PRICING A POST-RETIREMENT MEDICAL INSURANCE PRODUCT

NDUBAI JACKLINE MWENDWA

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the Research Proposal contains no material previously published or written by another person except where due reference is made in the Research Proposal itself.

NJUBAI JACKLINE MWIENAKIA ..... [*Name of Candidate*]

..... [*Signature*]

27/11/2017 ..... [*Date*]

This Research Proposal has been submitted for examination with my approval as the Supervisor.

GEORGE ODERA ..... [*Name of Supervisor*]

..... [*Signature*]

27/11/2017 ..... [*Date*]

Strathmore Institute of Mathematical Sciences

Strathmore University

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ABSTRACT

Privately purchased medical insurance is very expensive for retirees. In Kenya, some companies even put an age cap restricting on insurance. A post-retirement medical insurance product helps in planning for medical expenses after retirement and ensures that such expensive costs are avoided. This paper reports on the pricing procedure undertaken for the new upcoming product as well as the sensitivity of the profit margin to the various variables used in the model. Profit testing of the product was run on one of the insurance companies in Kenya. The pure premium method is used to obtain a premium based on claims experience, instead of guessing a 'reasonable premium' to be used in the profit testing model. Data was obtained from an insurance company and constituted of their medical claims experience as well as their loss ratios over 2013-16. Premiums were calculated and a mispricing established in a case where profit testing was not incorporated. The study also revealed that the fund charge, inflation and the investment rate were significant in the pricing process and had a significant impact on the profit margin. Every insurance company's goal is to make profit. Hence, even if the company strives to make post-retirement healthcare affordable, the company should ensure that the pricing model constructed results in a reasonably profitable premium. The incorporation of profit testing reduces the likelihood of a mispricing scenario. Furthermore, it is important that the inflation rate, investment rate and fund charge actual values are as close to the expected values as is possible.

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LIST OF ABBREVIATIONS

NHIF- National Health Insurance Fund

PRM- Post-retirement medical

CII- Critical illness insurance

LTCI- Long-term care insurance

RBA- Retirements Benefits Authority

PMI- Private Medical Insurance

CHAPTER ONE: INTRODUCTION

1.1 Background

Retirement has been seen to be associated with a loss of employer-provided health insurance (Karoly and Rogowski, 1994). Employees have always been able to enjoy employer sponsored medical insurance coverage. Consequently, most of those who enjoy this coverage do not have a post-retirement health savings plan. Privately purchased medical insurance is very expensive for individuals of retirement age (Karoly and Rogowski, 1994) due to the high premiums charged at old age due to a higher likelihood of falling ill. Furthermore, in Kenya most providers put an age cap on the medical insurance policy they offer resulting to a complete lack of private medical cover. What then happens after retirement?

In Kenya, the state offers a provident fund through the National Social Security Fund (NSSF). However, these retirement savings accumulated while working is in most cases inadequate for daily living. Hence with an additional burden of medical costs this leaves the retiree with a bare minimum to survive on. In addition, an individual could use the state medical insurance, that is, the National Health Insurance Fund (NHIF) that has an affordable premium that is independent of age. The key problem however is that this individual would not be able to enjoy the perceived good quality private medical care as they once used to enjoy from their employer sponsored coverage. In this regard, a post-retirement medical product could address this gap.

A post-retirement medical (PRM) plan is any arrangement under which an employer meets all or part of the cost of private medical care for medical conditions, or insurance in respect of such care, for retired employees and/or directors and their dependants (Financial Accounting Standards Board, 1990). It operates as a self-insured medical fund where contributions are made into the PRM scheme over an extended but specified period of time. The scheme basically works such that an individual contributes a certain rate into the scheme during their employment period so as to be able to receive medical insurance after retirement, without having to pay the expensive premiums required when one is older. PRM schemes usually do not provide once-off lump sum payments on diagnosis of a critical illness or payments to serve as income during periods of sickness. The most cost-efficient PRM schemes

are pooled. This means that the risks are shared across the entire membership and not determined individually.

The post-retirement medical benefits scheme is not a new area. It was first offered in the 1940s by insurance companies for their employees and became widespread in the 1960s (Scofea, 1994). They employed a pay as you go approach and it was designed as a defined benefits scheme. However, due to healthcare costs rising faster than overall cost of living (Cao, Ewing, and Thompson, 2012), new regulatory requirements and increasing retirees due to increased life expectancy that are a consequence of better medical care, employers ended up either eliminating or changing the plan and shifting the costs to the employees (changing to a defined contribution scheme). Although PRM schemes are not uncommon globally, in Kenya they're quite new. The first PRM scheme was established in 2000 and today provides comprehensive medical cover to over 5,000 retirees, with the number growing daily (Alexander Forbes, 2015). There are also a few more products that were offered in the year 2016 by APA insurance, AAR insurance and Alexander Forbes.

The pricing and profitability of a good insurance product depends greatly on some key factors such as the investment return, shareholders expected return, expense rate (inflation), commission rate, surrender and contingent benefits (Owusu, Appiah, Omari-Sasu, and Berimah, 2016), as well as customer need. In the case of a PRM scheme, medical expenses inflation rate being higher than the rise of medical costs is of huge significance in the pricing process.

Most, if not all, profit testing models used for pricing disregard reactions of the management of insurance companies to a changing world (Valkenburg, 1996). The ideal model is one that incorporates all the parameters in a particular balance to increase profit, provide high shareholder rate, high commission to motivate agents, reduce expense while not affecting the smooth running of the company and at the same time having a good amount of funds to pay all claims promptly (Owusu et.al. 2016). Therefore, a stochastic profit-testing model that will factor in the above aspects and, changes such as inflation rate is needed for use in pricing of the PRM product.

