PRODUCT DISSERTATION STRUCTURE

\*Use hard cover black with gold print

COVER PAGE

A Model to Design and price a .....

by

Kiwana Susane

September 2022

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\*Print only one side

Page i

\*Use only upper case on this page except for "A dissertation.."

Makerere (logo) University

College of Business and Management Sciences

School of Statistics and Planning

Department of Statistical Methods and Actuarial Sciences

A Model to Design and price a .....

By

Kiwana Susane

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A Dissertation Submitted to the School of Statistics and Planning in Partial Fulfillment of the Requirements for the Award of the Degree of Bachelor of Science in Actuarial Science of Makerere University.

September 2022

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DECLARATION

I, Kiwana Susane hereby declare that this report I have presented is entirely original except for where quoted and has never been submitted for the award of any degree at the University.

Signature.... Date.....

KIWANA SUSANE

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APPROVAL

This research proposal has been submitted with my approval as the student's supervisor.

Signature.... Date....

Mr. SEBUUFU MUSA

Lecturer,

Department of Statistical Methods and Actuarial Science,

School of Statistics and Planning,

College of Business and Management Sciences,

Makerere University.

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DEDICATION

I dedicate this research project to the Almighty God, my parents Ruth Katale and James Katale; my brothers Nelson Guest Katale, Patrick Katale, Edward Lubega and Mrs. Sarah Kabaija.

Thank you all for the support through this academic journey.

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ACKNOWLEGEMENT

I thank the Almighty Lord God for enabling me and giving me the ability to complete this research project.

I also thank my fellow students at the University for the continuous academic support and encouragement.

I would also like to extend my gratitude to my supervisor Mr. Sebuufu Musa for his guidance throughout the undertaking of this research project.

Lastly, I'm thankful to my family for their continuous support throughout the undertaking of this project.

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EXECUTIVE SUMMARY

The major objective of this study was to design and price ...

Other specific objectives related to this study were to ....

The key assumptions made in this study were ....

\*Summarise each of the sections that come after the table of contents

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TABLE OF CONTENTS

\*(Should I include pages i-vi)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study (\*in bold)

1.1.1 Overview

1.2 Problem Statement

1.3 Objectives

1.3.1 Main Objective

1.3.2 Specific Objectives

(\*Specific objectives include for example: yield a profit margin of greater than x%, product should be resilient to economic changes , any other)

CHAPTER TWO: DATA AND ASSUMPTIONS

2.1 Introduction

2.2 Assumptions

2.3 Explanation of Each Assumption

CHAPTER THREE: METHODOLOGY

3.1 Introduction

3.2 Software tools and Model Used

3.2.1 Calculations for each step

CHAPTER FOUR: RESULTS AND SENSITIVITY ANALYSIS

4.1 Introduction

4.2 Presentation of Results

4.2.1 Multiple Decrement Tables

4.2.2 Results from Excel

4.3 Discussion of Results from Excel

4.4 Sensitivity Analysis

CHAPTER FIVE: CONCLUSION AND RECOMMENDATION

5.1 Introduction

5.2 Conclusions

5.3 Recommendations

REFERENCES

APPENDICES

Appendix 1:

\* The following are suggestions to add as Appendices 1 to n.

- Multiple decrement tables for males

- for females

- annual premium rates for the term policy for a male life

- profit margin for different ages and terms

Appendix 2: Python Source Code

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LIST OF TABLES

Table 1:

Table 2:

etc.

page ix

LIST OF FIGURES

Figure 1: Variation of ... with ...

\*Here you indicate the graphs

page x

LIST OF ACRONYMS

IRA -

NPV -

etc

Page 1

CHAPTER ONE

INTRODUCTION

1.1

Introduction

This chapter presents/explains/entails/shows the ....

etc

Page 2

CHAPTER TWO

DATA AND ASSUMPTIONS

• Summarise the assumptions in a table

\* Generally assumptions include Mortality, interest rate, risk discount rate, expenses for initial, 2nd and other years, commission for initial, 2nd and other years, policy term. sum insured, annual premium rate, critical illness rates, disability rates, rate of growth, management charges, surrender rates

\* Check IRA reports and forms for commissions. Or even other countries if all fails.

\* Risk discount rates are got form CPI.

