KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

PRICING AND PROFIT TESTING OF 'KEY MAN' LIFE POLICY OF INSURANCE COMPANIES IN GHANA

By

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Declaration

I declare that I have personally undertaken this research under the supervision of Mr. Derrick Asamoah Owusu and that any other material contacted has been duly referenced.

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Dedication

I humbly dedicate this research to my newly born daughter Ayeyi Twum Berimah and my lovely mum,Charity Owusu Twum whose love and prayers kept me focused and motivated and to the Almighty God whose bountiful and unmerited favours saw me through this research and the degree programme.

Abstract

Background

Profit testing was run on three insurance companies in Ghana using the Modern Method of Profit testing under the Asset and the results obtained indicated that an increase in premium was not enough to increase efficiency and profit instead the investment rate had to be increased and expense decreased whiles giving shareholders substantial dividend rate. This project exhibited the fact that the investment rate has a great effect on the profit of the product and also illustrated that it was expedient to spread out the expense over a longer period of time with the first two years having the greater share of the expense followed by a low constant expense rate for the continuing years. The amount paid as dividend should motivate and attract investors, commission rate should motivate agents to bring more clients on board, at the same time there should be a strong reserve to cater for claim payment and the surrender and death benefit should be well allocated. All these factors were necessary to keep the insurance company running irrespective of the claims that must be paid that year. .

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Introduction

1.1 Background Study

A Key man life insurance policy is basically a life insurance policy on the key employee which lists the employee's firm as the beneficiary. On the death of that employee, the corporation receives the face value of the insurance policy. As in the case with most life insurance policies, the company should have an insurable interest on the key employee in order to designate itself as the beneficiary. In some instances, firms buy key man life insurance for an employee as a form of compensation. For example, the successor of a key employee may be listed as the beneficiary. We shut out any such policies from our analysis, including splitdollar life insurance policies.

A company that carries key man life insurance is hedged against the risk of the death of a key employee. This risk is idiosyncratic. If there exist a systematic component to key human capital" risk, it happens when key employees for many firms choose to walk away from their firms at the same time. These employees may transfer some of their human capital to a new company, but some part of their human capital. Thus, an investor who owns the stock of both the switching employees' old firms and new company also loses any potential claims to the cash flows from this company specific part. If employers were able to hedge against the systematic component, we would not be able to use policy amounts as a measure of exposure to key human capital risk. We would know the dollar amount of the risk, but the risk would be hedged. However, because only the idiosyncratic risk is hedged, we can use the disclosed policy amount as a measure of the value of the key human capital. From an investor's standpoint, as long as

firms pay actuarially fair rates for insurance, it should not matter whether firms hedge against the death of the employee.

The usage of key man life insurance as a measure of key human capital risk has some benefits. It is a direct, monetary measure of the value of a key employee to a business. It is also a better measure. We do not have to evalate it or choose any unobservable parameters, as is the case with many other measures of human capital. The firm is likely to have a good understanding of the value of its key employees. There are some tradeoffs to this measure. First, it is likely that some businesses who choose not to carry key man life insurance are exposed to this risk. In fact, many businesses do state that they are exposed to the risk, but choose not to carry the insurance. The majority of companies do not disclose whether they carry key man insurance. We exchange the ability to roughly measure the key human capital stock for all firms with the ability to measure it for a smaller number of firms with precision. But, with the smaller sample of firms, we can form a factor and test whether exposure to this risk is priced in the cross section of all stocks. If this factor is capturing compensation for exposure to the risk that key employees systematically leave their companies, it should be higher in expectation precisely when this risk is higher. In other words, it may vary with certain macroeconomic variables or with factors that affect labor markets or outside options. Eisfeldt and Papanikolaou (2011) explicitly model this risk for organizational capital using technology shocks to new firms.

Keim (1983) finds that small firms outperform large firms during the month of January. Additionally, we would expect that key human capital risk is stronger in smaller firms since the knowledge and training of key employees of these firms should make up a greater percentage of the firm's total assets. Our finding that firms with high exposure to key human capital risk outperform those with low exposure during January could be due to differences in size between these firms.

The research on Key Man is based on the five pillars in actuarial science, these are:

- The theory of solid calculus of probability by Fermat and Pascal.
- John Graunt's descriptive statistical analysis of demographic data in his "Observation made upon the Bills of Mortality".
- A probabilistic interpretation of Graunt's tables by the Huyghen brothers.
- Mortality table based on the yearly number's of death observed in the city of Breslau by Edmond Halley.
- Jan de Witt's compound interest technique for the value of an annuity.

In the next century all these elements were put together and they became the fundamental pillars for the sound management of life insurance. Those who did so can rightly be said to be the first actuaries: James Dodson, Richard Price and William Morgan. - (ASTIN BULLETIN, 1993)

The method of profit testing was introduced by James Anderson in his work "Gross Premium Calculations and Profit Measurement for Non-Participating Insurance" published in 1959 and won the Triennial Price for 1959-61. This was a radical new departure in the way of thinking about life business. At that time, there was a rapid upsurge in U.S investor interest in the insurance industry. He then analyzed the insurance products from an investor point of view and this led to pricing on a basis of return on capital (The Actuary News, 1983 Volume 17, No 9, paper interview of J.C. Anderson). The work of Anderson was to suggest criteria for measuring the contingency and profit margins and introducing these items into the calculation of premium rates. Forty years after the publication, his suggestion of contingency and profit loadings thought of as rates became

relevant, additionally, rates should vary with the type of risk assured and in case of profit loading, should be related to the amount of surplus that must be invested to acquire a stream of profit generated by the insurance business (Society of Actuaries 50th Anniversary Monograph).

The concept of profit testing was further developed by a British named I.C Smart who worked on the philosophy and mechanics of profit-testing in his paper "Pricing and Profitability in a Life office" published in 1977, this was followed by R.E Lee's writing on "A prophet of profit" in 1984 and Godford's work titled "The control cycle: Financial Control of Life Assurance company" in 1985.

Profit testing is an integral part of insurance. This method has evolved and is still evolving due to the dynamic economy in existence but the foundation on which they lay is accredited to James Anderson, the Father of Profit testing.

An insurance system is a mechanism for reducing the adverse financial impact of random events that prevents the fulfillment of reasonable expectation. (Bowers, 1989). Factors people consider before buying a life insurance product are:

- The financial strength of the life insurance company
- The claims delivery of the life insurance company
- The price of the life insurance product

((New York Life Insurance Company 2010, in the article "understanding how Life Insurance Company prices its policies").

Wharton University, in a report titled "Actuarial verses Financial Pricing of Insurance" 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." The question however is "How does one determine this transacted market price?"(Wharton University, 2006).

When it comes to price, however, things get a little more complicated. As with anything you buy, the cheapest is not always the best, but neither is the most expensive. A look at recent whole life policies reveals that prices vary widely, making it difficult to make an apples-to-apples comparison between policies.

An operating business must also know if their products are profitable. This is extremely difficult if the product is a long-term life product. Following the normal procedure, one can know if a business is profitable after the business has gone off the book, and for some life product, it can take a lifetime. Clearly a different, more sophisticated approach is needed to assess the profitability of such products before writing and producing a life product in the first place. This is where profit testing becomes necessary. Profit testing is the process of assessing the profitability of an insurance contract in advance of being written. (Richard Stephens, Article Profit testing 2006).

Insurance profit testing is about considerations that are taken before any insurance product is priced it includes how stakeholders are properly rewarded for the risks that they take. Profit testing is therefore used as profitability tool as well as a pricing tool.

For more than thirty years profit testing has been recognized as a major tool available to actuaries involved in product development. A profit test uses projection mathematics to establish the prospective profit profile (stream of profit which flow from the policy over its life) of a policy on a given set of assumptions.

The result is discounted at the risk free rate to give the present value of the future profits. (Profit testing Model for Swiss Pension Fund, by Bertschi Ljudmila et al).

There are some factors that affect profit testing:

- Mortality: Mortality rate runs throughout the profit testing method. The mortality rate affects the death benefit, reserves, premium and all actuarial related parameters.
- Investment earning: Reserves are invested at an investment rate to obtain interest known as investment earnings.
- Expenses: This is the cost the insurance company incurs in its daily activities. It includes commission and override paid to agents, administrative cost, operative cost etc.
- Persistency: This refers to a stable level of contribution. (New York Life Insurance Company 2010, in article ”understanding how Life Insurance Company prices its policies”)

The importance of profit testing cannot be underestimated in any way as the consequence of ignoring it is detrimental to the economy. A typical example is Korea’s insurance sector crisis. The problems really centre on the lack of financial management in an industry that has historically been driven by business volumes; this being a direct consequence of the strict ”tariff” based regulatory environment. Companies were not encouraged to consider the profitability of the products they sold and product development was commonly based on taking a competitor’s product and adding value to it in the form of a further benefit or two. After many years of these practices, they are left with probably the most complex product landscape in the world! (Society of Actuaries article on International Section News, May 2000-Issue No 22).

In conclusion, profit testing and pricing is essential to the life insurance industry.

Much research on the subject matter is needed in our country, Ghana hence this project.

1.2 Problem Statement

The risk of a life insurance company going bankrupt due to lack of profit testing as they would be taken over by events without adequate funds (Reserves).

Inappropriate premium pricing due to the increase in the number of life insurance companies in Ghana, which brings about unhealthy competition in the insurance industry and negatively affecting the growth of the industry (low investment rate)
(Comment by: Mr. Ebenezer Allotey, Managing Director of Prime Insurance Company Limited, on the subject "A move towards proper regulatory system in the Insurance industry?")

However, the problem is difficulty in knowning the profitability of long term life businesses. Strictly speaking, one only knows if a tranche of business has been profitable when the last contract has gone off the books, which could take fifty years for certain kinds of contract.(On-line article on Profit testing by Stephen Richards). The answer is the focus study.

1.3 Objectives

1. To measure the profitability of Key Man insurance product.

2. To achieve profits while setting aside some amounts each year to accumulatewith interest and are adequate to pay future claims in case of future losses.

1.4 Justification

- This research would help life insurance companies lay good feasible future plans to keep the insurance company in a good financial standing at all times. This would boost the insurance industries ability to pay claims on time and redeem themselves in the eyes of the Ghanaian public.

- This research would give the insurance company as well as its employee information the quantum of profit they receive from every single client they attend to. With this in mind the clients would be treated extremely well to improve the customer service delivery of that insurance company and attract more clients to its services. The phrase "the customer is always right" would work more efficiently in our country.

- Life insurance premiums are part of the nation's long-term savings, and so life insurance companies are very important in channeling savings into investments, thereby enhancing capital formation. Hence our project on profit testing would empower insurance companies to seek the optimal investment strategy and improve their profit; this would in turn improve the economic growth and Gross Domestic Product of the country.

1.5 Thesis Organization

This study will be organized in five chapters. Chapters one comprised of the introduction the introduction, background of study, problem statement objective, methodology, justification and thesis organization. Chapter two will deal with the literature review. Chapter three looks at the methodology. Chapter four presents

the analysis of data and results. The conclusion on findings and recommendations are presented in the fifth chapter.

Chapter 2

Literature Review

2.1 Introduction

This chapter goes over the extant literature on the concept of life insurance and investment management of Life assurance funds. The chapter therefore provides a wider discussion and review of life insurance theories and the empirical evidence by prior researchers. Furthermore an overview of the Ghanaian insurance industry was reviewed basically with regards to the regulatory instruments and regulation governing the operations of insurance business in Ghana and the case study company in particular.

Insurance is one of the greatest successful service industries that many strong economies of the world used to achieve their spectacular development and greatness. By affording protection to life as well as property, it provides security of person and property with accompanying peace of mind which promotes and encourages adventure and entrepreneurship (Jack 2003). One of its major economic roles is to enhance the mobilization of funds therefore, providing a foundation for financial intermediation to commerce, barter and industry. As an industry, it cretes employment to many. Its loss prevention function also contributes to risk improvement. Above all, it gives substantial taxes to government coffers, creating more goods, a lot of jobs, improving earning, providing educational and health

facilities.

Life Assurance or life insurance is a contract between the policy owner and the insurer, where the insurer agrees to pay a designated beneficiary a sum of money upon the occurrence of the insured individual's or individuals' death or other event, such as terminal illness or critical illness. In return, the policy owner agrees to pay an agreed premium at regular intervals or in lump sums. As with most insurance policies, life insurance is a contract between the insurer and the to be insured whereby a benefit is paid to the designated beneficiaries if an insured event occurs which is covered by the policy. The value for the policyholder is calculated, not from an actual claim event, instead it is the value derived from the 'peace of mind' experienced by the policyholder, due to the negating of adverse financial consequences caused by the decease of the Life Assured. Life Insurance according to Greene and Trieschmann (2005) is a method by which a group of people may co-operate to ease the loss resulting from premature death of members of the group. The insuring Organization collects premiums from each member, invests these contributions, guarantees both their safety and a minimum interest return, and doles out benefits to the estates of the members who pass or become handicapped. They further emphasize that, seen from an individual point of view; "life insurance is a method of creating an estate. It is a method of seeing to it that plans for accumulating property or providing income for the welfare of others, mainly the family, are realized regardless of whether the bread winner dies prematurely or lives to a ripe old age".

2.2 History of Profit Testing and Pricing

In mid 1970's and early 1980's during the periods of fluctuations in interest rates, U.S companies began to look at cash flows as a measurement of how well their companies were managing. In the 80's, there were new products, increase in

competition, increase in mergers and restructuring, reduction in profit margins due to increased competition, etc. The outcome has been a greater need to be able to manage and control insurance operations in the face of increasing fluctuations and uncertainty. The real advantage of cash flow as a measurement instrument is that it is the only basis that looks at ”real” money. Merely it is actually just an immediate solvency test. Cash flow is not a measure of ”how well” a company is doing, since solvency and profitability cannot be established by the same method. Solvency is a constraint which determines the security margins and method to use. Profitability tries to show how well a company is doing to eliminate the cost effect of first year and taking the future profits into account. (Derbally, 2001). Hence there had to be a means of measuring profitability and manage the fluctuation and the immense uncertainty surrounding the economy at that time. This brought about the beginning of profit testing.