The PRM product is a new product in the Kenyan market. This presents opportunities in ways one can differentiate the product such that consumers have a

variety of options to choose from. This paper therefore focuses on the pricing of this PRM product as well as ensures that the premium is profitable for the company offering it.

1.2 Research Objectives

1. To construct a pricing model that will be used in determining the premium to be charged for a post-retirement health product that will ensure profitability.
2. To determine the sensitivity of the profits based on changes in the variables used in the model.

1.3 Research Questions

1. How much should a member of the scheme contribute presently for a post-retirement medical benefit that will ensure profitability for the company?
2. What is the impact on the company's profits of changes in the variables?

1.4 Problem Statement

Research done by the Retirement Benefits Authority (RBA), revealed that medical bills is one of the key expense items for retirees but they are usually not well prepared for it. According to the Retirement Health Care Costs Data report (2015), an average couple retiring will consume two thirds of their lifetime Social Security benefits on total health care costs. Moreover, due to the age cap put for most private medical insurance schemes, these retirees are not able to access private medical insurance.

In previous models for profit testing, the traditional approach was used for pricing. This approach does not explicitly allow for profit or for yield curves (Dickson, Hardy and Waters, 2013). In addition, Owusu et.al. (2016) found that this approach does not depict cash flows over the course of the contract resulting to a capital requirement that was not explained. Moreover, modern management requires that capital be tracked in terms of the return on the capital and the timing of this return. Therefore, this led to the modern technique of profit testing that is widely used due to its capability of incorporating various factors. This ensures that sensitivity analysis can be done on the existing assumptions and hence profitability assessed and improved accordingly.

There are very few players in the insurance industry that engage in post-retirement

medical insurance business. They include APA, Alexander Forbes, AAR and Aon. As such, the task of pricing and reserving for private PRM insurance contracts for introduction into the Kenyan market is made difficult due to a lack of historical experience, adequate data and consensus on appropriate modelling methodology and assumptions (Cherutich, 2013).

Therefore, the purpose of this paper is to construct a pricing model for the PRM product using the modern profit testing models in the Kenyan set-up and, hence ensure that the premium charged satisfies the company's profit's criterion.

1.5 Motivation and Justification of the Research

There is scarce research on the provision of PRM benefits in African countries. More particularly, research has not been done on a PRM insurance product that works as a savings fund. Hence, very little is known on how efficient and profitable this product is in Kenya and even in other continents. This paper seeks to provide more empirical research on the introduction of PRM insurance as well as its efficiency in the Kenyan set-up.

The insurance industry is a booming industry in Kenya with new products coming up rapidly due to the untapped prospective markets. Due to the fact that the insurance industry is still a developing industry, the regulations are still very much evolving to cater for different emerging provisions in the insurance industry. The PRM insurance provision has not yet been rigorously regulated as of now since the product just came into play significantly in 2016. The only regulations are those as at 9th June 2016 by the Retirement Benefits Act, which basically legalizes the additional contribution of funds with the aim of accumulating a PRM fund, provided that the additional funds are segregated and invested as per the investment policy of the fund for this purpose. Due to very little regulation in this area, then insurance companies have a chance of trying out many things with the PRM benefit.

1.6 Significance of the Study

This project aims to solve the social problem of health care after retirement. More specifically to come up with a product that will in its main aim provide medical insurance for retirees. Therefore, this project will benefit retirees in the future, as it will work in such a way that an individual saves while working in order to accumulate their post-retirement medical fund.

The Retirement Benefits Authority will also benefit from this paper as it aims to construct a pricing model that best suits the Kenyan profile. This project will provide a pricing model to use for a post-retirement medical (PRM) product in the Kenyan setting that ensures that members of the scheme receive benefits as promised. Hence the RBA can better regulate this area of provision regarding capital requirements as well as pricing methods.

Furthermore, insurance companies and pension schemes can also benefit from this study as they embark on designing this new currently trending PRM product. Since this project aims to construct a model that will ensure profitability and affordability, then these companies will benefit from this research project significantly.

This research project also aims to assist the state. Currently, the state only offers health benefits through NHIF. They lack a benefit specially designed for retirees since the premiums they charge are standard, regardless of age. The retirement age in Kenya as stated by the state is 60 years. Hence, this demands for premium rates differentiation taking age into account due to the higher morbidity rates experienced by older people.

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

An insurance contract is financial agreement between an insurance company and the policyholder where the company agrees to pay specified benefits and the policyholder agrees to pay premiums to secure these benefits (Dickson, Hardy and Waters, 2013). A premium is the payment made by a policyholder for complete or partial insurance cover against a risk (Dickson, 2016), where an insurance contract exists. To determine premiums a pricing procedure is followed. Pricing refers to the process by which acceptable office premiums are established (Smart, 1977).

We have looked at the background of this study as with regards to previous researches and established the research gap to be researched on this paper, research objectives and the significance of this study. In this paper, what is being priced is this premium as defined above for the post-retirement medical benefit. In actuarial practice, one of the most vital duties is the pricing of a product. This is because the marketability, competitiveness, profitability and sustainability of the product heavily rely on the price of the product. In a report by Wharton University (2006), it says, "There is no right price of insurance: there is simply the ***transacted market price*** which is high enough to bring forth sellers and low enough to induce buyers." But how is this transacted market price calculated?

Simply stated, a post-retirement medical insurance policy is basically a policy where the policyholder is promised health insurance coverage on retiring; in return for premiums paid over their working lifetime or as a single lump sum premium. This product is unique because it involves contributing premiums for an agreed period of time, say a minimum of 5 years, in order to receive health insurance coverage on survival to the end of the agreed term or to receive a death benefit on death after the agreed term of saving. It could also have a maximum period of cover after retirement, say 20 years. Hence, it has a long-term life insurance aspect and a savings aspect that is geared towards accumulating a medical insurance fund. Clearly, a more sophisticated approach will be needed to price and assess the profitability of this product (Owusu et.al. 2016). This is where profit testing comes in.