\* For expenses, you can choose an insurance company with a similar product or check IRA Facts final PDF

\* get management charge from IRA, e..g teh annual insurance report of 2012 which was 3%

Page 3

CHAPTER THREE

METHODOLOGY

\* Show the versions. Microsoft Excel 2019, Python 3.60

\* Put the computations/formulae in table

\* See pictures taken

Page 4

CHAPTER FOUR

RESULTS AND SENSITIVITY ANALYSIS

\* here. where you include multiple decrement tables and profit tables

\* then plot graphs,eg. profit margin against age

\* see pictures taken for sensitivity analysis

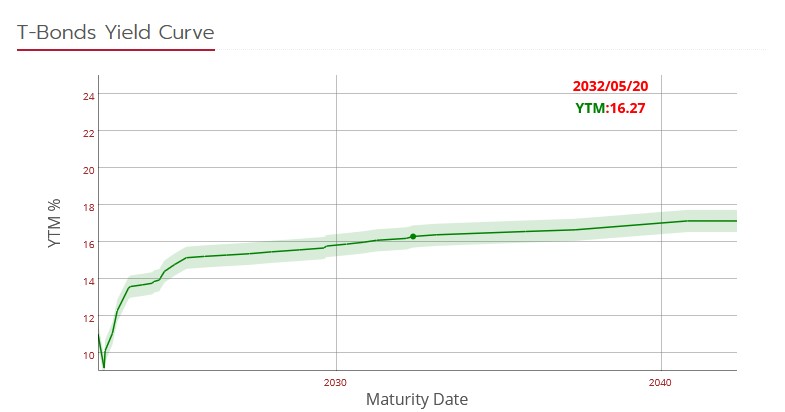
THE REST IS SELF EXPLANATORY AND ONLINE RESEARCH

EH!

\* Clarification

When Sebuufu said do for one life. You're going to do for a male unborn, for a female unborn.

But this applies more to those using life insurance policies where you first fo for a life aged 25, then 26, then 27, etc and both male and female.

REFERENCES

* For Uganda Mortality Tables (2015-2019): <https://ira.go.ug/download/uganda-insurance-task-mortality-tables/>
* For financial institutions charges (as at 1 April 2022): <https://www.bou.or.ug/bou/bouwebsite/bouwebsitecontent/Supervision/Banking_Charges/index.jsp?year=2022>
* The T-Bills Yield Curve: <https://www.bou.or.ug/bou/bouwebsite/FinancialMarkets/tbillsyieldcurve.html>
* Invitation to Tender Treasury Bills: <https://www.bou.or.ug/bou/bouwebsite/FinancialMarkets/tendertreasurybills.html>
* Debt instruments: <https://www.use.or.ug/content/debt-instruments>
* Public Health Statistics: <https://www.ubos.org/explore-statistics/25/>
* Insurance tax in Uganda: <https://www.independent.co.ug/insurance-companies-restless-over-increasing-taxation/>
* Insurance laws: <https://ira.go.ug/laws/>
* Insurance Regulations: <https://ira.go.ug/regulations/>
* <https://www.annuity.org/annuities/fees-and-commissions/>
* Infant mortality rate: <https://www.ubos.org/wp-content/uploads/2021/03/UBOS-WOMENS-DAY-BROCHURE-2021.pdf>
* Inflation rate: <https://www.ubos.org/wp-content/uploads/publications/06_2022CPI_JUNE_2022_PRESS_RELEASE.pdf>
* WHT: <https://www.ura.go.ug/resources/webuploads/INLB/WITHHOLDINGTAX08_12_2021.pdf>
* Commission rates: Kenya Insurance Act Revised 2020 pg.282
* Expenses: Kenya Insurance Act Revised 2020 pg.274

My Product: Structure and Benefits

* So, having thought about my product. Here's what I think about structure and benefits.

STRUCTURE

* It's a deferred annuity due product.
* I'm going to break it down into packages. Packages will vary by lump-sum. Lump-sum amounts will start from UGX 5m onwards such that monthly payments are at least 200k per month. The term of the product is going to be 36 months from the first payment. The first payment will be made 4 months after 3 months of pregnancy (in the 2nd trimester). Why? 4 months is not too long. It being longer may discourage policyholders from applying.
* It's not going to have a unit-linked component. Why? To minimize risk. Since this is a short period of time and payments are made monthly, it’s not wise to put money in the stock markets or even lending to the government (treasury bills are 91 days long at least). What happens when a surrender happens when the cash is still with the government?