In the former concept of profit testing, pricing and product actuaries got away with using very simple models to price, value and reserve for contingent life contracts for the 18th, 19th and surprisingly much of the 20th century. All the models required to do was to make sure premiums of life contracts would, with a very high degree of certainty, meet all claims and expenses. The key matter challenging the actuary was never setting ’correct’ prices or minimum reserves, but allowing the surplus to go forth in a fashion that it could fairly and prudently be distributed to policyholders and stockholders. The Irish and UK profession had solved virtually all its problems with the phenomenal success of the introduction of profits policy. Its success offered actuaries a comfortable cushion of capital so that an accurate valuation and pricing of risk was not demanded. And also, the calculations involving pay-off of insurance claims were shrouded in such secrecy that competition was muted. This nonetheless prevented the company or actuary to consider optimal investment strategy. In short, the with-profits policy allowed actuaries to dodge all the difficult pricing, valuation, capital allocation, and

investment management challenges that they would otherwise have been forced to

face.

The trick we learned from the with-profits contract is that one has to have a very good judgment about key contract terms like the benefits to be paid such that he is not caught unaware when the time of payment had closed in. This theory was replicated in the new areas actuaries entered into, such as pension funds (e.g. discretionary increases, discretionary treatment of early leavers) or unit-linked contracts (discretionary mortality and expense charges). The result was that actuarial science was fossilized in the cozy cocoon offered by with-profits. (Dr Shane Whelan, 2010).This took a dramatic turn in the late 20th Century and was extremely obvious in the 21st century due to huge economic crunch that hit the world in 2008 from which most countries have not recovered. In short, four points have contributed to modern profit testing (Derbally, 2001):

- Hard competition between insurers as the method in calculating pay-off are most transparent as every before.
- Pressure from investors to have comprehensive results.
- Product evolution towards flexibility.
- Financial control of solvency.

2.3 Types of Insurance

Insurance is a risk management aimed at the prevention and minimization of loss (Ghana-Survey, 2010).Insurance companies in Ghana falls in two categories mainly:

- Life insurance

- Non-Life insurance

Profit testing is mainly used in Life Insurance. Profit testing system is the system which takes profit and uses the progression of these over the expected life time of a policy to analyze the policy (Smart, 1977).

2.3.1 Types of Life Insurance

There are many types of life insurance products available to match the differing needs of many individuals and families. Thus is to say life insurance policies are of many variations but these are classified into three basic types as stated by George (2003). According to the author, George, the three types are: Term insurance, Whole life insurance and Endowment insurance. There are many factors to evaluate before purchasing life insurance coverage. Some of those things you should consider include your age, married status, number and ages of your children, medical history, earning capacity, debt ratio, and anticipated financial needs.

2.3.2 Term Insurance

Term Life insurance provides a specific amount of life insurance coverage for a designated time period only. Currently, the available policy lengths for Term Life insurance are one year, five years, ten years and fifteen years. Term Life Insurance covers the mortality risk for a stated length of time. It is the simplest type of life insurance. (George 2003). When the insured person dies within the time frame in which the policy is in effect, the insurance company pays out the face value of the policy but if the insured person lives longer than the term of the policy, the policy expires and would pay nothing. Term Life insurance policy does not build any type of equity, it is usually one of the least expensive types of insurance and is available in several forms. Term Life insurance is typically bought as a means of temporary protection or when an individual can't afford the

cost of other forms of Life insurance. Some people like to invest their money elsewhere and feel they can obtain higher yields without having to use a Life insurance plan. Term insurance has many characteristics. It can provide protection for a temporary period such as one, five, ten or twenty years or until insured reached a certain age such as 65 years or 70 years. George stresses that the policies can be renewed for additional periods without evidence of insurability. The premium is increased at each renewal.

A wide variety of term insurance products are sold today. Zietz (2003) identifies five different types of term life insurance policies. These are:

- Single-year term policies which promise to pay if the insured dies within the one-year policy term.
- Five year term policies, which also pay if death occurs within five years of the policy purchase
- Longer term policies may last for ten, fifteen and twenty years.

These policies pay if death occurs before the designated age Multi-year term policies. This may have benefits that decreases increase or remain at the same level.

A Decreasing Term Policy as explained by Zietz (2003) provides the beneficiary with less proceeds each year the policy is in force. That is, if death occurs in the policy year, the beneficiary receives the full-face amount, if death occurs in a succeeding year, the proceeds will be less etc. With the Increasing Term Policy, the proceeds increase each year. If death occurs in the first year, the insurer pays the face amount of the policy. The Level-Term Policy however pays the same amount of benefits if death occurs while the policy is in force. George (2003) in discussing types of term insurance products or policies varies a bit from Zietz's

categorization of products. George also identifies five types of term insurance policies namely:

- Yearly Renewable Term
- Five, Ten, Fifteen, or Twenty Year Term
- Term to age 65
- Decreasing Term
- Increasing Term and finally
- Re-Entry Term

The first three types of the term insurance policies are the same as those discussed by Zietz. However, George considers re-entry term as another type of term insurance, which was left out by Zietz. In the opinion of George (2003), the re-entry term policy (also called revertible term), the renewal premiums are based on select mortality rates (lower rates) if the insured can periodically demonstrate acceptable evidence of insurability. To remain on the law rate schedule, the insured must periodically show that he or she is in good health and is still insurable. Evidence of insurability generally is required at intervals of one to five years, depending on the company, amount of insurance and type of policy. Both Zietz (2003) and George (2003) point out the drawbacks or limitations of the term insurance policy. In the view of George, term insurance is good for younger ages, but it is not suitable for life time protection. For some individuals, the need for substantial amounts of life insurance will continue beyond age 65 or 70 and therefore term insurance is not appropriate at the older ages. Single term insurance premiums increase with time and eventually reach prohibitive levels. Because of the premium increase, some insured's would drop their term insurance policies. Thus, after years of premium payments, they may die uninsured. Frederick (1999) in discussing the limitations of term insurance

enumerates three important limitations. The first limitation he identifies is that, term policies expire at the end of their terms, but the need for a protection may continue. The need for continuing protection is especially pressing for policy holders who have developed poor health he emphasizes. The second limitation he stresses is the increasing cost of term insurance. The cost of renewing term insurance is on the ascendancy he notes. The absence of cash value is the third major limitation Frederick emphasized on. According to him other types of life insurance combine savings with protection, furnishing cash values for emergencies and for retirement income. It is sometimes argued that many of those who buy cash value insurance do so because they fail to consider the alternative of separating their insurance and saving programs or because they are talked into buying the more expensive policies by agents who thereby earn higher commissions.

2.3.3 Whole Life Insurance

Whole Life Insurance is a perpetual insurance that provides lifetime protection. The policies promise to pay the beneficiary anytime death happens, "Till death do us part" is the insurance promise. Two types of whole life insurance have been identified by George (2003) namely Ordinary Life and Limited-Payment Life Insurance. Ordinary Life Insurance (also called straight life and continuous premium whole life) gives lifetime protection to age 100 and the death claims are a certainty. If the insured is still at age 100, the face amount is given to the policy owner. And also, premium levels do not increase with age. Under whole life policy, the policy owner is overcharged for the insurance protection during the former years and undercharged during the later years. George further asserts that ordinary life insurance also has an investment or savings element called cash surrender values. The cash values are done due to the over payment of the insurance premiums during the former years. As such, the policy owner builds cash equity in the policy. The policy may be surrendered for its cash values or the

money may be borrowed under a loan provision. The cash values are comparatively small during the early years, but increase over time till they become significant.

2.4 Innovations in Whole Life Insurance

Traditional cash value policies has received criticism in recent years because the rates of return on the savings component are relatively low and not disclosed to policyholders. As such, a lot policyholders have replaced their older cash value policies with life insurance products that offer higher returns. In addition, because of comparatively high interest rates paid by financial institutions in recent years, life insurers have experienced intense competition from money Market mutual funds, commercial banks, savings and loans institutions, stock brokerage firms, and other financial institutions. To highly competitive and to overcome this criticism against traditional cash value policies, insurers have developed a wide variety of innovative whole life products that combine insurance protection with an investment element. Some important innovations in whole life insurance include the following (George 2003).

I. Variable life insurance

II. Universal life insurance

III. Variable universal life insurance

IV. Current assumption whole life insurance

V. Adjustable life insurance

2.4.1 Variable Life Insurance

Variable Life Insurance can be defined as a policy in which the death benefit and cash surrender values vary according to the investment experience of a separate

account maintained by the insurer (George 2003). Although there are different policy designs, variable life policies have certain common features. First, a variable life policy is a permanent whole life contract with a fixed premium. The premium is level and is guaranteed not to increase. Second, the entire reserve is held in a separate account and is invested in equities or other investments. The policy owner generally has the option of investing the cash values in variety of investments, such as common stock fund, bond fund, money market fund, or other funds, if the investment experience is poor, the amount of insurance could be reduced below the original face amount. Thus the minimum death benefit will be at least equal to the original face amount, but it can be considerably higher depending on the investment experience of the amount.

Finally, cash surrender values are no minimum guaranteed cash values. The actual cash values depend on the investment experience. Thus, although the risk of excessive mortality and expenses is borne by the insurer, the investment risk is retained entirely by the insurer; the investment risk is retained by the policyholder.

2.4.2 Universal Life Insurance

Universal Life Insurance is another variation of whole life insurance that is rapidly growing in importance in the developed countries like U.S.A. In 2006 alone, new purchase of universal life insurance amounted to about $270 billion, a sharp from $92 billion in 1983. Hakanssan (2009). The basic characteristics of universal life insurance can be defined as a flexible premium; nonparticipating policy that provides life time protection under a control that separates the protection and savings components. The policy owner determines the amount and frequency of premium payment, which can be monthly, quarterly, semi annually, annually or single payment. The premium is less explicit expenses

charges credited to a cash value account. The monthly interest is credited based on current rent rates that may be charged over time.

2.4.3 Variable Universal Life

Variable Universal Life Insurance (also called universal life II and Flexibility Premium Variable Life Insurance) is the innovative product in the evolution of interest sensitive products. This is a variable universal life policy discussed earlier but with two major exceptions:

- The policy owner has a variety of investment options for the investments of cash values

- There is no minimum guaranteed rate of interest

A variable universal life policy allows the owner to place the cash values in a broad diversity of investments. For instance, the underwriter may cause an aggressive stock fund, bond investment company, balanced fund, global fund, real estate investment trust, and money fund. Depending on the policy owner's investment objectives, goal and tolerance for risk, the fund can be invested accordingly. The money can also be displaced from one fund to another as investment objectives or market conditions charge. In addition, a variable universal life policy has no minimum guaranteed rate of interest and the principal is not assured. If investment risk falls solely on the policy owner. In view of this, some financial planners and consumer experts recommend caution in the purchase of a variable
universal life policy.

2.4.4 Current Assumptions about Whole Life Insurance

The fourth innovation in whole life insurance is the current assumption whole life insurance (also called interest-sensitive whole life). It is a non-participating whole life policy in which the cash values are based on the insurer's current mortality, investment and expense experience. In addition, an accumulation account is credited with a current interest rate that changes overtime. Although Current Assumptions Whole Life products vary among insurers, there are some common features. They are summarized below:

- An accumulation account is used to reflect the value of the account
- The accumulation account is credited with the premiums paid less expenses and mortality charges plus interest based on current rates A surrender charge is deducted from the accumulation account. A surrender charge that declines overtime. Such as 10 to 20 years is deducted from the accumulation account to determine the net cash surrender value.
- A guaranteed interest rate and current interest rate used to determine cash values. The minimum cash values based on the guaranteed interest rate. However, the accumulation account is credited with a higher interest rate and is not guaranteed for the life of the policy but changes overtime. Current interest rates generally range from 7(1/2) to 9 percent in the developed countries.
- A fixed death benefit and maximum premium level at the time of issue are stated in the policy.

2.4.5 Adjustable Life Insurance

The last but not the least innovation in whole life insurance according to George (2003) is the Adjustable Life Insurance. According to him, some innovations could be adjusted to life insurance policies that can be changed as family needs and

circumstances change overtime. For example, substantial adjustment in a personal life insurers program are often required in the even of marriage, birth or adoption of child, lay off from work, responsibility to aged parents, purchase of a home or business or retirement.

2.5 Endowment Policy

Endowment contracts are mainly savings contracts with an element of pure protection incorporated into the policy, so that if the insured dies before the savings plan is completed, the insurer completes it. Endowment policy is further divided into two types; the Limited-Term Endowment Contract and Retirement Income Policy. With the limited term endowment contracts, it covers a given period of years, usually 5, 10, 20, or 30 years. Notable among it is the 20 years policy period. Endowments are usually used as savings for some specific purpose such as education, retirement or travel. Alike to the endowment is the Retirement Income Policy. Retirement income policy is like to endowment, except that, the former is arranged so that its cash values amount to a sum sufficient to bring specific amount of income a month at retirement age usually 65 years. Endowment policies are provide for varying periods, such as a 10 years endowment, 20 and 30 years endowments and endowments at age 65; Greene and Trieschman (2005).

2.6 Asset, Liability and Investment

A deeper knowledge of the liabilities of insurance companies is necessary to develop an appropriate approach to the management of assets. Aside the higher amount of reserve, Life Insurance companies have a much higher ratio of reserves to equity. The lower capital levels for life insurance companies emanates from both management decision and regulatory requirement. They are grounded on

the realization of the fact that life insurance obligations are more comfortable to forecast than the duties of most other insurance companies. According to Fred and Neil, the accumulation of funds for certain death benefits means that the dollar value of liabilities per face value of insurance is higher for life insurance than other insurance. Thus, a higher proportion of liabilities to equity does not necessarily imply a higher ratio insurance face value to equity. The size of the equity base on important implication for asset management. With a limited equity base, the life insurance companies can endure less asset value shrinkage than non-life companies. Regarding assets, Fred and Neil (2004) also have the opinion that, the primary assets of insurance companies are investment portfolios in the form of government and corporate securities. Investment portfolio according to them is held for two reasons. Because the insurance companies receive premiums with insurance coverage provided for some time after collection, they have these cash to invest until they are paid out as benefit. On the liability side, this shows up as reserves. The second category of funds are kept as protection against losses due to factors such as excessive benefit expense or shrinkage in the value of assets on the liability side of the balance sheets, these funds are represented by surplus and equity accounts. The investment policy is set by two purposes the portfolio serves.