Profit testing is the process of assessing the profitability of an insurance contract in advance of being written (Richard, 2006). By profitability what is meant is the

conceptual definition of 'profit' and the measurement of that profit (Smart, 1977). Insurance profit testing constitutes a rigorous approach that looks at various relevant considerations before a new product is priced. This includes how stakeholders are properly rewarded for the risks they take. Profit testing is therefore used as an assessment as well as a pricing tool. The main factors that impact on profit testing are mortality, morbidity, investment earning, inflation, expenses and persistence (Owusu et.al. 2016).

2.1 Theoretical Literature

2.1.1 The Pure risk premium

A premium calculation principle is a rule that assigns a premium to any risk (Gerber and Jones, 1976). The pure risk premium principle sets the premium to be equal to the expected claims cost (Dickson, 2016). The term pure premium is unique to insurance and was derived to describe the portion of the risk's expected costs that is "purely" attributable to loss (Werner, Modlin and Watson, 2016).

$$\Pi_X = E(X)$$

Where, Π_X is the risk premium and X is the claims amount. This is equivalent to frequency (incidence rate) * severity (average cost per claim).

2.1.2 Profit Testing

The theory behind profit testing is the evaluation of profits emerging period by period (Lee, 1985). It considers the cash flows from the policy and their timings, and determines the premiums based on a set profit criterion. Its principle states that the actuarial present value of premiums is equal to the actuarial present value of benefit outgo plus the actuarial present value of contribution to profit (Owusu et.al. 2016).

2.2 Empirical Framework

2.2.1 The Design of Post-retirement Benefit

Private Medical insurance (PMI)

A private medical insurance is a form of traditional indemnity insurance designed to reimburse subscribers for financial loss stemming from the use of health care

(Foubister, Thomson, Mossialos and McGuire, 2006). PMI is purchased by individuals, or by employers on their behalf.

According to a report by the Ministry of Health (2016), the total health expenditure has increased over the years by about 33% in a 2-year timeframe to KES 234 billion or USD 2,743 million in 2012/13. The amount of out of pocket spending remains high, leading a lot of people into poverty and posing a barrier to access healthcare (Onyach, 2016). This is especially for the older populations that do not save or prepay for healthcare. Based on the findings in the report roughly 20% of the Kenyan population is covered by health insurance, with 85% covered by the NHIF, 9% by PMI and 6% by community based health financing. Most of these covered are in the formal sector. This means that retirees, who are in the informal sector, are barely covered by health insurance. In addition, the incumbent Kenyan PMI has an age cap for eligible individuals.

The NHIF offers health insurance coverage both for the informal and formal sector. The key shared features by the NHIF and the PMI relate to product content, or the core benefits covered. They both cover items attached to the principal procedure, such as diagnostic tests, nursing, accommodation and outpatient care. They also have an add-on for a death benefit, which entails a sum assured that is to be paid out to beneficiaries on death of the policyholder. Some of the features of a PMI are: rapid access to treatment, a care environment perceivably preferable to that available on the NHIF and a variety of choices (of appointment, of doctor, and of provider facility) in comparison with the NHIF. According to the NHIF benefits package as of 2015, the NHIF does not provide health care at high-level hospitals as it represents a waste of resources due to the treatments being 10 to 25 times higher than at lower-level hospitals. This means that a retiree that seeks access to private medical care is deprived of this care if they are covered by the NHIF.

Based on the results of the Kenyan 2009 census, 1 in every 5 households has at least an elderly person, that is, a person aged 60 and above. This indicates an improved life expectancy as people are living up to age 60 and hence this elderly population has a growing potential. Since at this point they do not have access to PMI, then this cover would mainly benefit such individuals.

2.2.2 Constructing a pricing model

Various studies have been done on the designing and pricing of medical insurance, which solves the problem of financial loss due to unplanned medical expenses. To choose a model with a view to conceptualizing real phenomena is a simple approach. However, this may not reflect the actual reality (Darbellay, 2001). Hence, the aim of any model is to simulate what the reality may look like as accurately as is possible.

Calculation of premiums is basically determining the price of risk, in this case, determining the price of an insurance accepting the risk of future medical expenses for a retiree. There have been various propositions from various financial economic research studies on the methods to use in determining these premiums.

A research by Sherris (2003) used the Capital Asset Pricing Model to price the risks, where the risks are assumed to follow a Gaussian distribution. This equilibrium model may seem the most suitable as it takes into account the buyers and sellers' preferences as well as the laws of supply and demand, hence giving the actuarial pricing an economic aspect. However, this is not the case as such assumptions on preferences are quite impossible to formulate for insurance (Deelstra and Plantin, 2014). Hence, this proved to be unreasonable and unrealistic particularly for medical insurance risks.

In addition, there was a study by Embrechts (2000), which used the arbitrage pricing theory. Arbitrage pricing derives the prices of some flows from the given prices of other flows by requiring that two portfolios that generate the same future flows have the same values (Deelstra and Plantin, 2014). The downside associated with the arbitrage pricing theory is that it assumes that sellers and buyers can buy or shortsell at any point in time with irrational low costs. It also assumes that the market is efficient (complete information is available for all market participants). However, these assumptions are not feasible in an insurance market particularly medical insurance.

