	50	50	55	60	65	50	50	50
contribution rate	0.1	0.15	0.2	0.15	0.15	0.15	0.15	0.15	0.15	0.15
investment strategy	0-0-0-0-100	0-0-0-0-100	0-0-0-0-100	0-0-0-0-100	0-0-0-0-100	0-0-0-0-100	0-0-0-0-100	0-0-0-0-100	0-0-0-0-100	0-0-0-0-100
Transaction cost	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.15
Replacement rates										
mean	1.28%	1.28%	1.28%	1.28%	7.45%	34.30%	25.37%	1.28%	1.28%	1.28%
std dev	4.01%	25.71%	4.01%	25.71%	21.16%	89.60%	80.23%	25.71%	4.01%	4.01%
coefficient of variation	3.14231737	20.13593547	3.14231737	20.13593547	2.839548698	2.61272089	3.1619790	20.1359355	3.142317367	3.14231737

Table XXII: Annuity benefits portfolio 5

Retirement age	Pension	Benefits monthly (100%)	USD	Benefits Monthly (60%)	USD
Py50	5300673	14,099.36	38.11	8,459.62	22.86
py55	6864578	26,737.09	72.26	16,042.25	43.36
Py60	8727730	54,560.67	147.46	32,736.40	88.48
Py65	11760325	143,193.66	387.01	85,916.19	232.21

Table XXIII: Changes in Contribution rate, transaction rates and retirement age portfolio 6

portifolio 6 changes in contribution, transaction and retirement age

contribution rate				retirement age				Transaction cost		
retirement age	50	50	50	50	55	60	65	50	50	50
contribution rate	0.1	0.15	0.2	0.15	0.15	0.15	0.15	0.15	0.15	0.15
investment strategy	20-20-20-20-20	20-20-20-20-20	20-20-20-20-20	20-20-20-20-20	20-20-20-20-20	20-20-20-20-20	20-20-20-20-20	20-20-20-20-20	20-20-20-20-20	20-20-20-20-20
Transaction cost	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.15
Replacement rates										
mean	1.29%	1.29%	1.29%	1.29%	7.28%	35.27%	45.78%	1.29%	1.29%	1.29%
std dev	0.70%	0.70%	0.70%	0.70%	1.65%	11.48%	55.29%	0.70%	0.70%	0.70%
coefficient of variation	0.543913352	0.218036416	0.543913352	0.543913352	0.226287954	0.325636759	1.207584452	0.218036416	0.543913352	0.543913352

Table XXIV: Annuity benefits portfolio 6

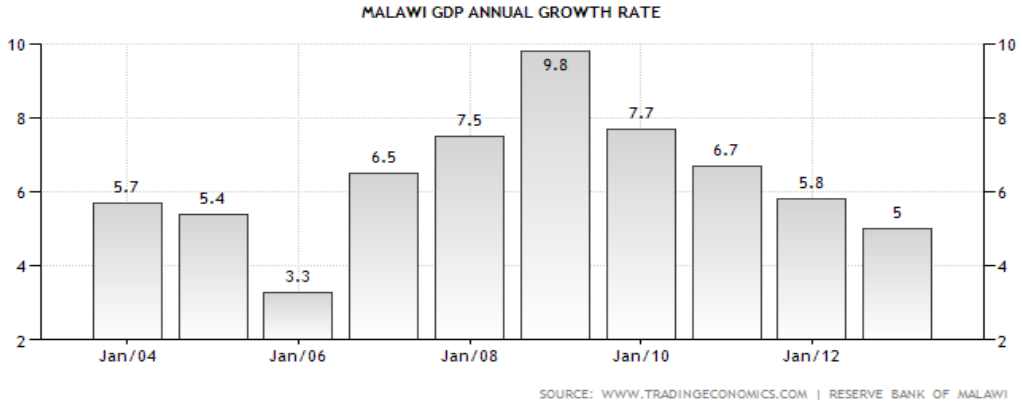
Retirement age	Pension	Benefits monthly (100%)	USD	Benefits Monthly (60%)	USD
Py50	11485832.61	30,551.38	82.57	18,330.83	49.54
py55	31266039.22	121,779.20	329.13	73,067.52	197.48
Py60	46220647.54	288,944.49	780.93	173,366.70	468.56
Py65	54099037.68	658,709.62	1,780.30	395,225.77	1,068.18

Table XXV: Risk analysis of the portfolios

Portfolio	average	std	sharpe	treynor	jensen	median	maximum	minimum	skewness	kurtosis	JB test	p value	ADF test	Durbin-Watson stat	p value
1	0.022727	0.016	0.015	0.005	2E-04	0.017763	0.06007	0.0052485	0.859029	-0.35375	26.03	0.00000	-2.931408	3.39224821	0.0000000
2	0.022727	0.099	1.533	0.396	0.152	1.7E-05	0.506643	9.374E-08	4.551778	19.7981	669.3	1.000000	8.9567682	2.503912299	0.0000000
3	0.022727	0.13	1.363	0.423	0.177	5.15E-06	0.843463	3.9E-08	6.33542	40.8208	2917	1.000000	3.8822791	2.399996667	0.0000000
4	0.023256	0.064	0.691	0.268	0.044	6.5E-06	0.279436	7.364E-08	3.172116	9.71128	156.4	1.000000	11.77472	1.069729318	0.0000000
5	0.023031	0.011	-24.59	-0.283	-0.265	0.020445	0.050021	0.0099576	0.909674	0.13325	21.14	1.000000	3.3214337	1.776234618	0.0003693
6	0.023256	0.091	2.084	0.38	0.189	0.000221	0.580687	2.7E-06	5.824703	35.9007	2233	0.99277	0.8078525	2.071635329	0.0000000
7	0.022727	0.08	3.307	0.393	0.265	0.000874	0.39797	2.96E-05	4.332301	18.1226	556.9	1.000000	5.5722632	2.369280142	0.0000000