Fred and Neil (2004) went further to argue that, the liquidity needs from the investment portfolio are minimal. In their opinion, most insurance companies are continually expanding in size, with premiums received during any month being more than sufficient to meet all cash out flows for the month. Actual sale securities would be necessary only if premium revenue declined. The company will add to its portfolio and reserve accounts from month unless its volume of business declines or disintermediation occurs. Even though, the liquidity needs from the investment portfolio are minimal, Fred and Neil (2004) caution that, this is not to say that day-to-day cash management is not an important function in an

insurance company. A large insurance company will have cash flows of several million dollars a day. A company may be able to improve profit by half a million dollars. Therefore the companies follow cash flow over the weeks and months closely to keep and monitor cash flow as closely as possible.

2.6.1 Risk and Returns

On the issue of risk and returns, Kopoke and Randal (2008) focused on the implications of risk of the increasing role of life insurance companies in offering investment products, and the vulnerability of both Life and Property - liability companies to rising interest rates, declining property values, and disappointing corporate profits. According to them, a number of Life Companies recently have been funding a significant portion of such assets with relatively short term liabilities, mostly guaranteed investment contracts (GICs), thus raising both interests sensitively and liquidity concerns. They went further to say that property liability companies are also vulnerable to increases in interest rates, since their claims are relatively short term and irregular. Higher interest rates lower the value of their assets, which may have to be sold to meet claims.

In general, risk concentration developed over several years, during which time the institutions appeared to be in sound condition. A turning point occurred, adversely affecting the areas of risk concentration, and it soon became apparent that the institutions were severely often fatally damaged. With respect to both banks and insurance companies Kopoke and Randall emphasize that, supervisory action should have been directed at the risk concentration before the triggering economic event (disruption of the junk bond Market, crash of real estate values or the like). While analysis by Kopoke and Randall did not equate the degree of the insurer's problems with those of banks; it does suggest that supervisory restraints on excessive risk taking are equally appropriate in both industries. In his comments, Boffman (2007) reviews the transformation of the larger life

insurance companies over the past 20 years in the multi-line financial companies. He finds that the majority of companies have adapted well to the more competitive environment. The large companies are generally safer because of geographic and product diversification. Failure has generally involved small companies. The few large life failures involve levels of risk taking well above that across the industry is low because of diversification and relatively high asset quality.

2.7 Key Man Life Insurance Policy

A Key man life insurance policy is basically a life insurance policy on the key employee which lists the employee's firm as the beneficiary. On the death of that employee, the corporation receives the face value of the insurance policy. As in the case with most life insurance policies, the company should have an insurable interest on the key employee in order to designate itself as the beneficiary. In some instances, firms buy key man life insurance for an employee as a form of compensation. For example, the successor of a key employee may be listed as the beneficiary. We shut out any such policies from our analysis, including splitdollar life insurance policies.

A company that carries key man life insurance is hedged against the risk of the death of a key employee. This risk is idiosyncratic. If there exist a systematic component to key human capital" risk, it happens when key employees for many firms choose to walk away from their firms at the same time. These employees may transfer some of their human capital to a new company, but some part of their human capital. Thus, an investor who owns the stock of both the switching employees' old firms and new company also loses any potential claims to the cash flows from this company specific part. If employers were able to hedge against the systematic component, we would not be able to use policy amounts as a

measure of exposure to key human capital risk. We would know the dollar amount of the risk, but the risk would be hedged. However, because only the idiosyncratic risk is hedged, we can use the disclosed policy amount as a measure of the value of the key human capital. From an investor's standpoint, as long as firms pay actuarially fair rates for insurance, it should not matter whether firms hedge against the death of the employee.

The usage of key man life insurance as a measure of key human capital risk has some benefits. It is a direct, monetary measure of the value of a key employee to a business. It also is a better measure. We do not have to evalate it or choose any unobservable parameters, as is the case with many other measures of human capital. The firm is likely to have a good understanding of the value of its key employees. There are some tradeoffs to this measure. First, it is likely that some businesses who choose not to carry key man life insurance are exposed to this risk. In fact, many businesses do state that they are exposed to the risk, but choose not to carry insurance. The majority of companies do not disclose whether they carry key man insurance. We exchange the ability to roughly measure the key human capital stock for all firms with the ability to measure it for a smaller number of firms with precision. But, with the smaller sample of firms, we can form a factor and test whether exposure to this risk is priced in the cross section of all stocks.

If this factor is capturing compensation for exposure to the risk that key employees systematically leave their firms, it should be higher in expectation precisely when this risk is higher. In other words, it may vary with certain macroeconomic variables or with factors that affect labor markets or outside options. Eisfeldt and Papanikolaou (2011) explicitly model this risk for organizational capital using technology shocks to new firms.

Keim (1983) finds that small firms outperform large firms during the month of January. Additionally, we would expect that key human capital risk is stronger in smaller firms since the knowledge and training of key employees of these firms should make up a greater percentage of the firm's total assets. Our finding that firms with high exposure to key human capital risk outperform those with low exposure during January could be due to differences in size between these firms.

2.8 Insurance Pricing

In the past two decades, economists, financial analysts, and actuaries have proposed alternative pricing models, due to the fact that there was no theoretical justification for the traditional methods used, there was high interest rate in the economy and the increasing competition in the insurance industry. The inspiration for more accurate pricing models falls into three categories:

- The time value of money: Insurance cash flows on a given contract occur at different times. Often, premium and expenses is paid at the beginning of the policy, whereas losses are settled months or years later. Monies exchanged at different dates have different values due to economic inflation, available interest rates and the opportunity cost of capital. Financial insurance pricing models consider both the magnitudes and the dates of cash transactions.

- Competition and expected returns: In a free market economy, the price of a product depends on the degree of competition in the industry. If a firm prices its product above the market level, it may lose sales. If it prices its product below the market level, its profits may fall. Hence it has to hover around the market price. The optimal price for products whose costs are known in advance of the sale is determined by production costs and

competitive constraints. In complex insurance products, however,there must be analysis of both expected costs and achievable returns.

- The rate base: Most businesses measure profits in relation to sales, this method is not favored by financial analysts and theoretical economists. Alternative rate bases are assets, which are used in public utility rate regulation, and equity (or net worth), which is used in most financial pricing models. (Feidbium, May 1992) With the pricing methodologies adopted in the UK and in many other developed insurance markets, the method of reserving and prudence of the provisions have direct impact on the price through the profit testing process. (DAYKIN, 2000) Whenever theoretical rate is calculated outside competitive range companies must choose between following alternatives (Anderson, Premium Calculation and Profit Measurement, 1959):

- Controlling one or more factors involved in relation with profit objectives and premium rates.

- Revisiting its profit objectives

- Adapting premium rates which are completely unrealistic.

- Accepting the penalties of loss

The premium rate is affected by the probability of collecting premium, interest earned on accumulated funds, death benefit, maturity benefit, surrender or lapse benefit, expense incurred, charges assessed for contingency ,profit objectives, reinvestment etc. The magnitude of effect depends on the product being priced and the corporate body as a whole.

2.8.1 Profit Testing in a Life Office

Profits are important to every viable economy and the survival of an enterprise. In studying the work of I.C Smart profits are synonymous to surplus as it the amount left over for distribution to shareholders and policyholders. Profit is also explained as the excess during any period of income over outgo, where outgo includes the necessary increase in valuation.

To run an insurance office, the following steps are needed:

- Recognize and reconcile the expectation of interested parties. When the profit produced is far below that expected, it cause interested parties to be discontent and tend to break from the company even though there is a profit and not a loss. The whole concept is about making profit to meet expectation.
- Reflect corporate purpose and the objectives so as to assist harmony of activities. The office objectives must be met. Profit is important but not to the detriment of the objectives of the company. Example is when a company makes huge profit this year due to good investment strategy but is noted for the slowest payment of claims and customers are dissatisfied with their customer service. The corporate purpose has not been met and must be considered.
- Correspond to the real world economic and risk bearing characteristics. The assumption used must be realistic and must meet the real work standard otherwise the profit testing models is just a white elephant.

In a life office, the amount of profit and rate of return in pricing systems may vary between offices and even by linesof businesses within a single office. This causes methods used to vary and no one method is truly universal.

Profit testing itself has a lot of advantages to a life office in the sense that it provides an excellent basis against which actual performance is measured. Performance is a relative subject as without a standard, performance cannot be measured. The introduction of profit testing sets the standard for the company which then works towards it. The level and rate of achievement in comparison to the standard sets the stage to measure performance.

In order to determine the capital consumed by a new policy and the adequacy of the premium rates one must do a profit testing. By projecting expected income and outgo against the background of the reserve basis using assumption as to all the underlying parameter we can test a policy for a profitability, which test includes its ability to support bonus if applicable.

The profit testing system is the only one which permits analyses of both amount and timing of expected profit emergence before and after bonus distribution if applicable.

Techniques used in Profit testing

Techniques used in calculating minimum premium may be divided into two main bodies:

- Asset Share
- Formula technique

Formula Technique: Corresponds to the calculation of a net premium such that at the interest chosen, the present value of death, survival and disability benefit plus expense is not greater than the present value of premium. Calculation is performed under the influence of mortality, disability and interest rate only. Profit then emerges as an excess of the office premium charged over the net

premium calculated or as a deviation between the actual expense and the assumptions made in premium calculating and profit testing.

The advantage of formula technique is that it is simple and easy to use; however, its disadvantages outweigh its advantages. This is due to the fact that no account is taken of the incidence of profit. In particular, no account is taken of the effect of the statutory reserve basis on the profit flow, so the exact time profit starts emerging is not seen. Secondly, no guidance is provided as to the likely future state of the office in areas of need for investment or disinvestment of asset, tax position and indeed many other considerations need to be studied separately and independently of the premium calculation process. Lastly, no account is taken of the impact of surrenders in the premium formula.

Asset Share Technique: This technique is more complex, incorporating many explicit parameters as well as the statutory reserves. The Asset Share easily builds a bridge between the profit test and projected future revenue account. Example of Asset Share methods are Hoskins's (the Accumulation method) and Anderson's (the Net Present Value method).Under the Accumulation method, cash flows (ignoring reserve increases) are accumulated at the earned rate of interest. The resultant asset share is compared with the statutory reserves and or surrender values at various durations: the excess of the asset share over the statutory reserve reflecting accumulated surplus funds. Profit criteria particularly associated with this method can be expressed as:

(a) Asset share at certain duration should be at least say 110% of reserves.

(b) Asset share should be at least equal to reserve-or surrender value-by not laterthan certain duration.

From this description it is clear that the Accumulation method carried out in this way is a little more than a sophistication of the Formula method. The essential

concept missing from the Formula approach and from the Accumulation version of the Asset Share approach is the identification of the impact of the valuation basis on the timing of profit emergence.

Under the Net Present Value method profits emerging are associated directly with the initial valuation strain at the rate of discount deemed appropriate on that valuation strain.

The stream of yearly book profits emerging against the valuation basis can be examined under the Net Present Value method in either or both the following ways:

1. Using the internal rate of return.
2. If one has identified the required risk discount rate independently from othercriteria, the Net Present Value of book profits at that discount rate can be calculated. This Net Present Value can then be tested against a profit criterion. Various profit criteria suggest themselves: an absolute amount, a proportion of sum assured or premium etc. A possible alternative statement of the Net Present Value profit goal is,by expressing the Net Present Value as a level percentage of premiums to achieve consistency of pricing in a comprehensible way

Traditional Method of profit testing

In early models of profit testing the equivalence principle was used to obtain the traditional margin and this led to profit testing Equivalence principle states that the Actuarial Present Value (APV) of Premiums is equal to the Actuarial Present Value of Benefits plus the Actuarial Present Value of charges (Derbally, 2001). It can also be quoted as the required reserve plus Actuarial Present Value of Future Premium is equal to Actuarial Present Value of future outgo (Dr Shane Whelan, 2010) This design requires little data and could be used in group data.

It is simple yet very powerful.

Using endowment:$P\ {}_{00}a\ddot{}_{x:n\ \_\ |} = A_{x:n\ \_\ |} + \lambda + \gamma a\ddot{}_{x:n\ \_\ |}$ Traditional Margin: $P''\ddot{a}_{x:\overline{n}|} - TM = A_{x:\overline{n}|} + \lambda + \gamma\ddot{a}_{x:\overline{n}|} + \sum_{k=0}^{n-1} V^{k+1} L_{x+k}\mu_{x+k} kP_x + \sum_{k=0}^{n-1} V^k B_k kP_x$

TM = Traditional Margin, B_k = Bonus, L_{x+k} = Lapse or surrender, λ=acquisition expense γ= administration expense, μ_{x+k}=probability to lapse.

The traditional way was however not suitable for modern evaluation due to fact it was challenging to use different discount rates in valuation. Secondly, the equation of value did not depict cash flows over the course of the contract so capital requirement was not explained. Capital is a rare resource with alternative uses. Modern management would need a more precise valuation of the capital requirement, as well as its timing and return on capital. Lastly, embedded options could not be valued.

2.8.2 Modern Method of Profit testing

The modern method of profit testing has a generic form $\sum_{t=0}^{\infty} \frac{CF_t}{(1+i)^t}$
The modern rewrites the traditional but has reserves added it. Its principle states that the APV of Premiums is equal to the APV of outgo+ APV of Contribution to profit.