BENEFITS,

* So, when the lump-sum is paid out, usually 3 months after pregnancy (the 2nd trimester), the insurance company will start investing the money. Payments will start being made 4 months after the lump-sum and they will be level. This is to cater for those who will have premature pregnancies at 7 months. Now, payments are made on a monthly basis at the end of each month.
* If the policyholder wants to cancel the policy, surrender value will be provided after deducting expenses. As the months go by, the surrender value will decrease until the policy expires.
* If the child dies, it's the same as the policy being cancelled. The policy holder will receive a sum equal to the surrender. However, there will be terms on who receives this payment to prevent morale hazards.
* Generally, this product will be similar to a pension product.
* The lumpsum is going to be 10m. we’ll start with that.
* We’ll have just initial commission since we have lumpsums received at onset.

IDEAS

* There is a risk of a child dying pre or post birth. How much shall we return when this happens?
* What about those parents who will have twins, triplets or quadruplets, quintuplets, etc.?
* There will be circumstances where the parent will want to take up multiple policies. They have a kid this year and the next year and take up multiple policies. Will expenses reduce in this case?

SECTIONS

I’m breaking up the entire project into sections:

* The investment section. Expenses, short term investments, lumpsum, surrender
* Risk management. Identifying risk factors, quantifying them and matching assets to liabilities/claims.
* The product and features.
* The Python Code. Create your code in such a way that the user inputs parameters at the start and the program does everything including outputting to Excel.
* Costs I’m looking at. Tax, Commissions, initial Expenses, management fees.

He says a policy sold at one million Uganda Shillings will be inflated by 35,000 Shillings stamp duty, withholding tax of 10 percent, VAT of 18 percent, the Insurance Regulatory Authority fee 1.5 percent and training levy of 1.5 percent.

WORKFLOW/OVERVIEW OF STEPS

* Topic:

BRIEFING

Pricing

Think about commission for the agents. Savings products have smaller commissions than insurance products. Commission in 1st year is high and reduces in the 2nd year and disappears in the 3rd year and beyond.

Also think about how surrender benefits will be given.

Profit margin, commission, expenses. It's okay to have a loss in the 1st or 2nd year but not subsequently.

Assumptions

Assume 10M as sum assured.

Use the Uganda Mortality table.

The average term of the product will determine the interest rates. If it's a ten year product, use a 10 year yield curve from the BOU website. And give a reason why it's that rate. Also, adjust for the risk margin and inflation. Assume that the Uganda Bond is risk free.

Also explain why commission is a given percentage. It has to be competitive so that other agents can compete for it.

Include all your assumption

Methodology

Start with a theoretical assumption. Assume a 35-year-old male and term 10 years. Model this in Excel including surrender, Multiple decrement table. Use LC3s assumption not LCs 2. If you're not offering a critical illness benefit, don't offer it. Then take to Mr. Sebufu to show the multiple decrement, typical example, the premium to be paid and profit margin. Revisit LCs 3 slides for the process. Adjust premium until an ideal profit margin is got.

Premiums shouldn't be too high nor too low.

If you need to assume a sum assured, assume 10M per year.

So, once he has passed your single example for one age, then you can model for ages X and all possible terms.

Here is where you're going to create an array. Start from 18 to maximum age for your products. Then include terms. For long term products it usually start from 5, 6, 7, ..., 15. People usually buy 15 years tops.

You can't do this shit in excel cause you don't use VBA. So use Python.

So create this array. The first output is premium per 1M (unit) sum assured. This is the premium rate table. Use annual premiums for longer term products. So. show the price schedule.

Key output 1 is this.

Key output 2

Array to show the profit margin

show by risk group eg. old, young, gender. It also involves recommendations. Sell more to females, or young ones, etc. with a reason

Link objectives to methodology to results. Research methodology

Objectives (tables)

Results should include the premium table.

Tables are

Objective 1. To price a product that achieves a certain range of profit margin. Then show the premium table.

Objective 2. profit margin of a given range. Then table profit margin variation by age and gender

Objective 3. test sensitivity of the premium and profits to small variations in key assumptions (mortality, interest rate and expenses. We only test for these 3. They are the ones that matter)

Do it up and down by up to 20% for these 3.

Then make a recommendation on what you find out.

See the presentation for LCS 3

when deciding how much to start pricing premiums. You're going to have to programme some of these things in Python.

Employers want a quick learner.

Reserving/Valuation

Get data then match the liabilities.

Use Gross premium approach not recursion. Do it for one person.

Use Excel to create table

Age

SA

term

duration (how much time passed)

Liability (this is the output)

Then sensitivity analysis for the 3

Same table for reserving.

Do descriptive statistics

Make the program dynamic.

background has the structure of the product. What it offers.