Annex 2: Figures

Figure 1: GDP Growth Rate



Source: RBM, Ministry of Labour and NSO

Figure 2: Pension Distribution

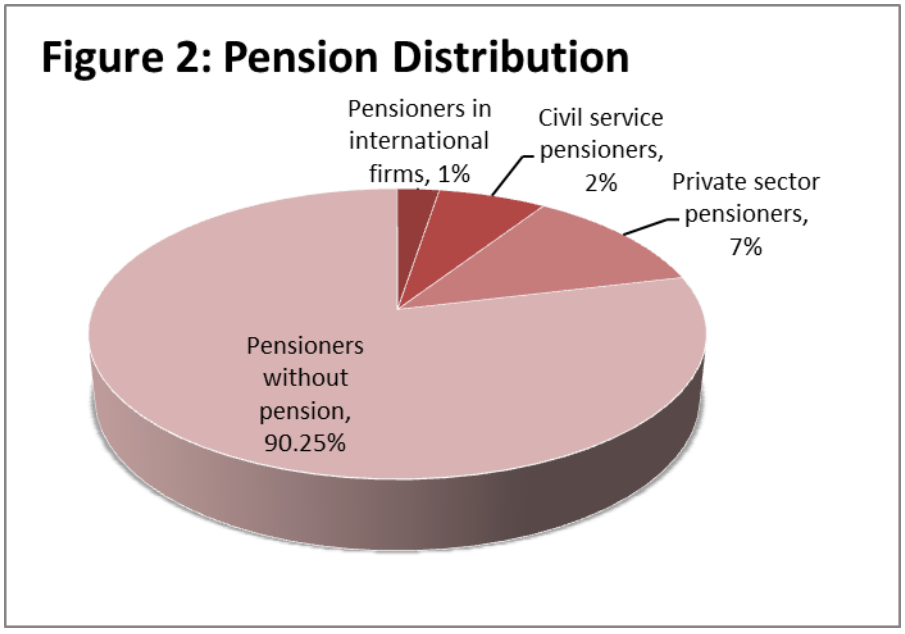


Figure 3: Returns on Investments

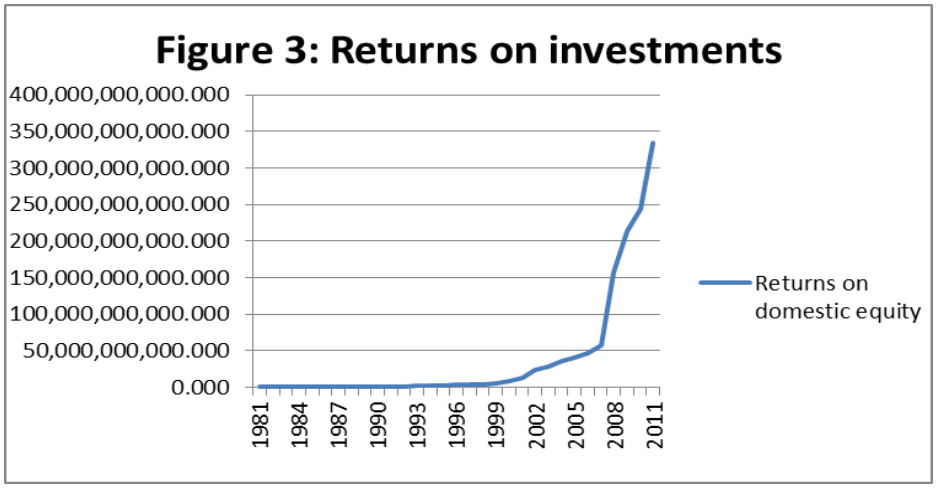


Figure 4: Returns on Global Investments

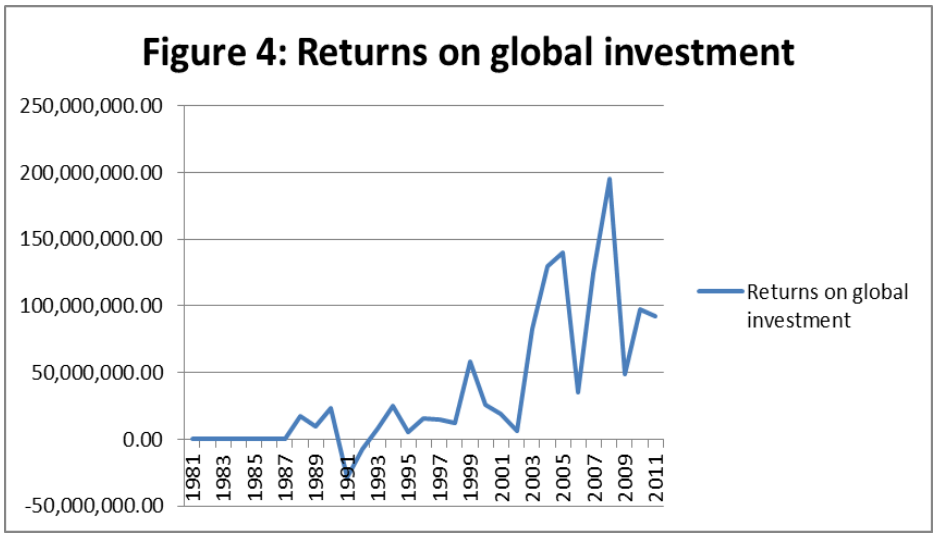
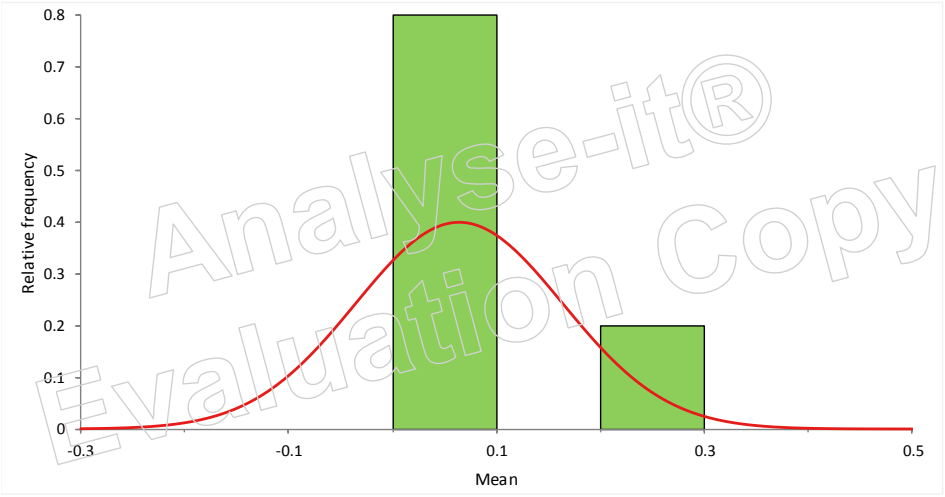