Formula:

$P_{nk=0-1}\ [P_{00}\ {}_kP_x - \gamma_k P_x - vq_{x+k}\ {}_kp_x - vL_{k+x}\mu_{x+k}\ {}_kP_x - B_k\ {}_kP_x - (v_{k+1}V_{k+1}P_x - {}_k\ V_kP_x) + I_k - G_k]v_k\ v_{nn}P_x - \alpha$

G_k = profit, B_k = Bonus, L_{x+k} = Lapse or surrender, λ=acquisition expense γ= administration expense, μ_{x+k}=probability to lapse, V_k = Reserve, I_k= Interest earned

2.8.3 Test of Profitability

Risk Discount Rate (RDR)

Risk Discount rate is defined as the rate of return linked to the business risk of the insurance company. In the work of I.C Smart he uses the rate of return of capital to determine the profit. Having constructed the profit test, it is important to ascertain the rate of return of capital employed by solving for the discount rate which equates the initial capital loss to the subsequent stream of profits. In reality, this rate is very subjective. It depends on the management, shareholders and investors. Unless it exceeds a certain level it may not be in the interest of the providers of capital for such business to be issued. Some approaches to determine the minimum level of discount required are:

- External Sources: the extent to which shareholders provide capital. The rate should be comparable to that obtained elsewhere, if there is comparable risk.
- Internal Sources: the extent to which policyholders provide capital. The rate should be in excess of the rate obtained for alternative investment with less risk attached.

A common criterion common used in profit evaluation is the Net Present Value (NPV) with Risk Discount Rate. Net Present Value is the present value of the expected future cash flows minus the cost.

Formula:
$\sum_{k=0}^{n-1} G_k v_{RDR}^k = NPV_{RDR}$

If NPV RDR is greater than zero the product is profitable. Internal rate of return (IRR): Discount rate at which net present value (NPV) of investment is zero. Formula:

$\sum_{k=0}^{n-1} G_k v_{IRR}^k = 0$

If IRR is greater than Risk Discount Rate then the product is profitable and aim of return is reached. However if IRR is less than RDR and greater than zero there is positive return but aim of return is not reached. Lastly, there is a loss if IRR is less than zero.

Expense

The area of expense is difficult to determine since an office is required to analyze its own past experiences both as regards level and trends of unit cost by line of business.

The office also has to decide upon the method of valuation and recovery of overhead (Smart, 1977).The expense can be divided into direct and indirect for better records keeping. In the work of James Anderson he proposed a method of introducing expense that allows allocation in the following ways:

- Expense varies by policy year per policy in force; expense per claim and expense per other termination are used together with a stipulated policy size.
- Percentage of premium expense is divided into commission and other percentage expense with complete flexibility by duration.
- Indirect year expenses are introduced as any indirect renewal expense can be expressed as a percentage of premium renewal expense

Reserve

Reserve is defined as an accounting entry that reflects the contingent liability (Junior, 2004).From an actuary's perspective the reserve must be adequate to demonstrate solvency, adequacy and reliability. A finance director on the other hand disapproves of a strong reserve as it increases the need for capital fund and inhibits expansion (Smart, 1977). Hence an actuary should be realistic and synchronize the two opinions to come up with an appropriate reserve to satisfy both patterns in the industry. This goes a long way to settle the strife that has been waging between the finance and actuarial department for centuries.

Contingent Margin

Contingent margins are required to meet cost of events so different from expected experience that statistical estimates are disqualified. For example the hazard of war or epidemic might be assessed as 25 extra deaths per 1000 per century at each attained age and introduced into the calculation by adding 0.0025 to each mortality rate. These

margins are charges for real but deferred cost. Over a very extended period of time, true profit may be realized from contingency margins, but only if charges made for contingencies proven to be redundant (Anderson, Premium Calculation and Profit Measurement, 1959).It is difficult to make an accurate estimate of persistency due to change in economic condition. Hence the use of conservative estimate of persistency is a practical device for including a contingency margin.

Resilience Testing and Re-Testing

This is a technique used by actuaries in many countries. It offers a more dynamic look at reserving instead of just seeing a snapshot of the position today. A useful approach is to look at a range of future scenarios and to test the ability of the company to meet those scenarios. The actuary should report to the board on the impact of assuming different future scenarios, including testing the impact on the portfolio of future changes in the market, mortality improvement, expenses etc. (DAYKIN, 2000).Profit testing can achieve no useful meaning unless it is ultimately related to the actual results. This is called retesting by product actuaries. Profit testing is done based on assumption for the beginning of the life office but after the office has run actively the product actuary compares his assumptions to what actually happened, and remodels the profit testing system to suit the company. Retesting is a very important aspect of profit testing as it makes the system more dynamic to the economy.

Reason for Model Used

The Model used is under the asset share method. This was adapted in order to illustrate the:

- Incidence and timing of profit.
- Future state of the insurance office in terms of investment strategy.
- Impact of surrenders
- Capital required using a more practical assessment

This model is compact, adequate and can be easy to use. A contingency margin of 0.005 is included to cover for any lack in persistency. The reserve and premium is calculated using the actuarial formula and the modern profit testing model.

Chapter 3

Methodology

3.1 General Commutations Functions

The use of commutation functions bring about some comfort in calculating formulae that are really repetitious in nature. It is therefore fitting for pricing functions and is a tool used by pricing and valuation actuaries. It is also a way by which net single premiums and actuarial present values for various plans are determined. As compared to deriving these values from first principles, commutation functions once derived can be used to simplify and reduce the working that goes into calculating these premiums, actuarial present values, etc. Through commutation functions intermediate values are tabulated and the premium values are expressed as functions of these intermediate values. (Learning Corporate Finance, 2010).

l_x is defined as the number of lives expected to survive to age from a group of newborn lives also called radix represented by l_0. d_x represents the number of lives among the l_0 newborn lives that die in the age range $[x,x+1)$. It is calculated as $d_x = l_x - l_{x+1}$.

The probability that a life currently age x will not survive k years is denoted as ${}_kq_x$ .It is also calculated as ${}^kq_x = \frac{{}_kd_x}{l_x}$

On the other hand the probability that a life currently age x will survive k years is denoted as ${}_kP_x$. This variable is calculated as ${}_kP_x = 1 - {}_kq_x$.

However, in order to make provision for unplanned events, unexpected death and lack of persistency exhibited by policy holders a contingent margin (θ) is introduced. Such that

$$ {}_kq'_x = {}_k\,q_x + \theta \tag{3.1}$$

The standard value for the contingent margin (θ) is given as 0.005

${}_kq_x^0 = {}_k\,q_x + 0.005$ ${}_kP_{x0} = 1 - {}_k\,q_{x0}$

Formula for Commutation Functions

D_x represents the expect lives at age x discounted, in other words it stands for discounted lives.

It is calculated as $D_x = v^x l_x$.

C_x represents the expected death at age range $[x, x+1)$ discounted. Formula is $C_x = d_x v_{x+1}$.

M_x represents the sum to infinity of the discounted death. Formula is $M_x = \sum_{t=0}^{\infty} C_{x+t}$.

N_x represents the sum to infinity of discounted lives. Formula is $N_x = \sum_{t=0}^{\infty} D_{x+t}$.

Other functions are $S_x = \sum_{t=0}^{\infty} N_{x+t}$ and $R_x = \sum_{t=0}^{\infty} M_{x+t}$

The discount factor v^k is calculated as $v^k = \frac{1}{(1+i)^k}$ where i is the interest rate per annum or pricing rate.

Usually the interest rate from the National Insurance Commission (NIC) of Ghana is between 4% and 6% on the average and is constant throughout the pricing valuation.

3.2 Life Insurances

Life insurances can be explained as a contract that provides payment upon death. Assumption: Death Benefit b_{k+1} refers to benefit that are paid to the next of kin when death occurs to the policy holder. It is assumed that the benefit is a unit of 1 for simplicity of the study.

3.3 The n-year Term Life Insurance

This contract pays unit amount at end of the year of death if insured dies within the n-year term. For the discrete model the deduction is

$$b_{k+1} = \begin{cases} 1 & k = 0,1,2,\ldots,n-1 \\ 0 & k \geq n \end{cases} \tag{3.2}$$

$$Z = b_{k+1} v^{k+1} \quad \text{hence } Z = \begin{cases} v^{k+1} & k = 0,1,2,\ldots,n-1 \\ & k \geq n \end{cases} \tag{3.3}$$

The actuarial present value of a n-year term insurance policy is denoted by $A^1_{x:\overline{n}|}$. The superscript "1" over the age *x* shows the death benefit is paid only if death occurs within the n-year term and is computed as

$A^1_{x:\overline{n}|} = \sum_0^{n-1} V^{k+1}{}_kP_x q_{x+k}$, in terms of the commutation functions is $A^1_{x:\overline{n}|} = \frac{M_x - M_{x+n}}{D_x}$ **Proof**

$$A^1_{x:\overline{n}|} = \frac{M_x - M_{x+n}}{D_x} = \frac{\sum C_{x+t} - C_{x+t+n}}{D_x} = \frac{\sum d_{x+t}v^{x+1+t} - \sum d_{x+t+n}v^{x+n+t}}{v^x l_x}$$
$$= \frac{\sum d_{x+t}v^{1+t} - \sum d_{x+t+n}v^{1+n+t}}{l_x} = \sum v^{t+1}\frac{d_{x+t}}{l_{x+t}}\frac{l_{x+t}}{l_x} - \sum v^{t+1+n}\frac{d_{x+t+n}}{l_{x+t+n}}\frac{l_{x+t+n}}{l_x}$$
$$= \sum_0^{n-1} v^{t+1}\ {}_tP_x q_{x+t}$$

(3.4)

3.4 N-year Pure endowment insurance

In this n-year pure endowment denoted as ${}_nE_x$ policy benefit is paid n-years after issue if the policyholder is still alive at that time.

$$b_{k+1} = \begin{cases} 0 & k < n \\ 1 & k \geq n \end{cases} \quad (3.5)$$

$$v_{k+1} = \begin{cases} v^n & k \geq n \end{cases} \quad (3.6)$$

$$Z = \begin{cases} 0 & k < n \\ v^n & k \geq n \end{cases} \quad (3.7)$$

$E_{x:n\_|} = v^n\ {}_nP_x$

And in terms of commutation functions $E_{x:\overline{n}|} = \frac{D_{x+n}}{D_x}$

Proof

$$E_{x:\overline{n}|} = \frac{D_{x+n}}{D_x} = \frac{v^{x+n}l_{x+n}}{v^x l_x} = \frac{v^n l_{x+n}}{l_x} = v^n\ {}_nP_x$$

3.5 N-year Endowment Insurance

In endowment insurance a benefit is paid at the earlier of the time of death (if the policyholders dies within n years of issue) and n-year after issue (if the policyholder survives n years issue).The n-year endowment insurance is denoted by $A_{x:n\overline{|}}$ $b_{k+1} = 1$ for all $k \geq 0$

$$v_{k+1} = \begin{cases} v_{k+1} & k \leq n-1 \\ v_n & k \geq n \end{cases} \tag{3.8}$$

$$Z = \begin{cases} v_{k+1} & k \leq n-1 \\ v_n & k \geq n \end{cases} \tag{3.9}$$

$$A_{x:\overline{n|}} = A^1_{x:\overline{n|}} + E_{x:\overline{n|}}$$

in terms of commutation functions $A_{x:\overline{n|}} = \dfrac{M_x - M_{x+n} + D_{x+n}}{D_x}$

Proof

$$\begin{aligned} A_{x:\overline{n|}} = A^1_{x:\overline{n|}} + E_{x:\overline{n|}} &= \frac{M_x - M_{x+n}}{D_x} + \frac{D_{x+n}}{D_x} = \frac{M_x - M_{x+n} + D_{x+n}}{D_x} \\ &= \frac{\sum C_{x+t} - \sum C_{x+t+n} + D_{x+n}}{D_x} \\ &= \frac{\sum d_{x+t} v^{x+1+t} - \sum d_{x+t+n} v^{x+1+n+t} + v^{n+x} l_{x+n}}{v^x l_x} \\ &= \sum v^{t+1} \frac{d_{x+t}}{l_{x+t}} \frac{l_{x+t}}{l_x} - \sum v^{t+1+n} \frac{d_{x+t+n}}{l_{x+t+n}} \frac{l_{x+t+n}}{l_x} + v^n \frac{l_{x+n}}{l_x} \\ &= \sum v^{t+1}\, {}_tP_x q_{x+t} - \sum v^{t+1+n}\, {}_{t+n}P_x q_{x+t+n} + v^n\, {}_nP_x \\ &= \sum v^{t+1}\, {}_tP_x q_{x+t} + v^n\, {}_nP_x \end{aligned} \tag{3.10}$$

Hence formula for

$$A_{x+t:\overline{n-t|}} = \frac{M_{x+t} - M_{x+n} + D_{x+n}}{D_{x+t}}$$

3.6 Life Annuity

Life annuity is a series of payment made at regular intervals over the future lifetime of an individual. Annuities provide benefit payments contingent upon the survival of the insured.