The ideal model is one which incorporates all the parameters in a particular balance to increase profit, provide high shareholder rate, high commission to motivate agents, reduce expense while not affecting the smooth run of the company and at the same time having a good amount of funds to pay all claims promptly (Owusu et.al. 2016). A study carried out in Ghana by Owusu et.al. (2016), on profit testing as a pricing

tool led to conclusive results that proved that the model was flexible, adequate and simple to use. A similar study by Harris, Riggieri and O'Connor (1993) found that profit testing is a necessary tool especially if the product in question is long-term, due to its sensitivity to economic conditions. It is also most suitable when past claims data is available. Profit testing allows premiums to be set to meet specified profit targets as well as allows the insurer to carry out sensitivity testing on the profit to changing parameters (Dickson et.al. 2013).

2.2.3 Significant Variables

The philosophy underlying this section is that a profit-test system being adopted ensures that the assumptions are realistic. Risks of adverse deviation are substantially to be dealt with the use of a risk discount rate appreciably in excess of that obtainable on alternative no-risk investments (Lee, 1985).

There are a number of particularly sensitive variables, which warrant special attention in the pricing of a PRM product (Axene, Biggs, Nelson, Nixon and Rysz, 1984). In their study, they identified that these variables include the claims experience by coverage, the demographic characteristics of the covered population, including age, sex, mortality and morbidity experience as well as geographic location by coverage.

In addition, other factors such as, the retirement age and the guaranteed period of cover are crucial (Axene et.al. 1984). The retirement age signifies the point at which the individual stops paying premium, and the promised benefits are to be paid. The time from inception of policy to retirement age is significant since as this time period increases then the less premium an individual pays. It also signifies the investment horizon for the company. The inclusion of dependants for coverage is an important factor since this means that spouses are also included in the insurance coverage. Hence, this has a significant effect on the premium charged (Dallas and Don, 1986).

In her study, Gakii (2013), found that the probability of reporting good health decreases as the individual attains a certain age. This study found that the optimum age was 27 years, whereby an additional year on this age increased the probability of reporting illness. Hence, age is a crucial variable that is needed for the pricing model to be constructed.

The risk discount rate is the rate at which the company invests in order to make profits and hence meet up to the expected required rate of return by shareholders (Owusu et.al. 2016). The net risk discount rate should be higher than the expected net rate of return; otherwise the shareholders could invest directly in a similar portfolio (Lee, 1985). This variable is significant for the profit-testing model as it determines the target profit the company is aiming to achieve.

The inflation rate assumed is a very sensitive variable due to the fact that medical claim costs keep increasing; however this may not only be because of price inflation, but simply because the individual is growing older (Dallas and Don, 1986). Hence in effect, the morbidity assumption should reflect the increase in medical claim costs as a result of that aging process.

2.3 Conceptual Framework

Independent variables: age, past claims costs, expenses, commissions, inflation rate, fund charge, risk discount rate and interest rate.

Dependent variable: premium payable, profits.

2.4 Highlighting Gaps in Research

The pricing and design of the PRM products is key to how the market will react to the product and whether the company offering the product will make a profit or a loss. Previous studies have focused on either parts of the PRM product or have studied the PRM product pricing but with use of different pricing tools.

In his study, Cherutich (2013) focuses on the pricing of the LTCI products in Kenya using the Markov chain processes through the framework of multi-state modelling. He focuses on using transition intensities and probabilities of transitioning from one state to another, to calculate premiums. This study fails to take into account the profit aspect of the product.

Owusu et.al. (2016) study the efficiency of the profit testing model as a pricing tool that ensures profitability for life insurance companies in Ghana. Other studies such as by Söderlund and Hansl, (2007) focused on premium pricing for health insurance using statistical models such as average premium pricing models. There have not been any studies dedicated to the pricing of the PRM product in its entirety. In

addition, the profit-testing model as a pricing tool has not been researched on in Kenya.

CHAPTER THREE: METHODOLOGY

3.0 Introduction

Having defined the research problem, refined the research objectives and questions as well as reviewed the available literature; this chapter aims to establish the structure of this study, define the population and hence, determine the sampling techniques. We then determine the best data collection and analysing techniques for the available data.

3.1 Research Design

The study is descriptive and explanatory in nature as it evaluates the design of a post-retirement benefits and the significant variables that can be used in the pricing model. It also determines the premium to be charged using the historical claims data available.

This is a cross-sectional research study since it is time constrained. The historical medical claims data are over a selected period of time, that is, from 2013 to 2016.

3.2 Population and Sampling Study

This research study is based on building a pricing model for a post-retirement medical benefit. However, the model is constructed such that any company in the related field of study can use it. Therefore, the population of this study is basically insurance companies as well as actuarial firms in Kenya.

Sample selection is based on non-probabilistic sampling method (convenience sampling). A strongly established insurance company is chosen so as to try to ensure representativeness of insurance companies and other investment companies in the industry. The sample frame in this study consists of one of the popular insurance companies in Kenya currently (2017).

3.3 Data Types (Reliability and Validity)

This research paper is a comprehensive study that aims to construct the most appropriate pricing model and evaluate the sensitivity of profits to changes in the investment return. Therefore, the nature of the data being analysed in this study is quantitative since to meet the research objectives, numerical measurements are required that will eventually lead to a suitable premium which will enable the accumulation of post-retirement medical fund.

The data used in the model is checked for reliability, accuracy and reasonableness. Various checks such as verifying that policies in the claims data exist in the exposure data, omissions filled reasonably. E.g. ages are filled in for the omitted ones using the average ages as per the data, are done. A single individual did the data collection. Hence, this ensured consistency of any data findings as well as the consistency of interpretations of any data collected and analysed. In addition, the data depicts the actual reality as it was obtained from an actual insurance company in Kenya. Therefore, the data used was found to be fit for the pricing model.

However, for other information such as the text in this research paper, the reliability could be compromised due to the nature of data source, which is secondary, since different researchers of the various journals may have interpreted information differently. On the upside, this data is credible as it is obtained from accredited journals and past and current administrative records.