Figure 6: Replacement rate disbursements

Descriptives



Normality

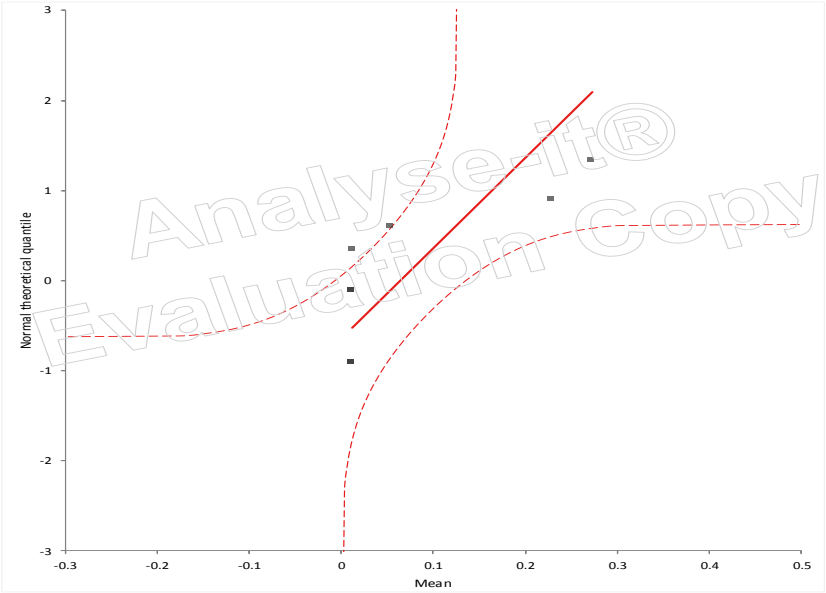


Figure 7: Replacement rate disbursements portfolio 1

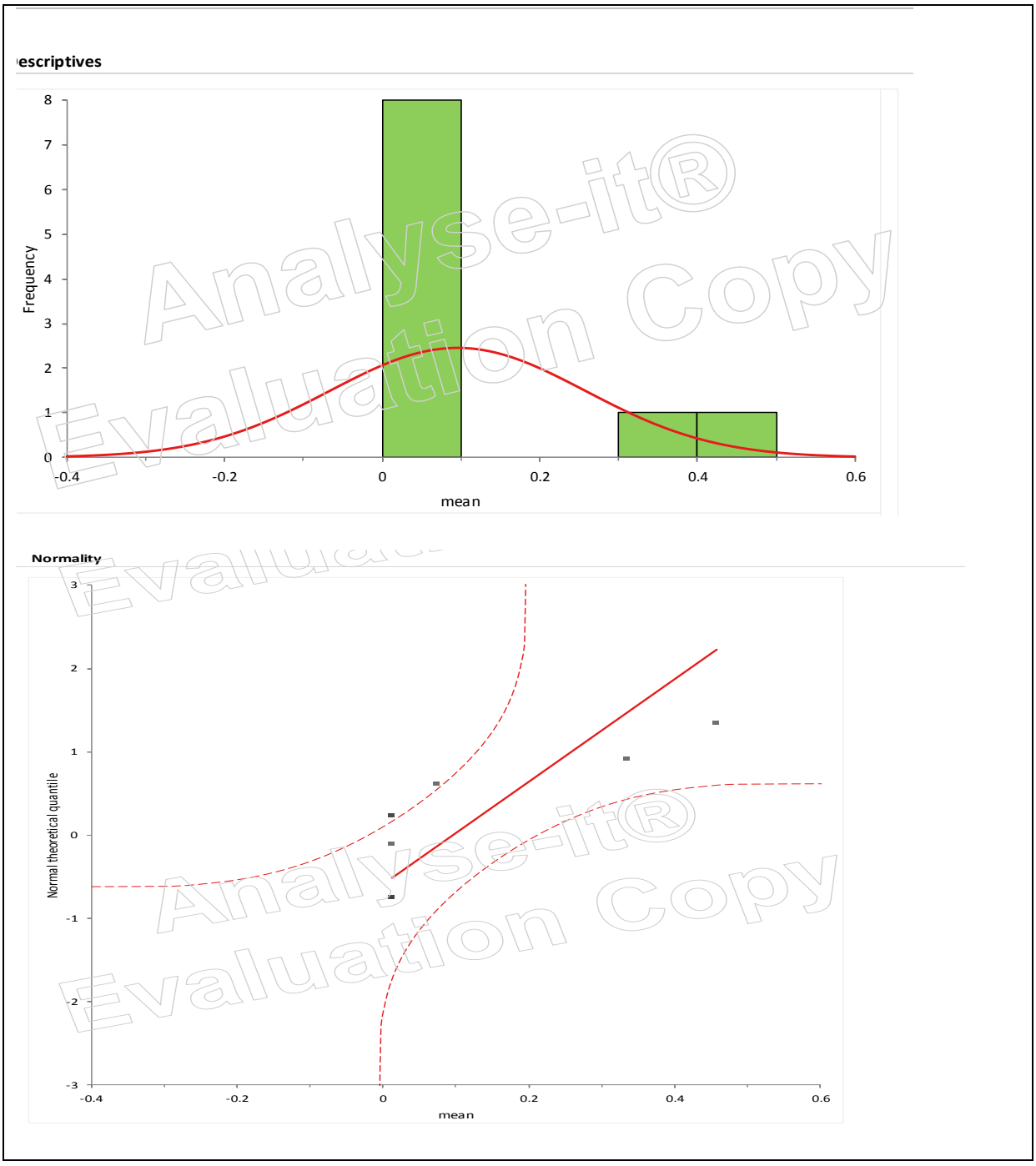


Figure 8: Replacement rate disbursements portfolio 2

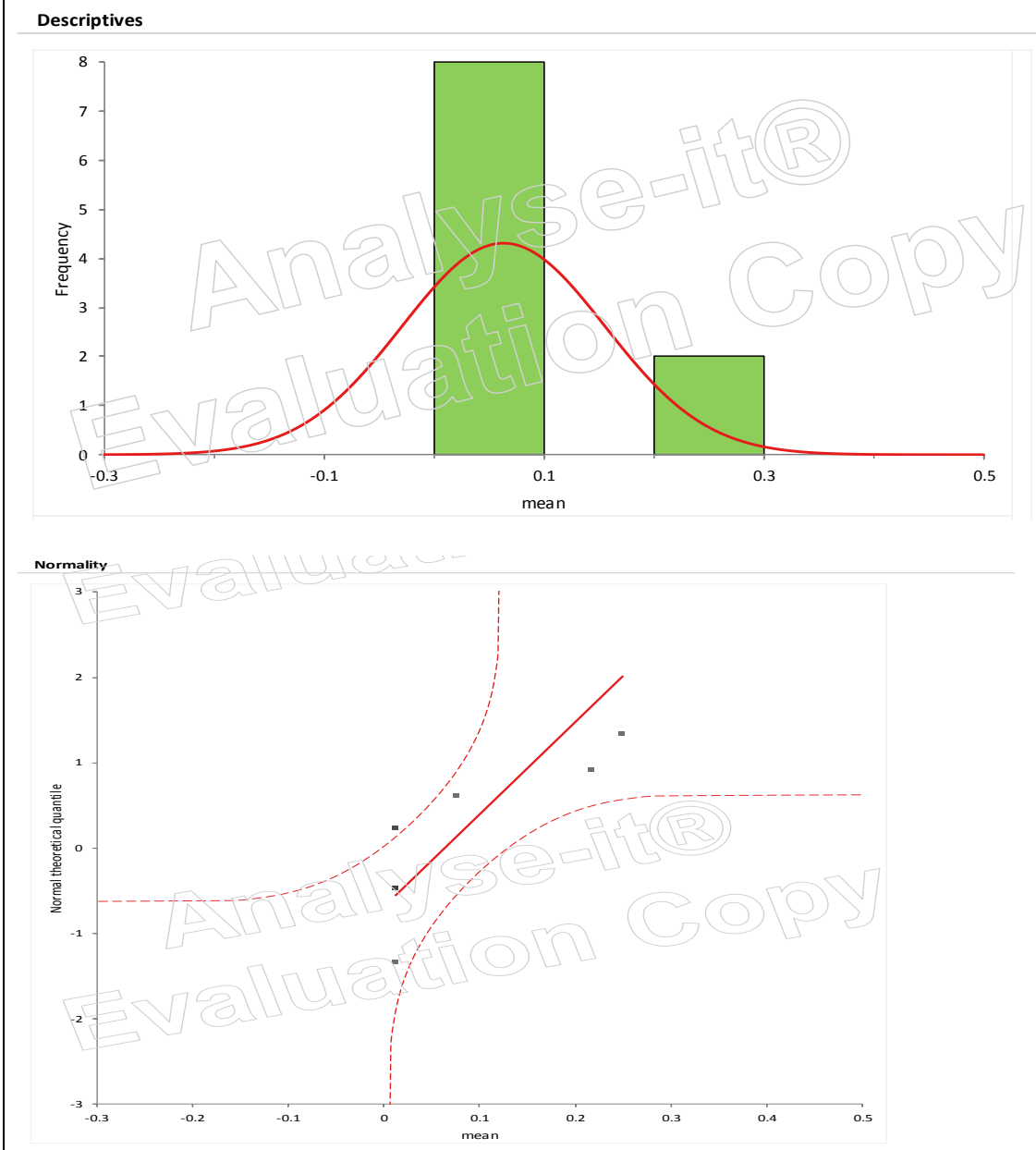


Figure 9: Replacement rate disbursements portfolio 3

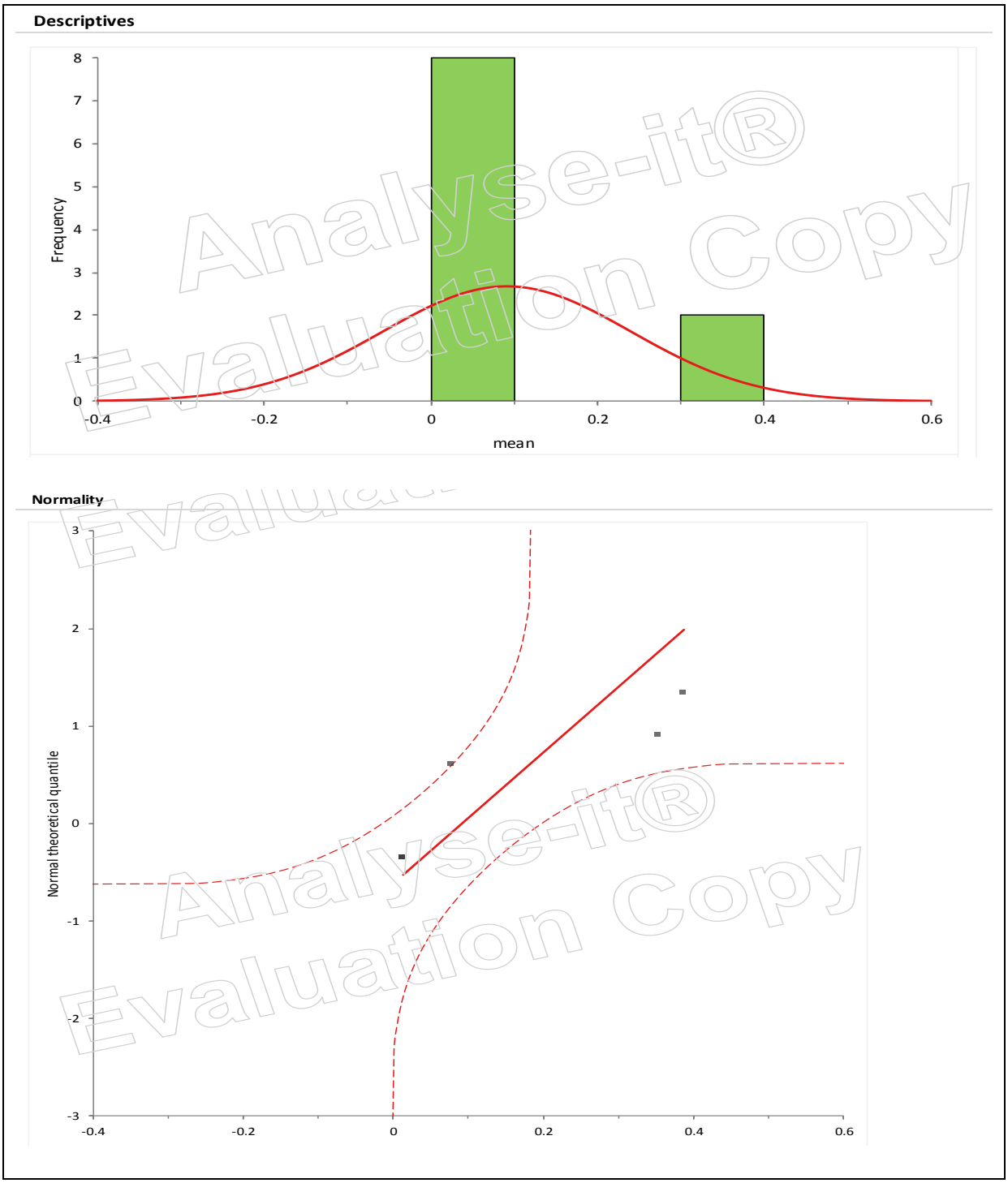