3.7 N-year temporary life annuity due

In this annuity payments are made only during the next n years and while (x) is surviving. In other words, payments cease on the earlier of:

- The death of the policyholder
- The expiration of n years after the date of issue

$$\ddot{a}_{x:\overline{n|}} = \frac{N_x - N_{x+n}}{D_x} = \frac{\sum D_{x+n} - \sum D_{x+n+t}}{D_x} = \sum \frac{v^{x+t} l_{x+t}}{v^x l_x} - \sum \frac{v^{x+t+n} l_{x+t+n}}{v^x l_x}$$

$$\sum V^t \ {}_tP_x v^{t+n} \ {}_{t+n}P_x = \sum_{t=0}^{n-1} v^t \ {}_tP_x$$

$$\ddot{a}_{x+t:\overline{n-t|}} = \frac{N_{x+t} - N_{x+n}}{D_{x+t}}$$

3.8 Parameters used in Pricing and Profit Testing

3.8.1 Premium for endowment

Premium is the amount of money paid by the insured in periodic interval in order to obtain a form of insurance cover. Using the equivalence principle

$$E(loss) = E(PV\ of\ Benefits) - E(PV\ of\ Premium) = 0$$

$$E(L) = A_{x:\overline{n|}} - P_{x:\overline{n|}} \ddot{a}_{x:\overline{n|}} = 0$$

In other words *E*(*PV of Benefit*) = *E*(*PV of Payments*)

$A_{x:\overline{n|}} = P_{x:n|}\ddot{a}_{x:n|}$

Premium for endowment

$$P\left(A_{x:\overline{n|}}\right) = b_t \left(\frac{A_{x:\overline{n|}}}{\ddot{a}_{x:\overline{n|}}} \right. \qquad ! \qquad (3.11)$$

Where b_k is the benefit to be paid to the insured in the event of death as long as a premium has been paid.

3.9 Reserves

In life insurance the company knows that for an endowment in the nth year the policy would mature and the policy holder would be paid the benefit assured. It is therefore prudent for the insurance company to allocate some of the premium received for future payment of maturity benefit. The allocation process is called reserving. A benefit reserve at time "t" is the difference between the expected value of future benefits and the expected value of future premium:

${}_tV = E(PV\ of\ future\ benefit) - E(PV\ of\ future\ premiums)$

Reserve for endowment is given as

$$ {}_tV\left(A_{x:\overline{n|}}\right) = b_t.A_{x+t:\overline{n-t|}} - P_{x:\overline{n|}}\ddot{a}_{x+t:\overline{n-t|}} \tag{3.12}$$

3.10 Minimum Death benefit guaranteed

A benefit term that guarantees that the beneficiary, as named in the contract, will receive a death benefit if the annuitant dies. The benefit received differs among companies and contracts, but the beneficiary is guaranteed an amount equal to what was invested or the value of the contract on the most recent policy anniversary statement, whichever is higher. (guaranteed, 2010)In calculating minimum death benefit assume that the insured pays for the cost of the minimum death benefit guarantee through level premium payments made at the time of his regular investment contributions (Pedersen).

Minimum Death benefit guaranteed $Db = max\left[P_{x:\overline{n|}}t, b_k\frac{t}{n}\right]$ t= number of payments made, n=total number of payment for the endowment.

3.11 Surrender Benefit

A policy is said to be surrendered when the insured terminates the policy before the end of the term of the contract. This practice is a liability to the insurance companies as they usually are not able to generate enough profit or even make a loss on that policy as it did not run for the required time. This is due to the fact that the premium the assured pays is calculated on the assumption that the premium would be paid 'n' times. In order to discourage policy holders, the insurance company inputs a fine that is extremely high if surrendered in the early period and low if surrendered in the late periods of the policy life. This penalty is embedded in the surrender factor (SF_{x+t}) which gives a portion of the current value of the policy as a surrender benefit. Surrender benefit= Surrender Factor (SF_{x+t}) x Rate of surrender (φ)x Reserve ${}_tV\left(A_{x:\overline{n}|}\right)$x probability of survival (p_x)

Surrender benefit is given as

$$Sb_{x+t} = SF_{x+t}.\phi.{}_tV\left(A_{x:\overline{n}|}\right).p'_x \tag{3.13}$$

3.11.1 Commission

The fee paid to a broker for executing a transaction for the insurance company. The commission is a percentage of premiums that the insured would pay to the insurance company. This is done to attract agents to work effectively and look for more clients for the company. However, the commission payment should be strategic in the sense that if the rate is too low the agents lose motivation. On the other hand if the percentage of premium charged for the first year is extremely high, the agents would encourage their clients to surrender after just a few years and buy a new policy. This enables them get more profit with the commission they obtain in the first year and the insurance company makes a big loss as the policy runs for a short time. Commission should be effective, moderate and reasonable, taking into consideration the human behavior agents may exhibit. $Cm_{x+t} = c\%P_{x:n\text{—}|}$

3.11.2 Expense Charged

Expense is defined as the cost incurred in running the insurance company. Most of the cost are fixed hence the more clients the insurance company has the less the expense charged per person. The theory of unity in numbers is critical in the insurance industry. The more the clients the less risk the company is exposed to hence the company and the clients both benefit as the premium charged tends to also reduce. Expense in some companies is a defined amount that runs for a particular period, whiles majority of companies calculate expense as a particular percentage of the premium. Example company A charges expense as *GHc* 4.00 irrespective of premium paid while Company B charge it as x% of premium. For the reason of this project we will follow the percentage approach used by majority of companies. $Ex \cdot p_{x+t} = e\%p_{x:n\text{—}|}$

3.11.3 Investment Rate Earning (I_a)

The investment rate earning is the rate at which the company invests in order to make some profit. Most companies diversify in their investment in order to reduce the risk associated with investment. Hence the rate used is the average rate at which the companies invest.

3.11.4 Cash Flow for Insurance Pricing

Cash flow in insurance pricing measures how much profit the insurance company is making yearly. This approach considers the profit without considering the fact that the insurance company will be paying claims and the fact that clients may decide to surrender their policies as time goes on. It calculates with the aim of allowing the decision makers to view the maximum profit the company can generate with the parameters inculcated. The only difference between pricing of an insurance policy and that of any other companies is the reserve considered. Reserving is by law, hence must be considered in order to obtain the maximum profit the company can generate.

In insurance pricing techniques one is interested not only in the price of the premium but the expense exhibited, in order to know the internal rate of return. This guides the company to the minimum investment rate required in order to make the policy profitable.

Cash flow : $$CpF_{x+1} = P_{x:\overline{n|}} - Cm_{x+1} - Ex \cdot p_{x+1} - {}_tV\left(A_{x:\overline{n|}}\right) \quad (3.14)$$

Cash flow : $$CpF_{x+t} = P_{x:\overline{n|}} - Cm_{x+t} - Ex \cdot p_{x+t} - \left[{}_{t+1}V\left(A_{x:\overline{n|}}\right) - {}_tV\left(A_{x:\overline{n|}}\right)\right] + i_a \cdot {}_tV\left(A_{x:\overline{n|}}\right) \quad (3.15)$$

As exhibited in the equation (1), the first year cash flow for insurance pricing considers the first reserve as an expense as it is the amount that he company has to take out of its budget and set aside for any eventualities.

In the rest of the years, increase in reserve is the one considered as a liability. Premium is paid at the beginning and benefits are paid at the end. The interest accrued is started from the end, hence at time zero which is equation (1) there is no interest. To enable a company obtain any interest it invests portions of its reserve in short term and long term basis depending on the strategies of the company, keeping in mind that at any time the duty would be laid on it to pay claims.

3.11.5 Internal Rate of return (IRR)

IRR is defined as the discount rate at which net present value (NPV) is zero. The internal rate of return is simply the rate of return on an investment. The risk discount rate (RDR) is the cost of borrowing or using money for investments. It may also be called the shareholder interest rate, as this rate is used in paying its various shareholders their dividends. This rate is very subjective and depends on the company, however majority of companies use an RDR of 15%. The decision to judge a policy as profitable or not depends on the whether the internal rate of return is higher than the risk discount rate. Policy is profitable if the IRR is higher than the risk discount rate or the cost of borrowing. There are also financing decisions, where there are cash inflows followed by cash

outflows. For example, companies receive payment in the beginning and then incur costs later. In the case of financing projects, the decision criteria is opposite to that of the investing projects. The financing project is accepted if the IRR is less than the risk discount rate. (Jones, 2004).Simply, if the IRR is being calculated of cash flows for cost, the IRR being less than the RDR is considered profit.

Internal rate of return $\sum_{t=0}^{n} \frac{CpF_{x+t}}{(1+irr)^t} = 0$

3.11.6 Cash Flow for Profit Testing

Profit testing is an essential part of pricing process. After a policy has had a tentative price developed and the set of pricing assumptions determined by the technique of insurance pricing the profit test process begins. The first time a profit test is applied to the set of tentative prices and assumptions, it yields a different profit margin than the company's target.

Profit testing mechanisms should therefore be flexible since the next step is the consideration of what changes can be made in prices, assumptions or plan design that will help he company meet their product needs at desired level of profit. An early step in profit testing is a "sensitivity analysis". Sensitivity analysis uses pricing model that has been chosen to estimate the effect on price or profit by making small changes in assumptions which generally vary major assumption. It is not unusual to have many different sets of pricing and assumption scenarios tested before a final pricing level is agrees upon. Profit testing must also be fairly complete if there are "weak prices" in the set of profit tests (i.e. classes or ages where the desired profit level is not achieved). Those are the ages or classes that are most likely to attract higher than expected sales. Profit testing cannot afford to overlook them.

These requirements of good profit testing methods, flexibility and completeness tend to be antagonistic to each other. The more complete a profit test is, the less flexible, and vice versa. It is the work of an actuary to strive to maintain a balance between the two (Albert Easton, 2007).

Formulae for Profit testing:
Cash flow for profit testing $CpF_{x+t} = CpF_{x+t}\ {}_tP'_x\delta_{x+t} - Db_{x+t}\ {}_td_x\delta_x - Sb_{x+t}\delta_x$ δ_x= number of active policy at age x.

This formula does a profit test for an individual as well as a group. It is a buildup of the insurance pricing model which considers claims paid such as death benefit and the lapses such as surrendered benefit. This model is far from the ideal of what insurance companies would prefer, however it is far more realistic and must be calculated well in order to plan and price the product. After profit testing then the final premium charge, commission paid, expenditure charge, minimum death benefit guaranteed and lapse benefit can emerge.

3.11.7 Net Present Value (NPV)

The NPV calculation finds the net present value using a predefined discount rate known as the risk discount rate (RDR). In profit testing the NPV is used to calculate the present value of premium cash flow and the profit cash flow. These two parameters are then used to determine the profit Margin. Net Present Value for premium

$$NPV\left(P_{x:\overline{n|}}\right) = \sum_{t=0}^{n} \frac{P_{x+t:\overline{n-t|}}}{(1+i_{rdr})^t} = 0$$

Net Present Value of Cash flow

$$NPV\left(CpF_{x+t}\right) = \sum_{t=0}^{n-1} \frac{CpF_{x+t}}{(1+i_{rdr})^t}$$

3.11.8 Profit Margin

Profit Margin uses the simple ratio and proportion to determine profit emerged at the end of the n- year. It is the NPV of profit cash flow divided by the NPV of premium, and it shows the percentage of the premium that emerges as profit.

Profit margin is given as

$$Profit = \frac{NPV\left(CpF_{x+t}\right)}{NPV\left(P_{x:\overline{n|}}\right)} \tag{3.16}$$

3.11.9 Flow Chart

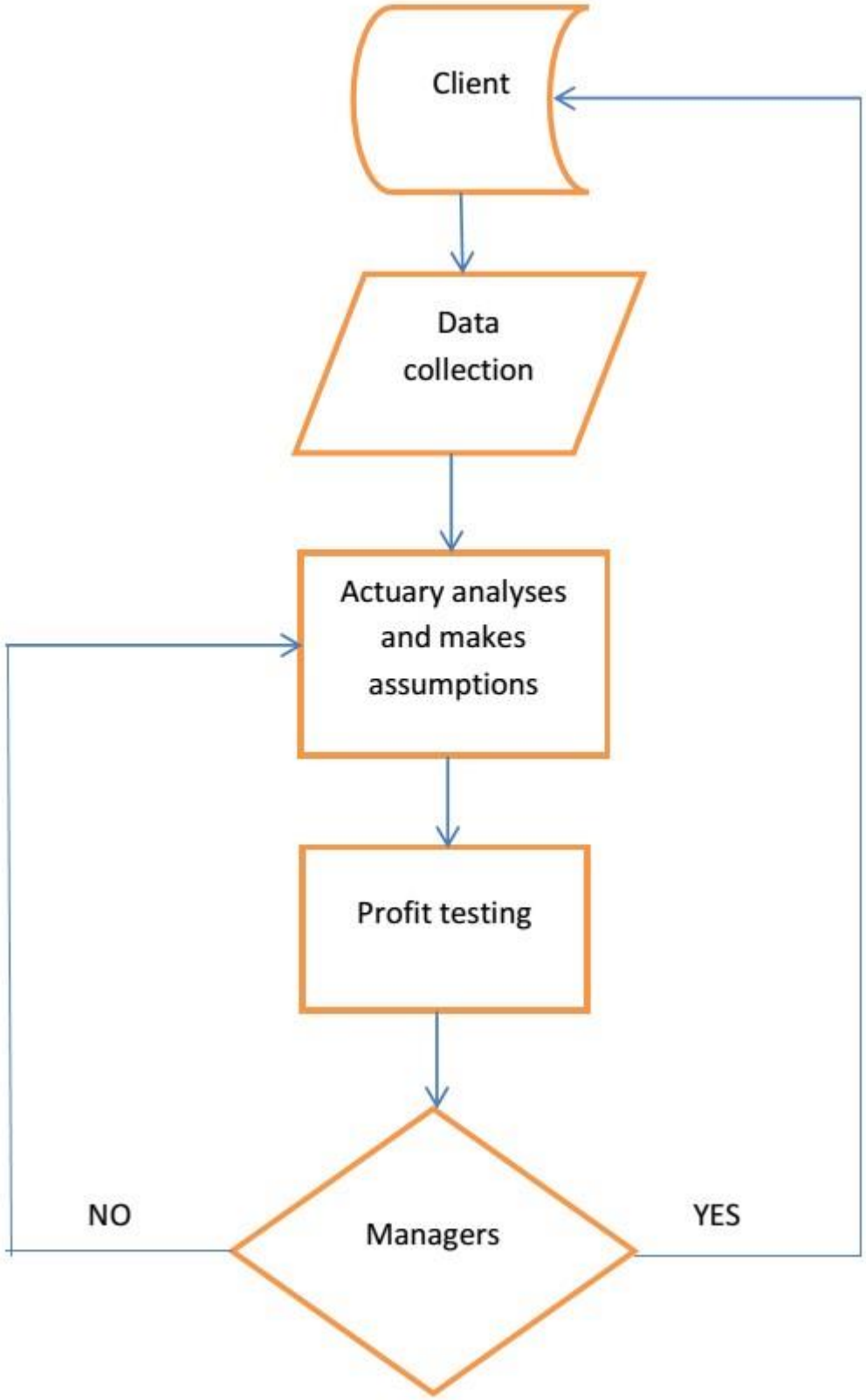

Figure 3.1: A flowchart that exhibits information flow from the time data is obtained from client to when the premium to be charged and other conditions of the contract is communicated back to the client.