3.4 Data Collection

Due to the nature of the data used in the pricing model being quantitative, the method of data collection was quantitative and was obtained from a registered Kenyan insurance company. This is a primary source of data as it is first hand data on the medical claims experience of that particular company. This study also obtained data from documented conference proceedings and reports.

Use of secondary sources of data (journals, past and current administrative records, books and newspapers) was necessary in this study since it is a cross-sectional type of study.

The data collected was based on 7,477 written medical insurance policies on ages from 0 to 88, from years 2013 to 2016. The claims data was collected which constituted information regarding the type of cover (inpatient/outpatient), the claim amounts, the ages of the claimants, the year of claim and other information such as gender and relationships (dependant/principal). There was a total claim amount of Kshs 140,998,540.76 experienced over the 4 years. These were from a total of 1,788 individuals over the 4 years. There was also data on the company's expense ratios and commission ratios.

3.5 Methodological Approach

Data Analysis

The data collected was reviewed and analysed using quantitative procedures, as the data itself was quantitative in nature.

The main objective of this study was to determine a premium that is profitable to a company. These methods are used to determine the premium:

3.5.1 Pure Risk Premium

The first step of pricing a health policy is predicting the amount of claim payments. The annual claim cost, the risk premium, is the product of the frequency of occurrence and the amount of the average claim (Chen, 2004).

The Ruin theory ascertains that the pure risk premium without any kind of loading is insufficient since, in the long run, ruin is inevitable even in the case of substantial (though finite) initial reserves (Burnecki, Nowicka-Zagrajek and Wyłomańska, 2005). Nevertheless, the pure risk premium can be and still is of practical use because, for one thing, in practice the planning horizon is always limited, and for another, because there are indirect ways of loading a premium, e.g. by adding the profit loading with the expense and commissions loading or neglecting interest earnings.

The procedure is as follows:

a) Annual Pure risk premium per type of cover (outpatient/inpatient) per cohort of age

Pure risk premium [Π_X] = expected claims costs [E (X)]

Hence, E (X) = κ *ν, where κ= frequency and ν= severity (average cost per claim).

$$= \sum_{k=55}^{k=75} \boldsymbol{\kappa_k} * \boldsymbol{\nu_k}$$

Frequency (Incidence rate)

This is a measure of claim incidence and is generally expressed per unit of exposure (Werner et.al. 2016).

Incidence rate per type of cover per age = Number of unique claimants per type of cover per age/Number of original policies per age in the exposure data

Severity (Average cost per claim)

This is a measure of the average loss per claim (Werner et.al. 2016).

Average cost per claim = Total amount of claims per type of cover per age/Number of unique claimants per type of cover per age

Total pure risk premium = Π_X

b) Office Premium (OP)

This is the actual premium charged, loaded for expenses and commissions.

i. $OP = \Pi_X /$ 1-expense rate-commissions rate

ii. Total Expected claim costs (office premiums) for retirees = $\sum_{k=55}^{k=75}(\mathbf{OP})\mathbf{k} = \mathbf{EC}$

Where: k = age cohort

iii. EC adjusted for inflation = $\mathbf{EC * (1+ inflation)^{(Years\ to\ retirement)} = EC_i}$

iv. EC adjusted for inflation per cover type = $\mathbf{EC * (1+ inflation)^{(Years\ to\ retirement)} = EC_i}$

v. Annual premium at each age cohort = $\mathbf{EC_i / S_n}$

vi. Annual premium at each age cohort per cover = $\mathbf{EC_i / S_n}$

Where: $S_n = ((1+\text{investment return})^t - 1)/d$

$d = \text{investment return} / (1+\text{investment return})$

3.5.2 Profit testing method

Having obtained an estimate of the risk premium, the task is to come up with a premium that ensures profit for the insurance company.

Premium rating using profit tests can be done based on the following procedure:

a) Choose a model point.

b) Pre-retirement stage:

i. Net premium = Annual office premium – Commissions – Expenses
ii. Opening fund$_{T1}$ = Net premium$_{T1}$
iii. Fund before management charges = Opening fund * (1 + Investment return rate)
iv. Closing fund pre-retirement = Fund before management charges – Fund charge
v. Opening fund $_{Tn}$ = Closing fund pre-retirement $_{Tn-1}$ + Net premium $_{Tn}$
vi. Profit signature = Closing fund pre-retirement + Fund charge

c) Post-retirement stage:

i. Closing fund post-retirement = Fund before management charges – Fund charge – Expected benefits (medical claim amounts)
ii. Profit signature = Fund charge$_t$
iii. Profit margin = NPV of profit signature/ EPV of premiums

$$\text{Profit margin} = \sum_{t=1}^{t=\infty}(1+r)^{-t} * (PSt) / \sum_{t=1}^{t=\infty}(1+r)^{-(t-1)} * (Pt)$$

Where: r is the risk discount rate

PSt is the profit signature at time t

Pt is the Office premium at time t

3.6 Limitations

The data used was of a short period of time (4 years), which is not really good since for more accurate premium, a large data is required.

Medical costs inflation was also not derived from the claims experience of the company since the data was of a short period and fluctuations could not be smoothed.

CHAPTER FOUR: RESULTS AND ANALYSIS

4.0 Introduction

The primary objective of this study was to construct a pricing model for a post-retirement medical insurance product, which ensures a premium charge that is affordable and profitable for an insurance company. This chapter hence outlines the various results obtained and analyses of the data obtained from the company.