Figure 10: Replacement rate disbursements portfolio 4

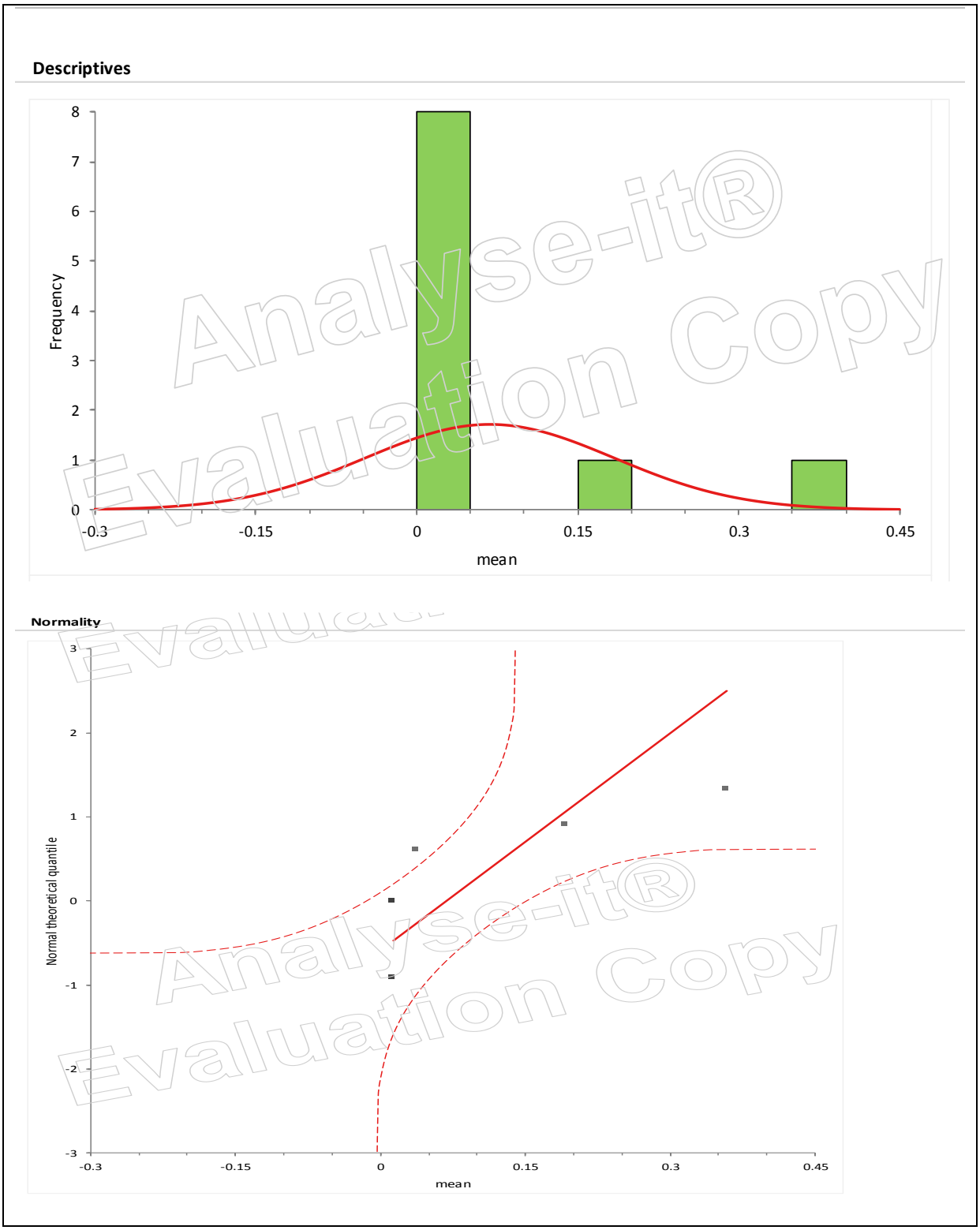


Figure 11: Replacement rate disbursements portfolio 5

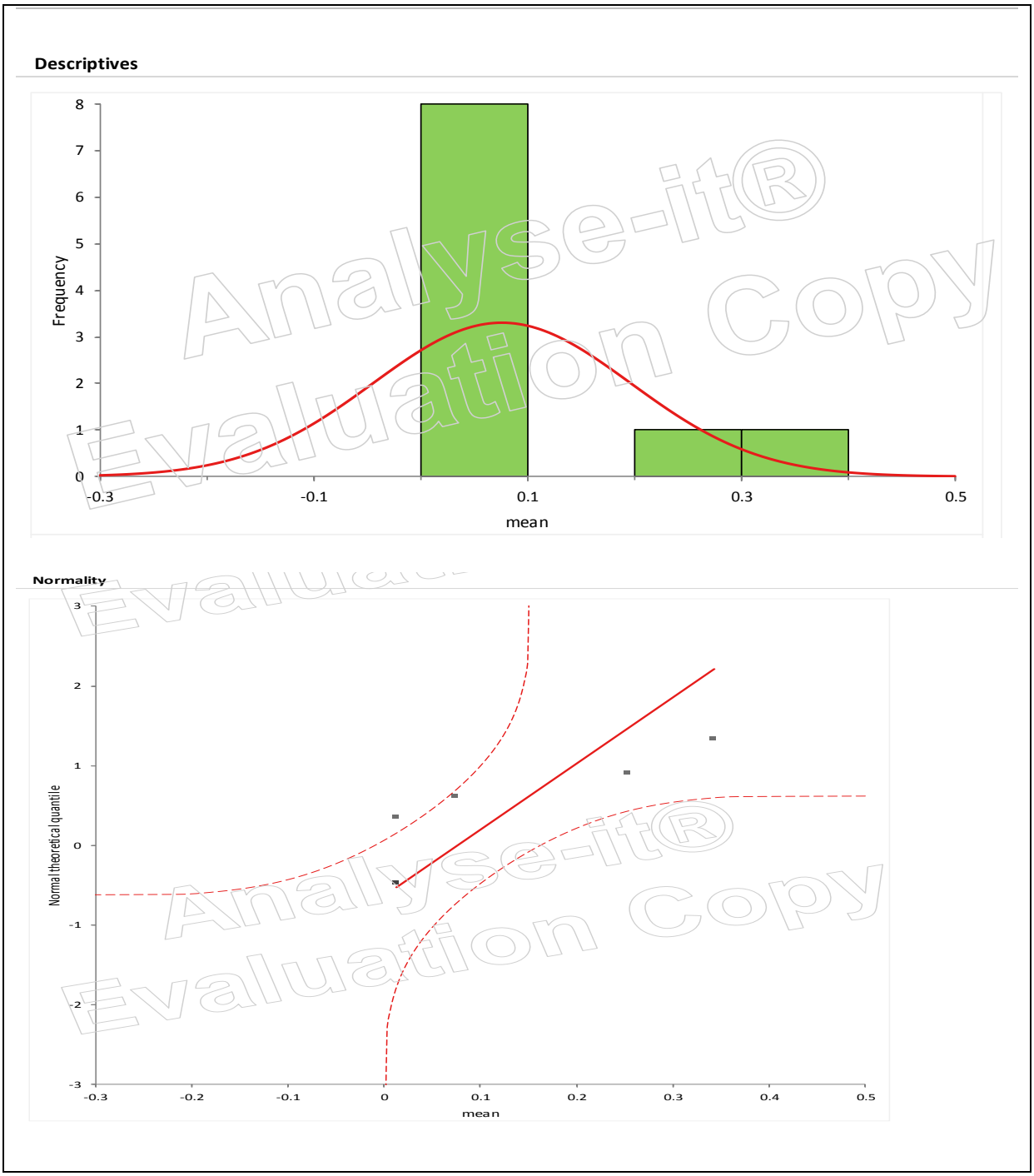


Figure 12: Replacement rate disbursements portfolio 6

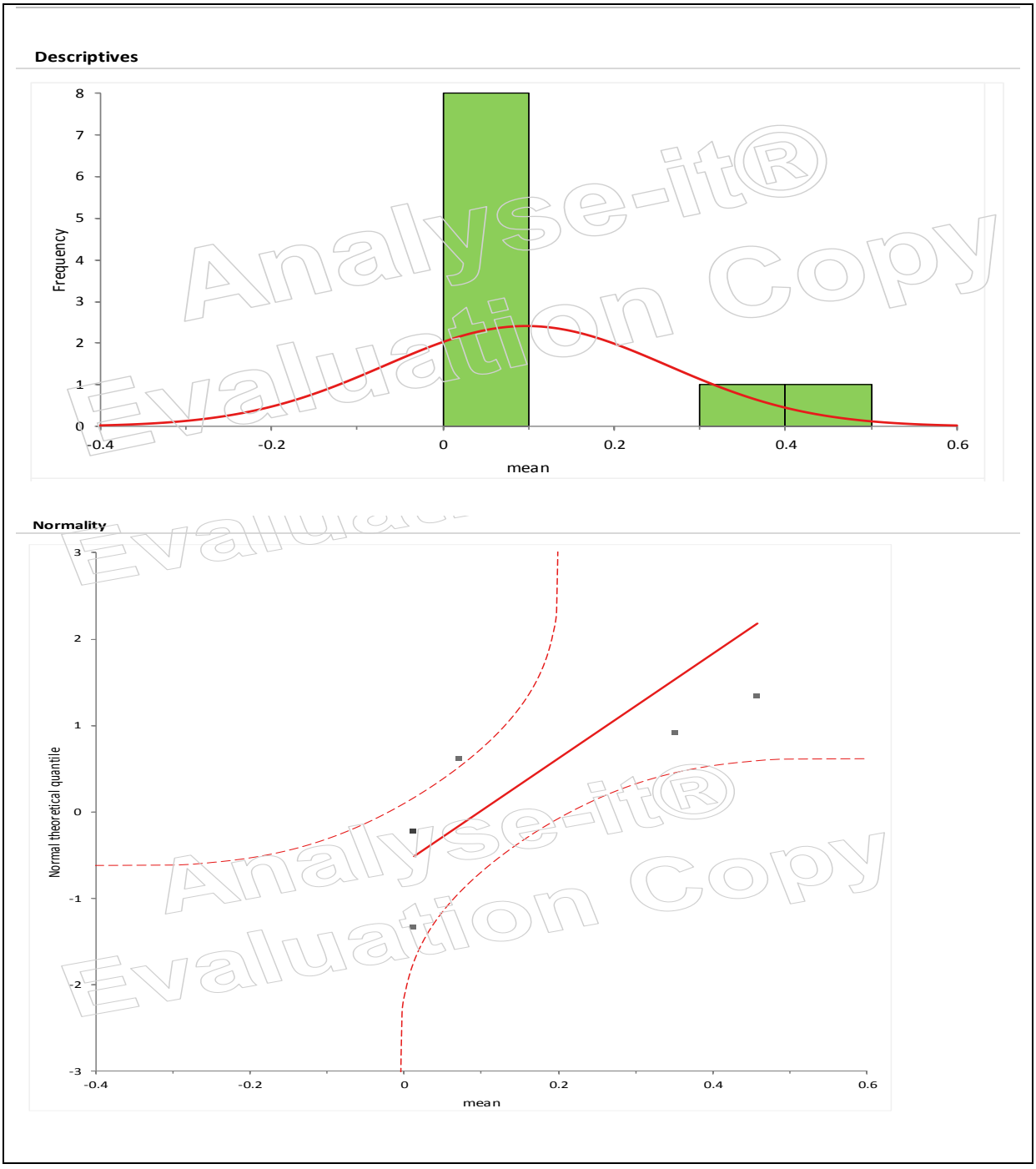
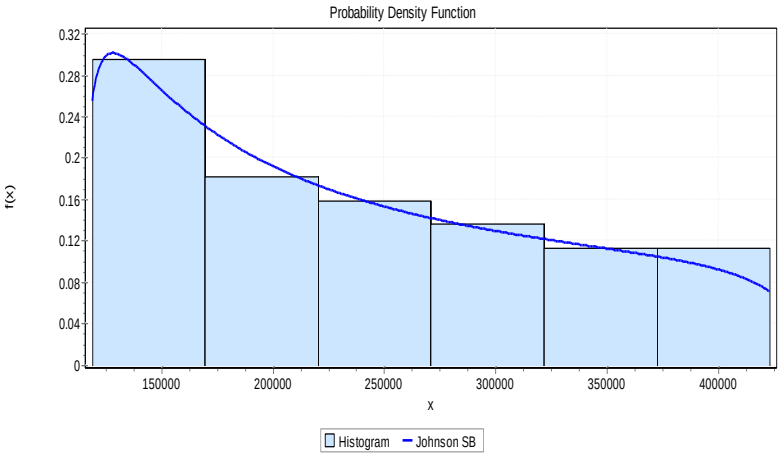


Figure 13: Returns Distribution using Johnson SB

Portfolio 1: Bank deposits

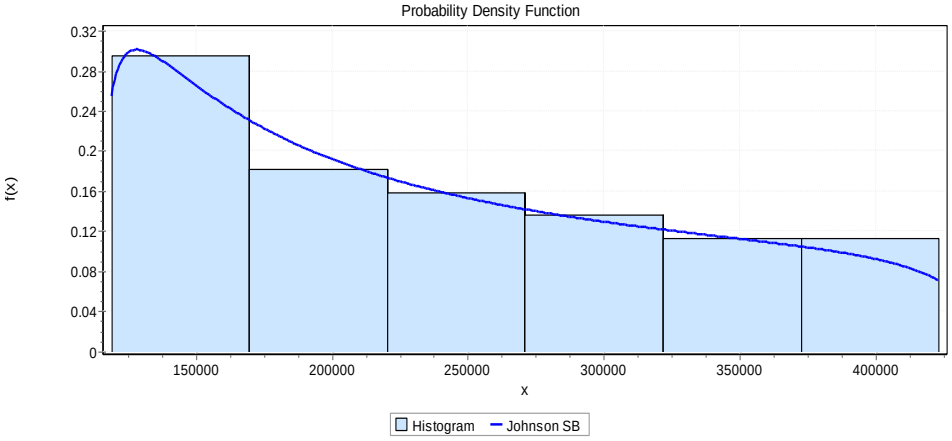