Chapter 4

Data Analysis

4.1 Data Collection

Data was collected from three insurance companies in Ghana. The data can classified as Company A, company B and Company C. The data included investment rate, commission and expense paid out for the first year, second year, third year and continuing years per policy, minimum year required before surrender and the shareholders rate also called dividend rate. Assumption:

- The pricing rate is 5% of the sum assured for all company analysis.
- The number of policies in force at the start of the policy period is hundred (100)

4.2 Software Used In Analysis

- A profit testing program was written in Visual Basic using the formulae explained in chapter 3.
- Microsoft Excel

4.3 Analysis of Data

4.3.1 Results of company A

Table 4.1: Results of company A

Age	30	commission 1st year	17.50%	premium	GHc813.14
number of payments	30	commission 2nd year	7%	Internal rate of return	86.41%
sum assured	50,000	commission 3rd year	7%	NPV of premium	GHc4347.18
Investment rate	18%	expense 1st year	GHc70.00	NPV of cash flow	GHc 5982.38
Shareholder's rate	12.50%	expense 2nd year and beyond	7.5%	profit	72.67%

Company A, has an average commission rate, average investment rate, a high first year expense of GH c 70 which is fixed irrespective of the premium paid hence the policy a huge loss of GHc188.56 for the first year. The rest of the cash flows are positive since the expenses charged for the rest of the years are very low. The internal rate of return is 86.41% which greater than the shareholder interest rate of 12.5% means that the profit obtain exceeds the profit expected.

The Risk Discount Rate also referred to as the interest given to Shareholders is 12.5% which is moderate hence the company pays them the dividend and the rest is their profit. Company A obtains a profit of 72.67% which means that 72.67% of the PV of the total premium calculated is converted to positive cash flow. In analyzing the graph of the cash flows, the first year loss is exhibited, and then the second year up to the forty fifth year the graph increases gradually. The lowest value of GHc-188.57 in the first year increase steadily to GHc 2589.26 in the final year. At the nineteenth year there is a depression at the company makes a higher provision for the surrender value and this slightly reduces the cash flow exhibited.

Company A has a profitable product and is efficient. It makes high provision for expense to run the company, pays moderate commission to its agents to motivate them, pays its shareholders a rate below the Treasury bill rate to sustain a moderate flow of capital and has less investment rate, hence less funds available to pay claims promptly. Its gives out more of its money, makes higher provision and receives moderately less funds.
This model is moderately efficient and can be improved by increasing the investment.

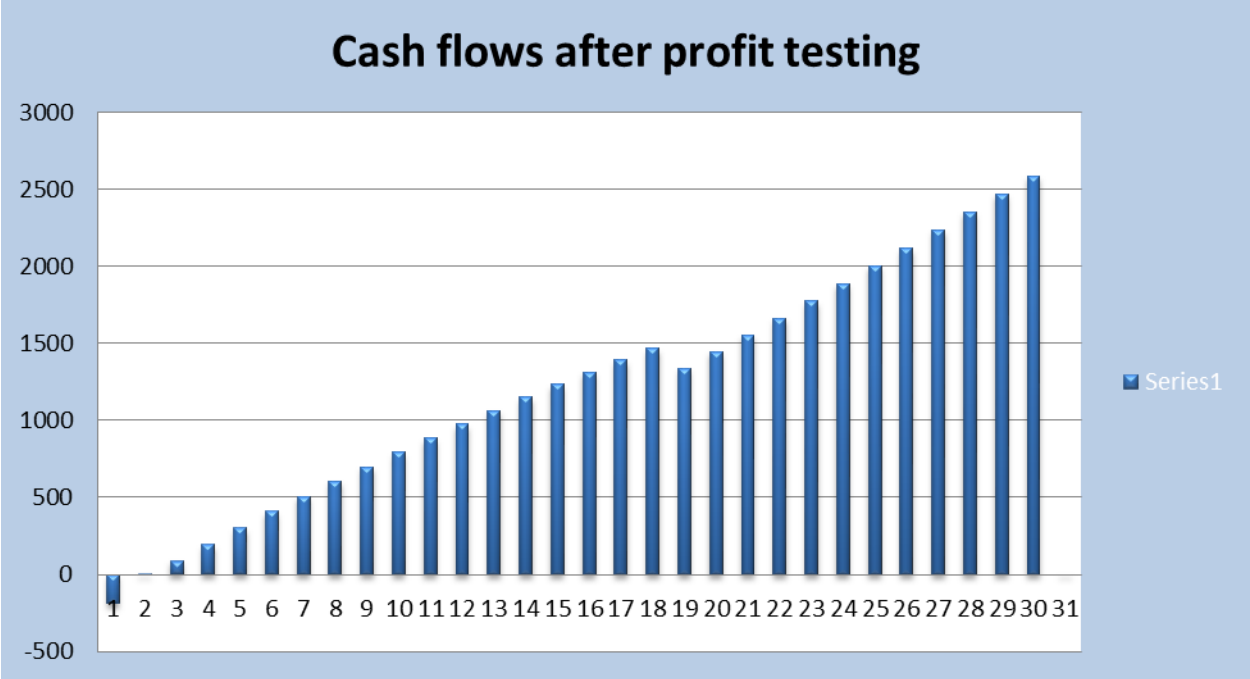

Figure 4.1: Cash flows after profit testing Company A

4.3.2 Results for Company B

Table 4.2: Results of Company B

Age	30	commission 1st year	25.00%	premium	GHc813.14
number of payments	30	commission 2nd year	7%	Internal rate of return	470.79%
sum assured	50,000	commission 3rd year	5%	NPV of premium	GHc5783.54
Investment rate	90%	expense 1st year	GHc0.00	NPV of cash flow	GHc 40032.54
Shareholder's rate	13.00%	expense 2nd year and beyond	0.00	profit	692.18%

Company B exhibits a different pattern from that of company A. This is due to the fact that company B has a huge investment rate of 90% of the premium and makes no provision for expense hence no expense charge is considered. Instead it is added to the amount to be invested increasing the cash flows considerable. The premium paid is the same GHc 813.14 since the same pricing rate is used. The internal rate of return is gigantic hence reflects an extremely huge profit.

The company also pays its shareholders a relatively low interest in respect to the rate of investment, hence the rest of the amount goes into the company coffers and the profit is 692.18%.That means the 692.18% of the present value of the premium expected will be converted to positive cash flow. In such a situation, the company can increase the

percentage of shareholder rate and enable clients get more profit. Company B exhibits an investment policy due to way the expense is ignored at the investment rate is so profound.

In analyzing the graph below, the first year has a negative value of GHc-179.55 which is extremely low. This is due to the fact that the huge first year expense which accounts for a chunk of the negativity in the first year has been eliminated.

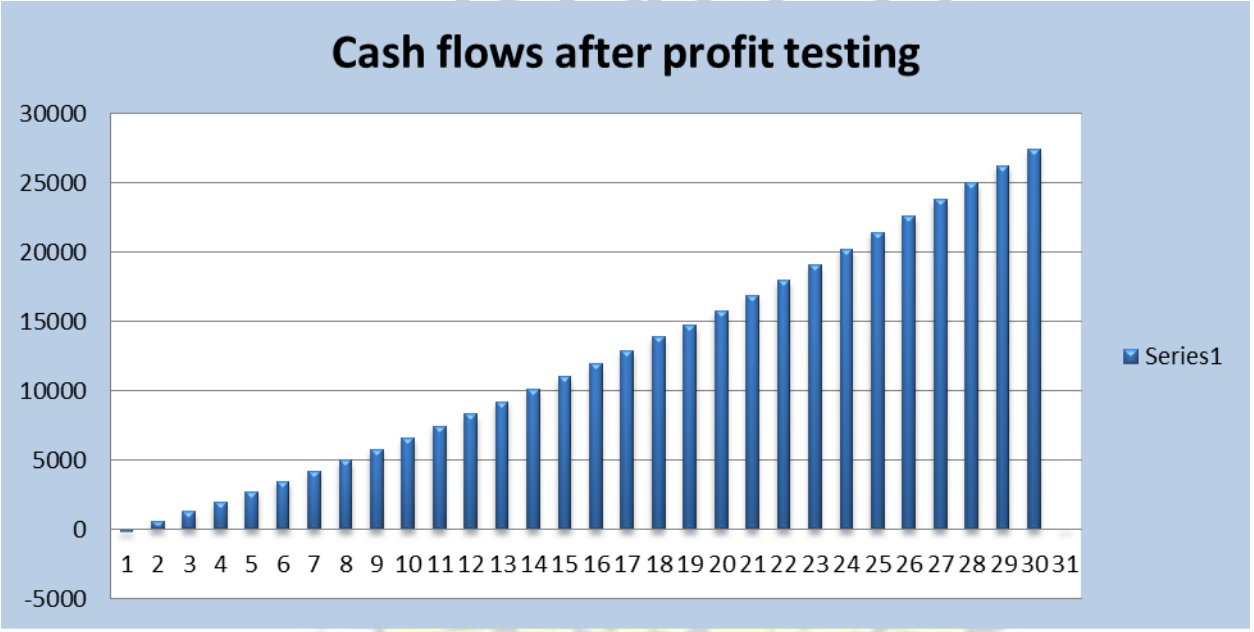

Figure 4.2: Cash flows after profit testing for Company B

The graph increase at a faster rate than that of company A and the cash flow values are also far higher as the graph of company B has a steeper slope. It increases form GHc-179.55 in the first year to GHc27446.76 in the final year. The provision factors used in Company A is the same used in Company B however there is no depression on the nineteenth year in this graph, due to the fact that the high investment rate of 90% overshadows that depression. In other words the interest obtain in the nineteenth year is so huge it covers up the surrender value that is a liability to the company making the graph rise steadily throughout.

Company B has an extremely profitable product by analyzing the profit margin. It has huge amount of reserves accumulated to pays claims. However, there is no provision

made for expenses, that provision is invested and accounts for the huge profit margin. So expense is paid out of the profit gathered. This is a very risky venture since a fall in the investment made would be a huge impediment to the smooth running of the company. Salaries of workers would be at a standstill, expenses would not be paid and the amount reserved to pays claims would be highly inadequate. The model can be classified as efficient only when the investment rate is high.

4.3.3 Results for Company C

Table 4.3: Results of Company C

Age	30	commission 1st year	10.00%	premium	GHc813.14
number of payments	30	commission 2nd year	7.50%	Internal rate of return	243.34%
sum assured	50,000	commission 3rd year	5%	NPV of premium	GHc6917.05
Investment rate	18%	expense 1st year	GHc4.45	NPV of cash flow	GHc 6403.04
Shareholder's rate	10.50%	expense 2nd year and beyond	4.45	profit	92.57%

Company C has a similar pattern to that of Company A due the fact that the investment rate is the same and the commission hovers around similar rates. However the expense of the first is different, and is relatively low as compared to company A but the continuing years of company C has a higher expense as compared to Company A. The premium is GHc 813.14 and the internal rate of return is 243.34% which is way higher than that of Company A's 86.41% this is due to the low expense in Company C.

The profit of 92.57% Company C is higher than that of Company A as a result of company C paying lower shareholder rate of 10.5% to that of 12.5%. In analyzing the graph below, first year and second year have a negative value, on the other hand the graph increases in the same pattern as company A. One can therefore conclude that company product A and Company product C are very similar.

Company C, has a profitable product which is efficient. Expense is catered for, commission given is low compared to that of company A and B, there is low shareholders rate in comparison to other companies analyzed. One can conclude that company C gives out less of the premiums charged in order to increase profit. The efficiency of the model

can be improved by increasing the investment rate, which would make more provision for an increase in rate given to shareholders and agents to motivate them.

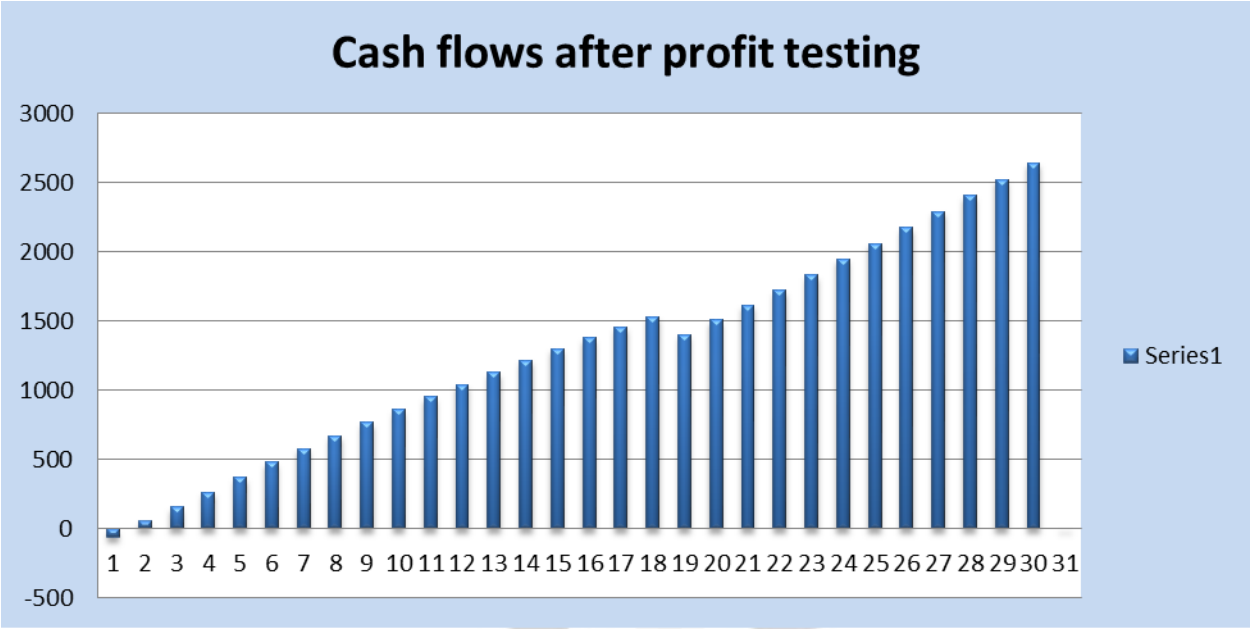

Figure 4.3: Cash flows after profit testing

4.4 Analysis of Pure Premium

Pure premium is the premium charged to cover loss before taking account of expense and profit. In the assumption stated the interest rate used was 5% hence a constant pure premium of GHc813.14. However the pure premium calculation varies with the change in interest rate or discount factor as illustrated in the table below.