------------------------------------------------------------------

MY INSURANCE PRODUCT

Newborns insurance.

What's that? An insurance policy for couples with new borns. Having a child is expensive. When they are born, extra money has to be spent on clothes, health, utilities, mother's feeding. It can be financially devastating to the couple in those first two years. That's why having a cushion for at least a year can help smooth out the whole process.

So basically, this product works like this: a lump-sum is paid at onset. Or premiums are paid at least 6 months prior to delivery.

There's a risk of the child dying in which case the insurance company keeps the money. Otherwise, the insurance company has to keep on paying monthly annuities. Of course there are caps. We don't want to have to pay millions cause the new born has a rare disease.

Target market

Usually, people who buy insurance are educated. But again, they are usually young. 20+. It's a way of managing cash flows.

Why Should People Buy this insurance product?

Well, most of the people I know with kids say, they just figured it out. But there wasn't always peace of mind. Now why would someone pay a lump-sum. Because they are given assurance. But especially to reduce volatility in expenditure especially when premiums are paid in advance. The earlier the premiums, the cheaper they get.

That's my idea. We eliminate the financial volatility associated with having a baby. And parents can know their child will be provided for.

------------------------------------------------------------------

TIPS FROM MR. SEBUUFU FOR MY PROJECT

Add an investment component. Choose the bank with the highest interest rate. Remember, capital preservation.

The product should pay premiums every month for 2-3 years.

Collect data on morbidity from Ministry of Health and UBoS. If you can't get the data, go to the headquarters.

Let the lump-sum be paid 3 months into pregnancy.

You're going to do a lot of risk analysis. Quantify all the risks involved.

Do this product as though you're going to do it for a company.

Tailor it for different classes of risk.

Only text him when it's absolutely necessary. And be concise.

Task: Make a list of all commercial banks In Uganda and their rates. Should we do fixed deposits in UGX or Kshs or TZ or sole other east African company.

How are you going to handle default/bank crashes?

ASSUMPTIONS

1 Allocation is 90% to the unit fund and 10% to the non-unit fund surrender value = fund value - surrender penalty

2 Rate of growth of the unit fund is 10%

3 Bid-offer spread is 1% and is non-recurring extra surrender benefit = (surrender value - fund value) \* (aq)x(w)

4 Expenses and Commissions are paid at the start of every year

5 There's no renewal commission and no renewal expenses extra death benefit = (aq)x(d)\*max[S-F(t),0]

6 There are two decrements: by surrender and by death

7 All bonuses from the unit fund go to the policyholders cost of allocation = premium allocated x (1 - B/O spread)

8 assume 0% surrender in the last year

9 Claim expenses (maturity, death, surrender) are in total 7% of the bid value of the unit fund. expected claim expenses = claim expenses x (sum of all dependent decrement probabilities)

10 Surrender probabilities are 0.05 at the end of the year and 0 at the end of the term year

11 All Benefits are payable at the end of the year of death

12 Commission is 2% of the single premium

13 All death probabilities were taken from male graduated mortality rates from the Uganda Mortality Table

14 Risk discount rate recorded on 20th may 2032

15 interest rate as at 23rd sptember 2022

16 Initial expenses are 5% of bid value of the single premium

17 I'm also assuming that all rates lie between -100% and 100% and allocation rates between 0 and 100% and growth rates between 0 and 100%

18 Fund Management charges are 1% of bid value of the unit fund at the end of the year

19 Corporate taxes on the unit fund are 30%

20 Withholding taxes on the unit fund are 15%

21 The model states the single premium and determines the benefits to be received

22 Maturity benefit is 100% of bid value of the unit fund. That means the extra maturity benefit is 0. No need to add the column extra maturity benefit.

23 Surrender value/benefit is 70% of the unit fund or the single premium, whichever is higher. To discourage surrendering. This clearly shows the surrender penalty is 30% factored into the surrender value.

24 Death Benefit/Guaranteed Sum Assured is 100% return of the initial premium or the fund value, whichever is higher

25 The columns in the unit linked and non-unit linked tables include only costs/expenses and gains. We do not include the benefits (maturity, death and surrender). This table serves to show the expenditures and incomes .

26 a negative extra death cost is a profit. It's the equivalent of the penalty. So no need to add the column for surrender profit.

27 the reason why extra death cost, not sure.

28 this model is for males. It uses males mortality data

29 for the programming model, code for 15 years (because policies rarely exceed 15 years in Uganda). Then do for both male and female and all ages up to 60 years.