Kolmogorov-Smirnov					
Sample Size					44
Statistic					0.01915
P-Value					1
Rank					1
α	0.2	0.1	0.05	0.02	0.01
Critical Value	0.15796	0.18053	0.20056	0.22426	0.2406
Reject?	No	No	No	No	No

Anderson-Darling					
Sample Size					44
Statistic					0.03226
Rank					2
α	0.2	0.1	0.05	0.02	0.01
Critical Value	1.3749	1.9286	2.5018	3.2892	3.9074
Reject?	No	No	No	No	No

Chi-Squared					
Deg. of freedom					5
Statistic					0.00589
P-Value					1
Rank					1
α	0.2	0.1	0.05	0.02	0.01
Critical Value	7.2893	9.2364	11.07	13.388	15.086
Reject?	No	No	No	No	No

Portfolio 2: Government bonds

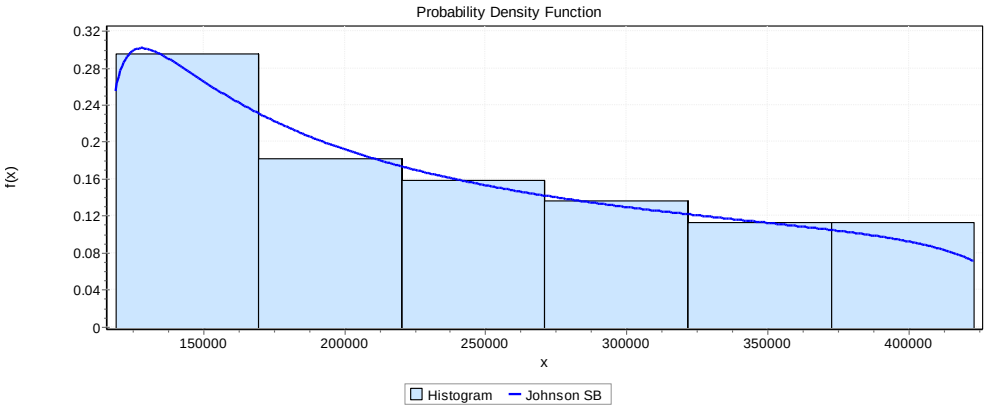


Kolmogorov-Smirnov					
Sample Size					44
Statistic					0.01915
P-Value					1
Rank					1
α	0.2	0.1	0.05	0.02	0.01
Critical Value	0.15796	0.18053	0.20056	0.22426	0.2406
Reject?	No	No	No	No	No