Table 4.4: Pure Premium

Interest Rate	Premium GH c
3%	1110.86
5%	813.14
8%	508.90
10%	376.44
12%	283.49

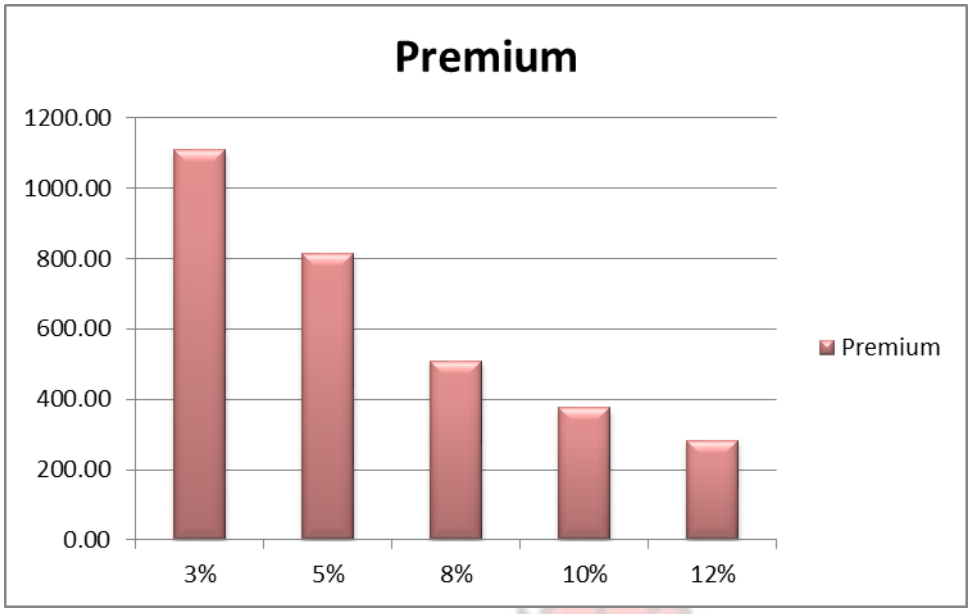

Figure 4.4: Premium

The pure premium charged decreases with increase in interest rate. Interest rate is defined as the cost of borrowing capital, simply put, the interest given to policyholders. This reduction in pure premium is due to the fact that the higher the cost of borrowing less is borrowed and vice versa. The reduction in the pure premium automatically affects profit. However a reduction in pure premium goes a long way for the insurance company in the sense of competition on the market. However company can only increase the rate given to policyholders hence reducing premium when the reduction would no cause a loss. In other words this approach is advisable when the company has over exceeded its profit margin by a large percentage example is company B with a profit margin of 777.7%.

4.5 Ideal Model

Table 4.5: Results of Ideal Model

Age	30	commission 1st year	25.00%	premium	GHc813.14
number of payments	30	commission 2nd year	12.50%	Internal rate of return	58.27%
sum assured	50,000	commission 3rd year	5%	NPV of premium	GHc 5096.77
Investment rate	24%	expense 1st year	50%	NPV of cash flow	GHc 5109.65
Shareholder's rate	15.00%	expense 2nd year	15%	profit	100.25%
		expense 3rd year and beyond	7%		

The ideal model is the model 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 run of the company and at the same time having a good amount of funds to pay all claims promptly.

In analyzing, the table of the ideal model, one would notice a high investment rate of 24% which is achievable as the average lending rate is 24% to 35%, a shareholder rate of 14% which is attractive, a high commission paid to agent of 25%, 12.5% and 5% for the first , second and third year respectively, which is above the average rate of 17.5%, 7% and 5%.The expense charged is lower than the average ones used,secondly the expense is spread out over three years instead of the two years the company A,B and C use. The ideal model has a first year of 50% which is higher than the average of 70%, second year expense of ideal model is 15% which is higher than the average used of 7% and the third year of the ideal model and the one used by other companies is the same. In effect the expense in the ideal model is 12% less than the average used.

In effect the profit margin is 100.25%, which is very high and all stakeholders benefit from this model. This model is effective, profitable and has a substantial amount to pay claims. One can conclude that in the ideal model more is given to its stakeholder and there is a huge profit margin.

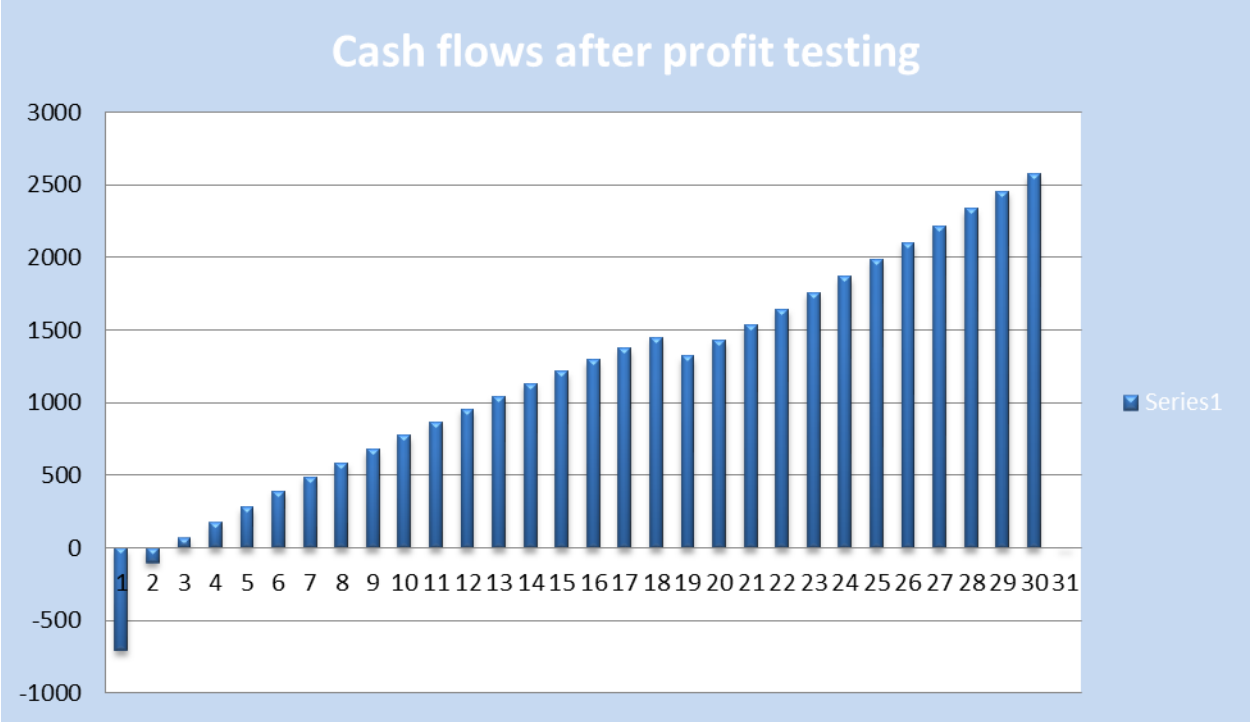

Figure 4.5: Cash flows after profit testing for Ideal Model

Chapter 5

Conclusion and Recommendations

5.1 Conclusion

An Ideal model was obtained after the analyses of the three insurance companies and that produced a 100.25% profit which indicates that the investment rate has the most effect on the profit margin, followed by the shareholder rate, expense charged and commission paid. The premium charged plays a role, however the same premium can produce a very high profit margin if the investment rate is increased and expenses spread over the years.

Recently, due to the economic changes around the world, insurance companies are asking for an increase in premium in order to increase profitability. However from the results obtained, in order to achieve this aim, insurance companies should not only concentrate on the premium increase but increase rate of investment, reduce the expense charged, spread the expense over a longer period of three years instead of two, and charge a substantial shareholder rate to attract investors.

5.2 Recommendation

In light of the project done, it would be expedient for insurance companies to liaise with banks in Ghana to enable them obtain high interest rates on amount of money invested in their bank. For further studies, legal issues can be considered alongside an appropriate model that would satisfy both the bank and the insurance company. This would improve and strengthen bancassurance in Ghana.

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Appendix A

Questionnaire used for data collection

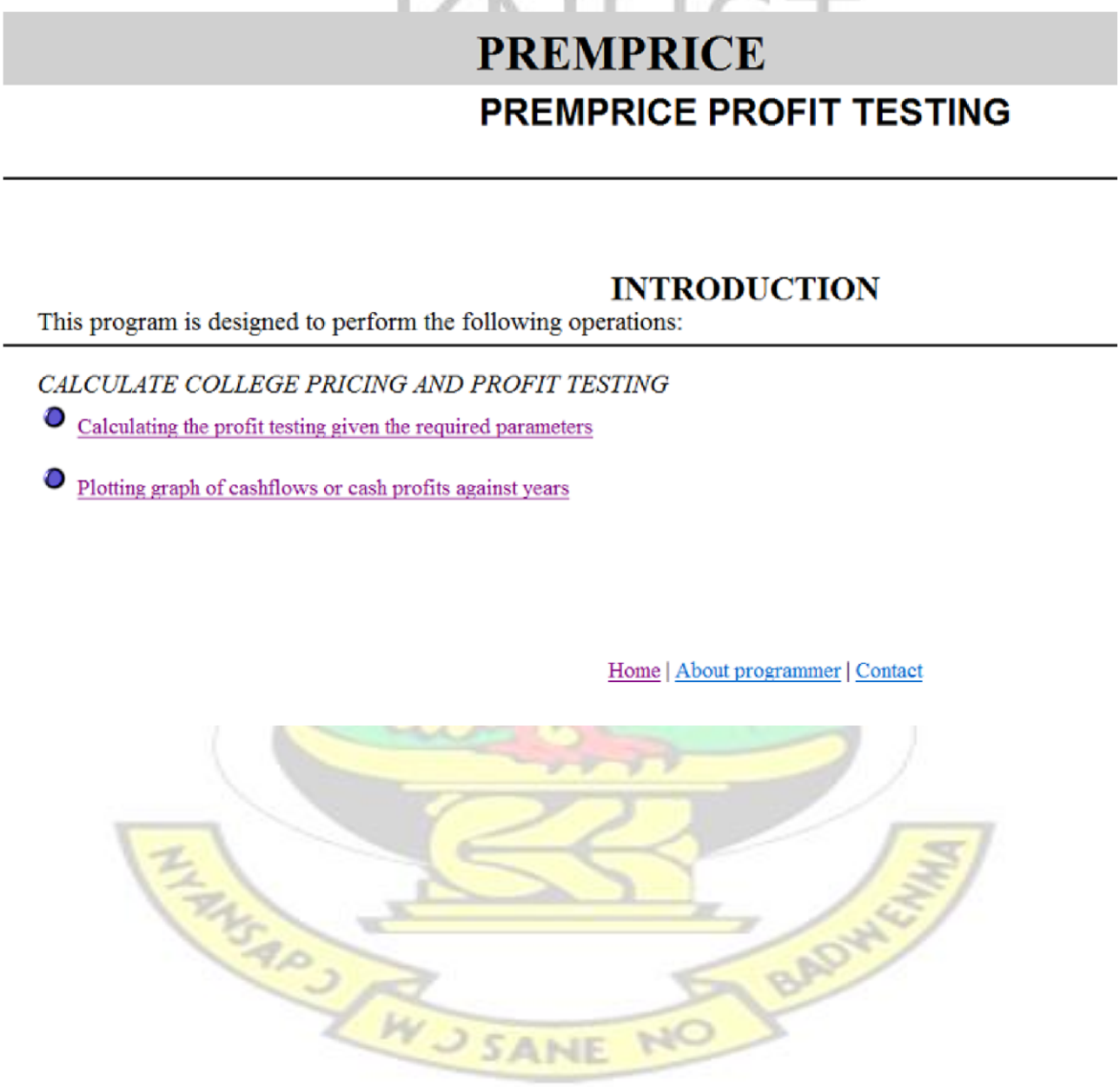
1. What life products do you have? .....
   .....
2. What is the minimum premium charged? .....
3. What percent of premium is paid as commission to agents for the first year.....%,and what percentage is paid for the continuing years if policy is active .....%
4. Expenses charged per policy for the first year .....%,and whatpercentage is charged as expense for the continuing years if policy is active .....%
5. Minimum years required before a policy is surrender .....
6. Average surrender rate for a life product .....%
7. What rate does the company invest the premiums received in order to satisfy the customer .....%
8. What percentage interest rate is given to investors and shareholders as dividendin order to attract more capital to keep the company running.....%
9. What is the interest rate used by the company to calculate the premium .....%

Appendix B

SOFTWARE USED

This depicts the software developed in VB.Net and how it was operated to analyze the data collected.