Various assumptions were used in obtaining the goal of this research study:

Table 4.0: Assumptions

Model point age	*32*
Retirement age	*60*
Benefit payment period	*20*
Inflation rate	*3%*
Investment return	*18.36%*
Risk discount rate	*21.36%*
Initial expense rate	*50%*
Renewal expense rate	*20%*
Commission rate	*10%*
Commission period	*10*
Fund charge	*2%*

Commission Structure: The commission rate was based on the company's commission ratio as per their 2017 2nd quarterly report.

Expenses structure: The expense rate was based on the company's commission ratio as per their 2017 2nd quarterly report.

Investment Return: This was calculated based on what return was appropriate in achieving the targeted medical fund.

Inflation: As per the IRA, this should be 10% of the estimated escalation rate. The lowest annual inflation rate Kenya as a country has experienced from 2000 to 2016 is 2% and the highest is 15% with an average annual rate of 10.16% (KNBS, 2017).

Risk Discount Rate: This is usually higher than the investment return so as to meet up the expected required rate of return by shareholders. The risk margin added to the investment return was 3%. This could be varied in the model.

Benefit Payment Period: According to an analytical report on mortality by the Kenya National Bureau of Statistics, life expectancy of adults at age 60 ranges from 14 to 23 years. Hence, the period of benefit payment is reasonably within this range.

Retirement age: This is the normal retirement age in Kenya.

Model Point Age: This was chosen based on the average age summary statistics of the data of the policyholders.

4.1 Summary Statistics of Data Obtained from Company

The data obtained from the company was adequate enough for the intended purpose for this research study.

Table 4.1.1 Exposure Data

This represents the number of policies that were written.

Number of policies	Year				
Age range	2013	2014	2015	2016	Total
0-9	80	199	577	575	1431
10-19	79	165	439	435	1118
20-29	113	184	381	368	1046
30-39	70	147	418	418	1053
40-49	109	164	403	375	1051
50-59	128	175	330	298	931
60-69	133	147	212	212	704
70-79	24	30	48	40	142
80-89				1	1
Grand Total	**736**	**1211**	**2808**	**2722**	**7477**

Table 4.1.2 Claims Data

This represents the total number of claims, not the individual claims.

Total Number of claims	Year				
Age range	2013	2014	2015	2016	Grand Total
0-9	242	398	1504	1014	3158
10-19	39	104	487	356	986
20-29	223	333	967	603	2126
30-39	153	313	1037	552	2055
40-49	200	355	841	550	1946
50-59	478	649	1020	494	2641
60-69	659	671	908	475	2713
70-79	109	178	256	105	648
80-89			2		2
Grand Total	**2103**	**3001**	**7022**	**4149**	**16275**

Table 4.1.3 Average ages of the data

This represents the average ages of the policyholders as at the time they claimed.

	Year				
	2013	2014	2015	2016	Grand Total
Average age	39	34	31	30	32

Table 4.1.4 Claim amounts

This represents the total claim amounts that were paid or confirmed to be payable by the company.

Total claim amounts	Year				
Age range	2013	2014	2015	2016	Grand Total
0-9	1,062,058.04	2,889,292.33	7,830,808.77	5,777,849.04	17,560,008.18
10-19	129,979.02	719,956.00	2,916,801.33	2,195,200.60	5,961,936.95
20-29	1,415,925.23	3,393,538.33	7,453,355.28	4,292,109.98	16,554,928.82
30-39	2,334,802.64	1,773,264.54	8,167,365.63	6,066,728.88	18,342,161.69
40-49	941,344.48	2,820,217.91	6,952,233.82	5,409,179.69	16,122,975.90
50-59	4,205,564.01	6,686,214.23	12,442,168.12	5,381,250.85	28,715,197.21
60-69	4,524,275.72	6,697,371.05	7,200,565.66	7,558,470.84	25,980,683.27
70-79	1,293,508.01	1,351,100.78	2,551,683.05	6,506,079.90	11,702,371.74
80-89			58,277.00		58,277.00
Grand Total	**15,907,457.15**	**26,330,955.17**	**55,573,258.66**	**43,186,869.78**	**140,998,540.76**

4.2 Premium Payable per type of cover

These premium rates were calculated as per the methodology broken down in chapter three:

Table 4.2: Premiums (Inpatient, Outpatient, Full Cover) Per Age Cohort

	PREMIUM PAYABLE						
Age of premium payer	Pure premium method	Cashflow method	Difference	Percentage difference	Inpatient Premium	Outpatient Premium	Full cover premium
32	52,783.51	18,112.70	lower	-65.68%	10,422.34	7,690.36	18,112.70
33	91,638.91	20,108.47	lower	-78.06%	11,570.74	8,537.73	20,108.47
34	42,137.24	22,336.10	lower	-46.99%	12,852.56	9,483.54	22,336.10
35	31,848.01	24,825.77	lower	-22.05%	14,285.15	10,540.61	24,825.77
36	41,190.83	27,612.47	lower	-32.96%	15,888.67	11,723.80	27,612.47
37	25,002.39	31,298.61	higher	25.18%	18,009.73	13,288.88	31,298.61
38	25,120.01	35,498.39	higher	41.32%	20,426.36	15,072.04	35,498.39
39	26,869.43	40,291.83	higher	49.95%	23,184.58	17,107.25	40,291.83
40	24,799.12	45,776.60	higher	84.59%	26,340.60	19,435.99	45,776.60
41	24,326.81	51,390.98	higher	111.25%	29,571.21	21,819.77	51,390.98
42	39,353.12	57,367.57	higher	45.78%	33,010.24	24,357.33	57,367.57
43	37,967.39	64,177.80	higher	69.03%	36,928.96	27,248.85	64,177.80
44	16,496.40	71,948.28	higher	336.15%	41,400.22	30,548.06	71,948.28
45	64,486.17	80,827.31	higher	25.34%	46,509.36	34,317.95	80,827.31
46	17,334.24	91,655.93	higher	428.76%	52,740.32	38,915.61	91,655.93
47	26,316.43	103,800.65	higher	294.43%	59,728.59	44,072.06	103,800.65
48	84,485.20	118,459.78	higher	40.21%	68,163.70	50,296.09	118,459.78
49	26,306.67	136,388.88	higher	418.46%	78,480.39	57,908.49	136,388.88
50	26,360.23	157,395.50	higher	497.09%	90,567.94	66,827.55	157,395.50
51	178,300.96	183,535.41	higher	2.94%	105,609.27	77,926.13	183,535.41
52	42,911.25	215,522.80	higher	402.25%	124,015.34	91,507.46	215,522.80
53	55,411.34	256,516.76	higher	362.93%	147,603.94	108,912.82	256,516.76
54	111,663.24	312,162.41	higher	179.56%	179,623.36	132,539.06	312,162.41
55	56,837.04	391,035.27	higher	587.99%	225,008.09	166,027.18	391,035.27
56	62,928.29	506,358.83	higher	704.66%	291,367.15	214,991.68	506,358.83
57	45,308.05	702,323.45	higher	1450.11%	404,128.40	298,195.05	702,323.45
58	111,587.07	1,088,692.24	higher	875.64%	626,451.32	462,240.92	1,088,692.24
59	74,656.38	2,254,970.14	higher	2920.47%	1,297,546.70	957,423.44	2,254,970.14