Anderson-Darling					
Sample Size					44
Statistic					0.03226
Rank					2
α	0.2	0.1	0.05	0.02	0.01
Critical Value	1.3749	1.9286	2.5018	3.2892	3.9074
Reject?	No	No	No	No	No

Chi-Squared					
Deg. of freedom					5
Statistic					0.00589
P-Value					1
Rank					1
α	0.2	0.1	0.05	0.02	0.01
Critical Value	7.2893	9.2364	11.07	13.388	15.086
Reject?	No	No	No	No	No

Portfolio 3: T bills

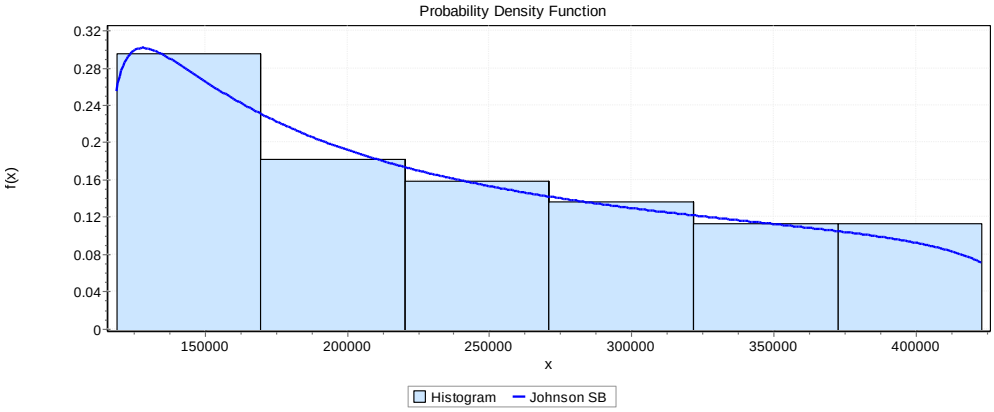


Kolmogorov-Smirnov					
Sample Size					44
Statistic					0.01915
P-Value					1
Rank					1
α	0.2	0.1	0.05	0.02	0.01
Critical Value	0.15796	0.18053	0.20056	0.22426	0.2406
Reject?	No	No	No	No	No

Anderson-Darling					
Sample Size					44
Statistic					0.03226
Rank					2
α	0.2	0.1	0.05	0.02	0.01
Critical Value	1.3749	1.9286	2.5018	3.2892	3.9074
Reject?	No	No	No	No	No

Chi-Squared					
Deg. of freedom					5
Statistic					0.00589
P-Value					1
Rank					1
α	0.2	0.1	0.05	0.02	0.01
Critical Value	7.2893	9.2364	11.07	13.388	15.086
Reject?	No	No	No	No	No

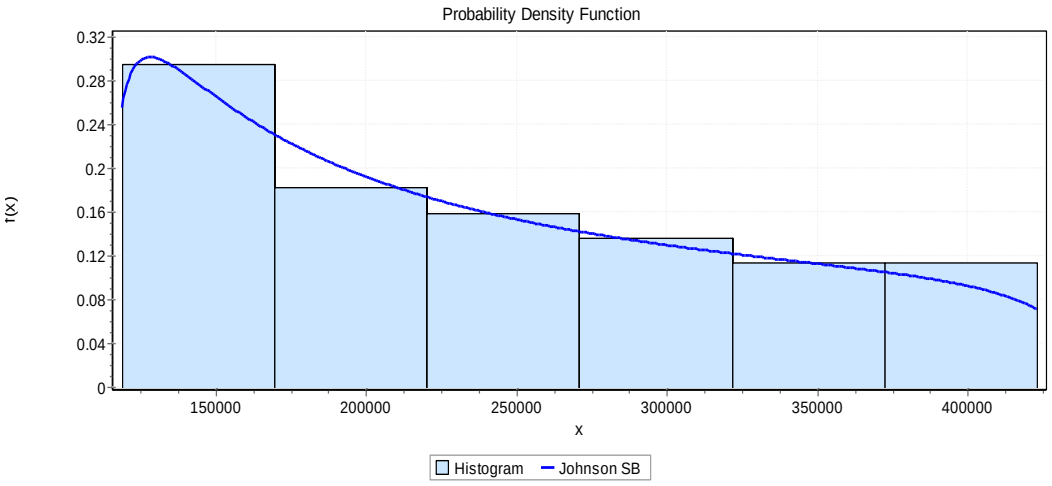
Portfolio 4: Domestic Equity



Kolmogorov-Smirnov						Anderson-Darling					
Sample Size					44	Sample Size					44
Statistic					0.01915	Statistic					0.03226
P-Value					1	Rank					2
Rank					1	α	0.2	0.1	0.05	0.02	0.01
α	0.2	0.1	0.05	0.02	0.01	Critical Value	1.3749	1.9286	2.5018	3.2892	3.9074
Critical Value	0.15796	0.18053	0.20056	0.22426	0.2406	Reject?	No	No	No	No	No
Reject?	No	No	No	No	No						

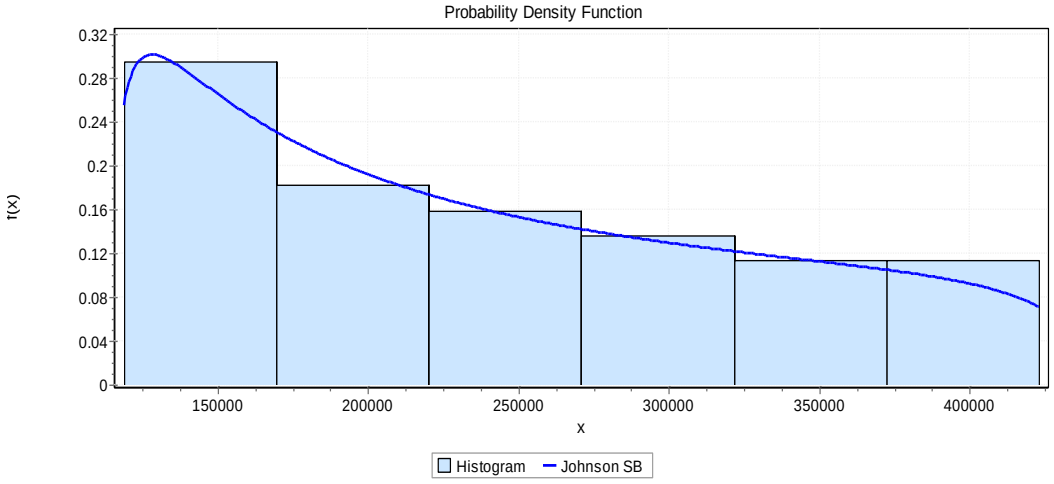
Chi-Squared					
Deg. of freedom					5
Statistic					0.00589
P-Value					1
Rank					1
α	0.2	0.1	0.05	0.02	0.01
Critical Value	7.2893	9.2364	11.07	13.388	15.086
Reject?	No	No	No	No	No