Figure 5.1: PremPrice Software



PREMPRICE

FOR AN INDIVIDUAL SET OF DATA

By double-clicking on the icon on the desktop or running the program from the **<START MENU>** , this window is presented displayed

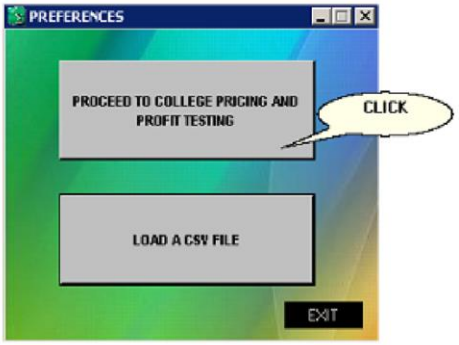


Figure 1

Figure 5.2: PremPrice Software

Figure 2 will be presented.

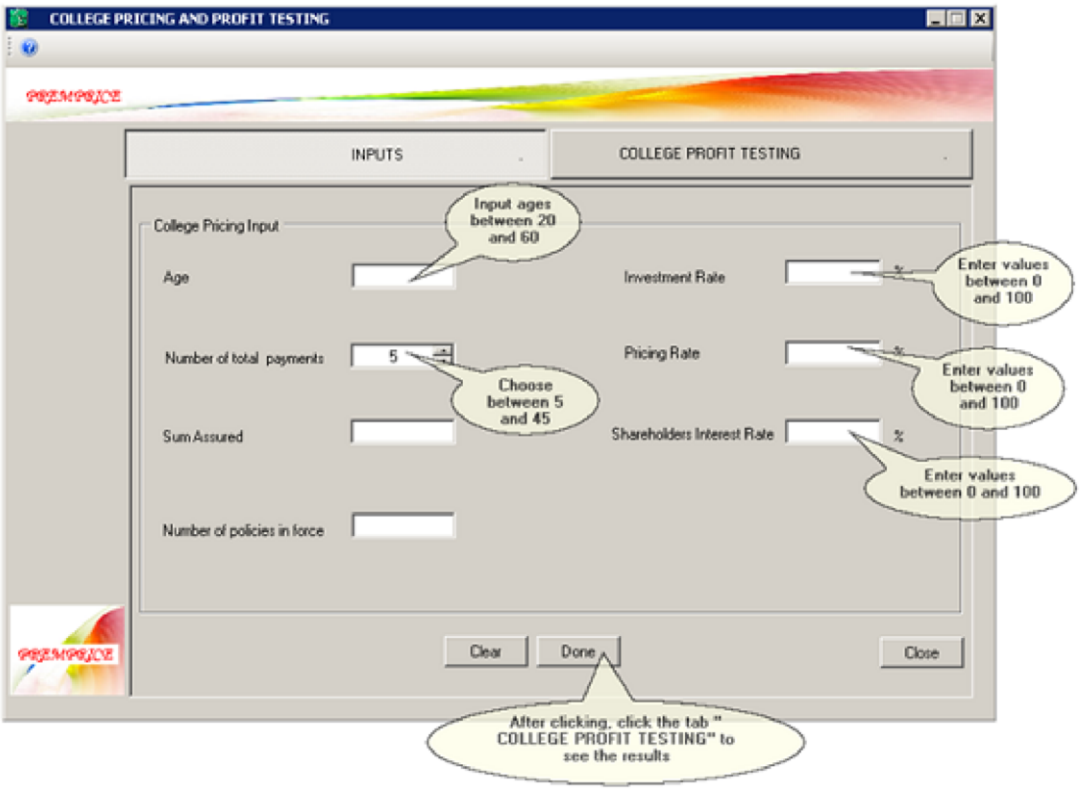
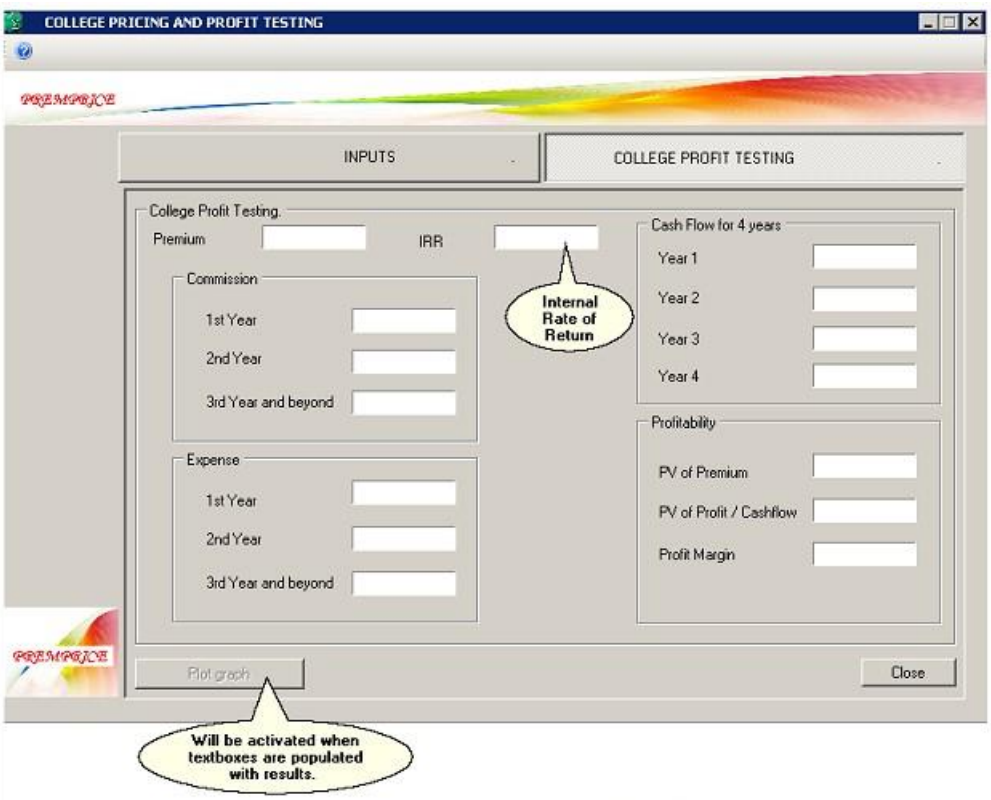


Figure 2: College pricing and Profit testing /INPUTS/

By clicking **<Done>** and again, clicking on the tab **<COLLEGE PROFIT TESTING>**, Figure 3 will appear populated with

Figure 5.3: PremPrice Software



.Figure 3: College pricing and Profit testing /COLLEGE PROFIT TESTING/

Plotting of graphs

Figure 5.4: PremPrice Software

Figure 5.5: PremPrice Software

By clicking **<Plot graph>** on the tab **<COLLEGE PROFIT TESTING>**, Figure 4 will appear prompti

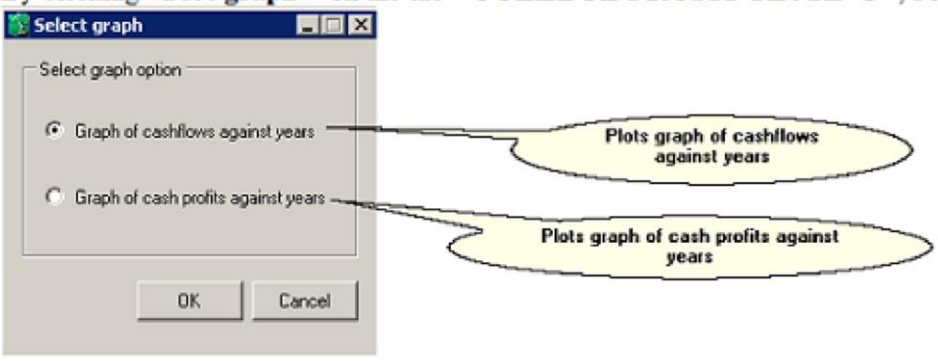


Figure 4: Graph Selection

Using sample data, Figure 5 shows Graph of cashflows against years, when <OK> is clicked

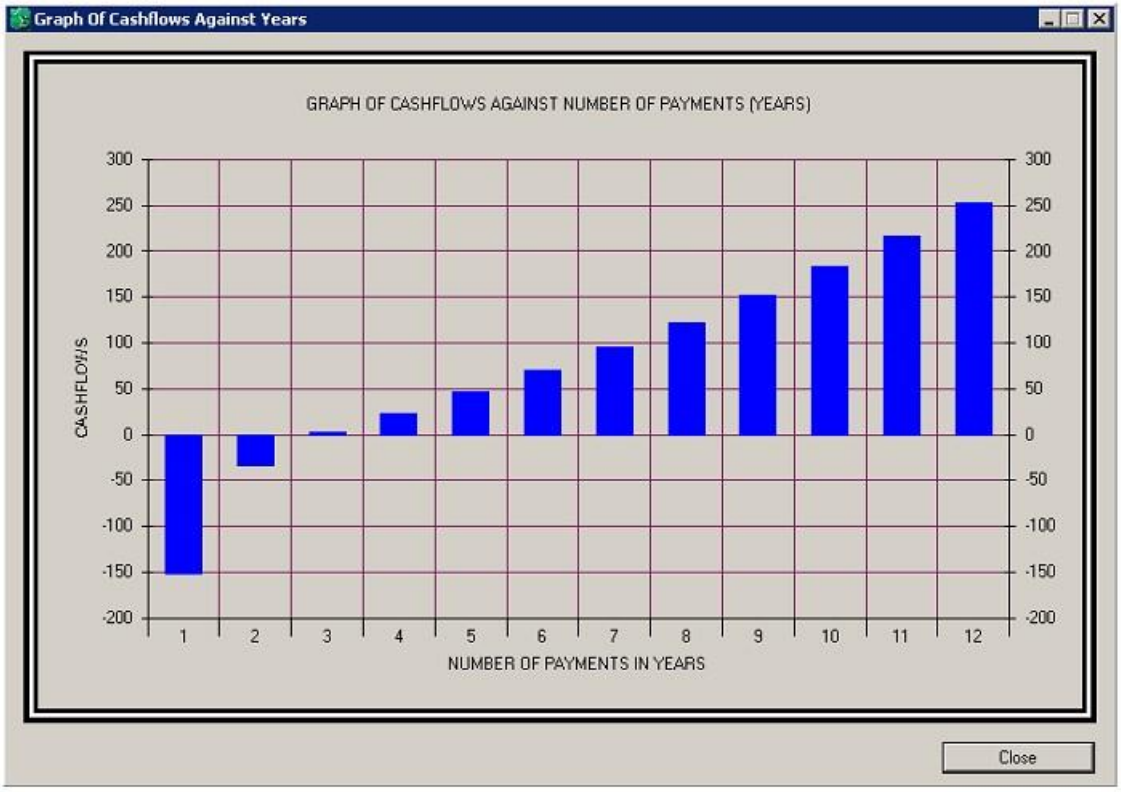


Figure 5.6: PremPrice Software Figure 5.7: PremPrice Software

Figure 5: Graph of cashflows against years

Using sample data, Figure 5 shows Graph of cash profits against years, when <OK> is clicked

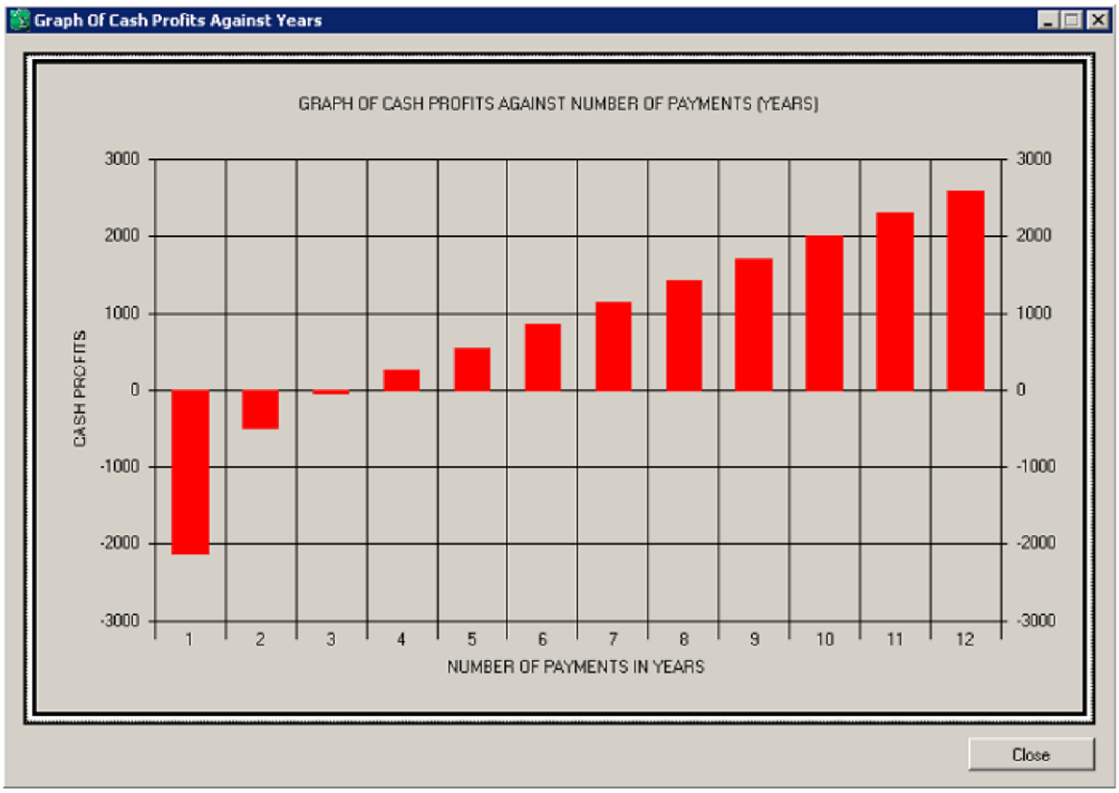


Figure 6: Graph of cash profits against years