Based on the above results in the table, if just the pure premium method is used without the incorporation of profit testing, there is a mispricing witnessed with policyholders from the age of 37 and above paying lower premiums than they should.

4.3 Profits Expected

These were the shareholders profits expected from the model point of an individual policyholder of 32 years of age. A profit margin of 24.63% would be expected based on the various assumptions used.

Table 4.3: Shareholder Profits Per Year

	NPV Profits	EPV premiums	Profit Margin
	25,232.79	102,437.10	24.63%
Years	Discounted Shareholders profit	Discounted Premiums	
1	141.32	18,112.70	
2	338.84	14,924.21	
3	491.76	12,297.01	
4	608.36	10,132.29	
5	695.45	8,348.64	
6	758.62	6,878.98	
7	802.46	5,668.03	
8	830.74	4,670.25	
9	846.54	3,848.12	
10	852.39	3,170.71	
11	855.46	2,612.55	
12	851.22	2,152.65	
13	841.26	1,773.70	
14	826.86	1,461.47	
15	809.08	1,204.20	
16	788.78	992.21	
17	766.66	817.55	
18	743.26	673.63	
19	719.05	555.05	
20	694.39	457.34	
21	669.56	376.83	

22	644.80	310.49
23	620.27	255.84
24	596.13	210.80
25	572.48	173.69
26	549.39	143.12
27	526.94	117.92
28	505.15	97.16
29	482.81	-
30	458.77	-
31	435.39	-
32	411.83	-
33	389.93	-
34	369.42	-
35	351.33	-
36	333.61	-
37	314.85	-
38	299.41	-
39	284.03	-
40	269.60	-
41	257.05	-
42	239.28	-
43	227.85	-
44	217.78	-
45	207.54	-
46	196.42	-
47	187.73	-
48	179.43	-
49	171.50	-

4.4 Scenario Analysis

These were the various scenarios analysed in order to exhibit the various possible outcomes of the profit margins.

Table 4.4: Scenario Insights

Scenario Analysis								
		Current Values:	Worst case (mkt conditions)	Best case (mkt conditions)	Standard case(mkt cnditions)	Expenses controlled	Expenses at peak (with worst case mkt conditions)	Expenses at peak (with best case mkt conditions)
Variables								
	Inflation rate	3.00%	11.00%	2.00%	5.00%	3.00%	11.00%	2.00%
	Investment return	18.36%	7.00%	20.00%	10.00%	13.92%	7.00%	20.00%
	Fund charge	2.00%	2.00%	2.00%	2.00%	2.00%	1.50%	2.00%
	Risk margin	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
	Commission rate	10%	10%	10%	10%	5%	30%	30%
	Initial expense rate	50%	50%	50%	50%	35%	60%	60%
	Renewal expense	20%	20%	20%	20%	10%	20%	20%
Resulting profit margins								
	Profit margin	24.63%	5.64%	31.11%	10.16%	18.21%	2.49%	21.84%

Based on the above results, it is clear that the turnout of market conditions regarding the inflation rate and the investment return are very significant in the outcome of the profit margins. The expense (initial, renewal and commission) variables have a minimal effect.

4.5 Sensitivity Analysis of Profits to Investment Return (Risk Discount Rate)

These were the resulting profit margins with respect to the changes in the investment return, holding all other variables constant:

Table 4.5: Profits with changing Investment Return

Investment return scenarios	All else constant					
	Current rates:	Lowest rate	Top 4 rate	Top 3 rate	Top 2 rate	Highest rate
Investment return						
	18.36%	7.00%	10.00%	12.50%	16.00%	20.00%
Profit margin						
	24.63%	8.33%	10.39%	12.86%	18.40%	30.98%

Based on the above results in the table, the higher the changes in investment returns the more sensitive profit margins are. Furthermore, assuming the change remains constant, the profit margins sensitivity increase as the investment returns magnitude increase and v.v.

4.6 Sensitivity Analysis of Profit Margins to Inflation

These were the resulting profit margins with respect to the changes in the inflation rate, holding all other variables constant:

Table 4.6: Profits with changing Inflation

Inflation scenarios	All else constant					
	Current Rate:	Lowest rate	Top 4 rate	Top 3 rate	Top 2 rate	Highest rate
Inflation						
	3.00%	1.00%	2.00%	7.00%	9.00%	11.00%
Profit margins:						
	24.63%	24.82%	24.74%	23.59%	22.31%	19.93%

Based on the above results in the table, the higher the changes in inflation the more sensitive profits are. Furthermore, assuming the change remains constant, the profit margins sensitivity increase as the inflation magnitude increase and v.v.