Portfolio 5: Global Investments



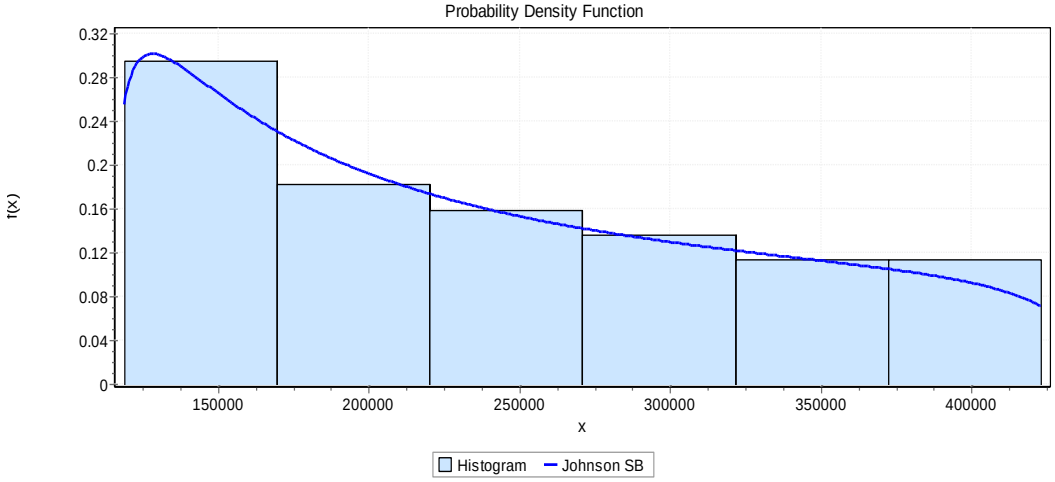
Kolmogorov-Smirnov						Anderson-Darling					
Sample Size					44	Sample Size					44
Statistic					0.01915	Statistic					0.03226
P-Value					1	Rank					2
Rank					1	α	0.2	0.1	0.05	0.02	0.01
α	0.2	0.1	0.05	0.02	0.01	Critical Value	1.3749	1.9286	2.5018	3.2892	3.9074
Critical Value	0.15796	0.18053	0.20056	0.22426	0.2406	Reject?	No	No	No	No	No
Reject?	No	No	No	No	No						
Chi-Squared											
Deg. of freedom					5						
Statistic					0.00589						
P-Value					1						
Rank					1						
α	0.2	0.1	0.05	0.02	0.01						
Critical Value	7.2893	9.2364	11.07	13.388	15.086						
Reject?	No	No	No	No	No						

Portfolio 6: Naive Portfolio



Kolmogorov-Smirnov						Anderson-Darling					
Sample Size					44	Sample Size					44
Statistic					0.01915	Statistic					0.03226
P-Value					1	Rank					2
Rank					1	α	0.2	0.1	0.05	0.02	0.01
α	0.2	0.1	0.05	0.02	0.01	Critical Value	1.3749	1.9286	2.5018	3.2892	3.9074
Critical Value	0.15796	0.18053	0.20056	0.22426	0.2406	Reject?	No	No	No	No	No
Reject?	No	No	No	No	No						
Chi-Squared											
Deg. of freedom					5						
Statistic					0.00589						
P-Value					1						
Rank					1						
α	0.2	0.1	0.05	0.02	0.01						
Critical Value	7.2893	9.2364	11.07	13.388	15.086						
Reject?	No	No	No	No	No						

Portfolio 7: 50-50-0-0-0

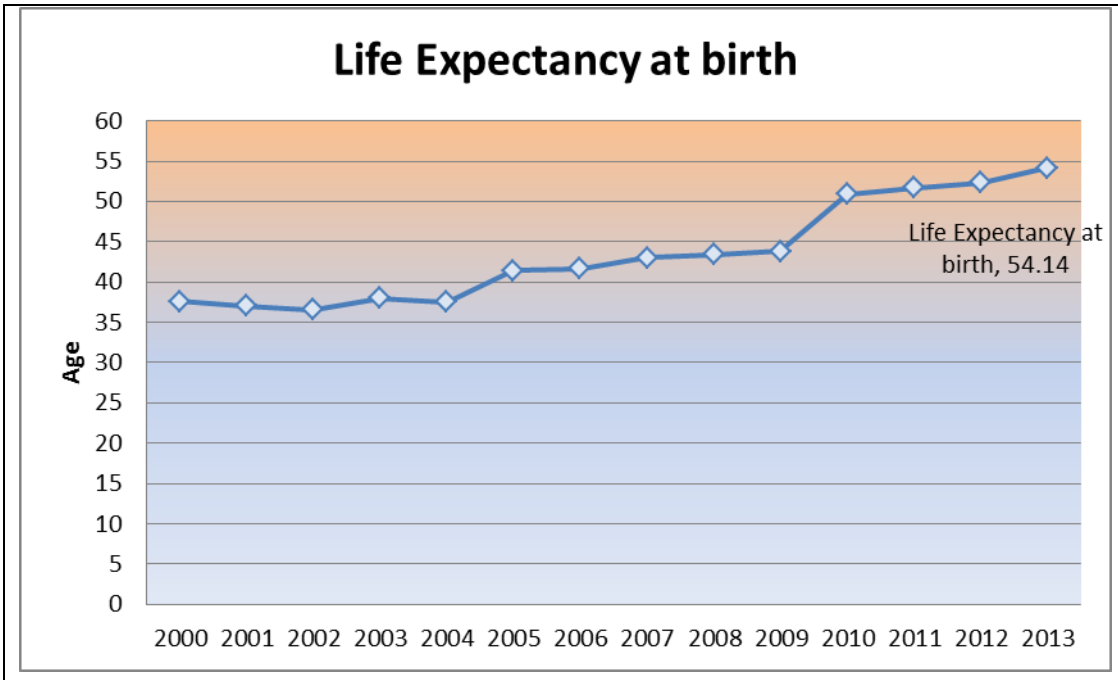


Kolmogorov-Smirnov					
Sample Size					44
Statistic					0.01915
P-Value					1
Rank					1
α	0.2	0.1	0.05	0.02	0.01
Critical Value	0.15796	0.18053	0.20056	0.22426	0.2406
Reject?	No	No	No	No	No

Anderson-Darling					
Sample Size					44
Statistic					0.03226
Rank					2
α	0.2	0.1	0.05	0.02	0.01
Critical Value	1.3749	1.9286	2.5018	3.2892	3.9074
Reject?	No	No	No	No	No

Chi-Squared					
Deg. of freedom					5
Statistic					0.00589
P-Value					1
Rank					1
α	0.2	0.1	0.05	0.02	0.01
Critical Value	7.2893	9.2364	11.07	13.388	15.086
Reject?	No	No	No	No	No

Figure 14: Life expectancy at Birth



2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
37.58	37.08	36.59	37.98	37.48	41.43	41.7	42.98	43.45	43.82	50.92	51.7	52.31	54.14

Source: Malawi National Statistics Office (NSO)

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