4.7 Sensitivity Analysis of Profit Margins to Fund Charge

These were the resulting profit margins with respect to the changes in the fund charges, holding all other variables constant:

Table 4.7: Profits with changing Fund charges

Fund charge scenarios	All else constant					
	Current Values:	Lowest rate	Top 4 rate	Top 3 rate	Top 2 rate	Highest rate
Fund charge						
	2.00%	0.50%	1.00%	1.50%	2.50%	3.00%
Profit margins						
	24.63%	7.83%	14.41%	19.95%	28.60%	31.98%

Based on the above results in the table, a very small change in the fund charge results in a relatively higher change in the profit margins. Also, assuming the change remains constant, the profit margins sensitivity reduce as the fund charges magnitude increase.

4.8 Sensitivity Analysis of Profit Margins to initial expense, Renewal Expense and Commission rates.

These were the resulting profit margins with respect to the changes in the initial expense, renewal expense and commission rates, holding all other variables constant:

Table 4.8.1: Profits with changing Initial expense.

Expense rate scenarios	All else constant					
	Current rates	Lowest rate	Top 4 rate	Top 3 rate	Top 2 rate	Highest rate
Initial expense						
	50.00%	20.00%	25.00%	35.00%	45.00%	60.00%
Profit margin						
	24.63%	26.72%	26.37%	25.67%	24.98%	23.94%

Table 4.8.2: Profits with changing Renewal Expense.

Renewal expense scenarios	All else constant					
	Current rate	Lowest rate	Top 4 rate	Top 3 rate	Top 2 rate	Highest rate
Renewal expense						
	20.00%	5.00%	10.00%	15.00%	25.00%	30.00%
Profit Margins						
	24.63%	29.30%	27.74%	26.19%	23.08%	21.52%

Table 4.8.3: Profits with changing Commission rates.

Commission rate scenarios	All else constant					
	Current rate:	Lowest rate	Top 4 rate	Top 3 rate	Top 2 rate	Highest rate
Commission rate						
	10.00%	5.00%	15.00%	20.00%	25.00%	30.00%
Profit margin						
	24.63%	26.29%	22.98%	21.32%	19.66%	18.00%

Based on the above results in the 3 tables, a constant change in the rates result to a constant change in the profit margin regardless of the magnitudes of the rates. In addition, a relatively big change in the rates results to a very small change in the

profit margins. The higher the changes in the rates the more sensitive the profit margins are.

CHAPTER FIVE: DISCUSSIONS AND INTERPRETATION

5.0 Introduction

This chapter consists of three sections: The first section summarizes the study, discussions of linkages to other works, conclusions and recommendations. The second section is a summary of the findings and the conclusions, which are drawn from the key findings. The last section will involve recommendations for research that can be drawn from the findings of the research project.

5.1 Discussions

The purpose of this research project was to calculate a premium that was adequate and profitable to the company based on their past data, as well determine the impact of the variables used in the pricing. In this study, using profit testing as a pricing tool has worked well with a profit margin that is adequate. In addition, the fund charge, investment return and the inflation assumptions were proved to be significant with the expense assumptions having very minimal effects on the profit margins.

These findings are consistent with those of Owusu et.al. (2016), where their study revealed that the investment rate has a great effect on profit of the product. Taken together, these findings suggest that the investment return and inflation assumption is crucial in the pricing process for a product such as the PRM insurance product. The findings on the expenses assumptions are however inconclusive.

Owusu et.al. (2016) found that it was expedient for the expense rate to be higher for the first year followed by a constant rate in the following years. However, based on this study's findings, such a strategy resulted into a lower profit margin. This could be explained since the period over which expenses were being paid, remained the same in both cases. This is because the expenses were a function of premiums.

5.2 Conclusions

From the various analysis of the finding, it is clear that using profit testing, as a pricing tool is more suitable compared to the pure premium method only. The results showed that there is likelihood that from a certain age, in this case, age 37, premiums payable would be too low if the pure premium method is used, hence leading to company losses from inadequate pricing.

The results showed a profit margin of 24.63%. Based on the sensitivity analysis, the fund charge, inflation rate and the investment return assumption were very significant in the pricing model. The fund charge proved to be the most significant assumption as a very small change led to a relatively higher change in the profit margin. However, the sensitivity reduced as the magnitude of the fund charge increased. For the inflation rate and the investment return, the higher the changes in the rates, the more sensitive the profit margins were. Hence, based on the analysis, increasing the investment return rate and setting up a constant expense rate throughout the period of premium payment will increase profitability.

The initial expense, renewal expense and the commission rates assumptions had a very minimal overall effect on the profit margin. This could be due to the high investment return that was used.

The study has provided useful analytical tool for insurance companies and their policyholders. These stakeholders stand to benefit if the findings herein are implemented. Indeed, it will lead to high profit margin, policyholder satisfaction due to fair affordable pricing and prompt claim payments consequently. To sum it up, it will improve efficiency in the sale of the post-retirement medical insurance product in Kenya.

5.3 Recommendations

It would be interesting to construct a model for a PRM insurance product that offers death benefits on death after retirement. This is especially since the mortality assumptions and the gender variable could be evaluated as to their significance in the pricing model.

In addition, this research study focuses on PMI coverage. Therefore, this project recommends that a study be carried out on construction of pricing models for critical illness insurance coverage and long-term care insurance coverage post-retirement with regards to the end goal of profitability.

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