



**ANNUAL PREMIUM CALCULATION ON  
SINGLE LIFE INSURANCE USING GOMPERTZ  
MORTALITY ASSUMPTIONS**

**UNDERGRADUATE THESIS**

**Submitted as one of the requirements to  
obtain**

**Sarjana Aktuaria**

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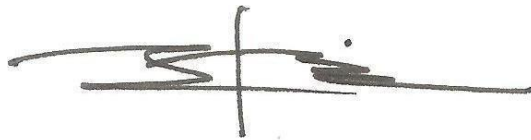
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## CHAPTER I

### INTRODUCTION

#### I.1. Background

All humans have limitations in knowing what future events will occur in their life, which is why human life will always be uncertain.

Likewise, risks in life can come into human life unpredictably, and the consequences can shatter all plans that have been prepared.

Risk can come in various events such as natural disasters, accidents, death, illness or disability.

Learning from the pandemic of Covid-19, which was declared a global pandemic by WHO on March 11, 2020.

This incident had an impact on human health and activities throughout the world, including the financial issue of the world.

This event shows that risks can occur unexpectedly, anytime, anywhere in the future.

Adverse events cannot be stopped but losses can be minimized.

One of the measures to minimize financial risks that can occur in the future is insurance.

Insurance comes from the word assurance which means protection or guarantee.

Based on law, insurance can be interpreted as a contract between two groups, namely, the Insurer (insurance company) and the Insured (individual or business entity).

The insured will pay the premium to the insurance company that accepts the risk (Insurer).

The premium payment is proof of risk transfer from the Insured to the Insurer.

Therefore, the premium payment must be made by the Insured.

If the Insured suffers a financial loss in the future, the Insurer will provide compensation in the amount of money that has been determined in the insurance policy (Otoritas Jasa Keuangan, 2019).

Life insurance is closely related to risk control in life.

Life insurance itself is a safety program in the formation of passing on the economic risk of an insured person's death or life, and premium payments will stop at that time.

Based on the number of insureds, life insurance is divided into two, single life (individual) insurance, where the number of insured is one insured and multiple life for more than one insured.

Multiple life insurance is divided into joint life insurance and last-survivor life insurance.

Based on the length of coverage, life insurance is divided into four types: Whole Life Insurance, Term Life Insurance, Endowment Insurance and Unit Link Life Insurance.

In Constitution Number 40 of 2014, premium is an amount of money set by the insurance company or reinsurance company and agreed upon by the insured, for the amount of money that have to be paid based on the insurance policies.

Premium payments are also made to obtain agreed protection benefits.

The premium payment system can be made once in a lifetime, referred to as a single premium or regular premium (periodic premium), which is paid periodically at certain periods, monthly, quarterly, semi-annually and annually.

Premium is paid in the shape of an annuity.

Annuities themselves are classified into two forms, discrete annuities and continuous annuities.

A discrete annuity is a series of payments that is made at the same intervals each period, while a continuous annuity is a series of payments that can be made at any time (Ridho, 2013).

In general, insurance companies often experience higher losses at the end of the period due to the insured's increasing age.

As age increases, the death rate also increases, which causes the mortality rate of the insured to increase as well (Bowers et al., 1997).

Therefore, the method of Gompertz Mortality Assumption, which is utilized to determine the acceleration of mortality, and could also determine the probability of survival and the probability of death from the probability density function that would help find an appropriate premium is used in this research (Nababan et al., 2014).

The use of the Gompertz assumption in this research is also because this distribution is a fairly accurate distribution in describing the mortality rate of a population with only two parameters, compared to the Makeham and Weibull distribution which needs to use three parameters (Wachter, 2014).

Based on previous research conducted by (Fatimah et al., 2016) that calculate the determination of the value of a whole life annuity of a woman using Gompertz distribution.

The results of the determination of the whole life annuity-due value using the Gompertz distribution is influenced by parameters on the Gompertz distribution, the discount factor and one's age.

The whole life annuity-due using Gompertz distribution gives a valuation that the older a person is, the smaller the life annuity value will be.

Moreover, the higher the interest rate used, the smaller the life annuity value will be.

In other research conducted by (Calista, 2023) that analyse the suitability of parameter estimation values in Gompertz mortality law of a case study of Indonesian Mortality Table (TMI 4) man and women.

It results in the Linear Least Squares (LLS) method is a suitable method for estimating parameter values in the Gompertz mortality law when applied to Indonesian Mortality Table (TMI 4) for men and women.

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Name : Michelle Novia  
Student ID number : 021202000034  
Study Program : Actuarial Science  
Faculty : Business

I hereby declare that my undergraduate thesis/final project/business plan entitled “**Annual Premium Calculation on Whole Life Single Life Insurance Using Gompertz Mortality Assumptions**” is to the best of my knowledge and belief, an original piece of work based on sound academic principles. If there is any plagiarism detected in this thesis, I am willing to be personally responsible for the consequences of these acts of plagiarism, and will accept the sanctions against these acts in accordance with the rules and policies of President University.

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Michelle Novia



## ABSTRACT

Premium calculation is one of the important aspects to insurance companies. Careless determination of the premium price can cause the insurance company to fail to bear the risk that the company has. There are several ways to determine premium payments. In this research the premium calculation will be computed using Gompertz mortality assumptions which will be applied to the annual premium calculation of whole life and term life single life insurance of man and woman. The benefit assumed, interest rate, Insurer age, Gompertz parameter and several actuarial notations such as life annuity-due and net single premium is needed in the premium calculation using Gompertz mortality assumptions. This research uses the data of Indonesian Mortality table (TMI IV) and the Linear Least Squares (LLS) method to find the Gompertz parameter to find the survival probabilities. Based on the calculation performed in this research, the value of the premium using Gompertz assumptions is influenced by parameters on the Gompertz assumptions, the interest rate used, and the Insured age. Using the LLS method the parameter found for woman is 0.00006592 for  $B$  and 1.083 for  $c$  and the parameter for man is 0.00009501 for  $B$  and 1.082795 for  $c$ . Moreover, the value of the premium based on Gompertz mortality assumptions using Linear Least Squares (LLS) method with the same age of 30 years old for man is higher than the value of the premium for woman, with the value of IDR 6,020,436.98 for man and IDR 4,808,984.04 for woman using whole life insurance and the value of IDR 2,342,104.10 for man and IDR 1,644,897.21 for woman using term life insurance.

**Keywords:** *Premium Calculation, Gompertz Mortality Law, life Insurance, Single Life*

## ABSTRAK

Perhitungan premi merupakan salah satu aspek penting bagi perusahaan asuransi. Penetapan harga premi yang ceroboh dapat menyebabkan perusahaan asuransi gagal menanggung risiko yang dimiliki perusahaan. Ada beberapa cara untuk menentukan pembayaran premi. Dalam penelitian ini perhitungan premi akan dihitung dengan menggunakan asumsi mortalitas Gompertz yang akan diterapkan pada perhitungan premi tahunan asuransi seumur hidup dan asuransi jiwa berjangka tunggal pria dan wanita. Asumsi manfaat, suku bunga, umur penanggung, parameter Gompertz dan beberapa notasi aktuaria seperti anuitas seumur hidup dan premi tunggal bersih diperlukan dalam perhitungan premi dengan menggunakan asumsi mortalitas Gompertz. Penelitian ini menggunakan data tabel Mortalitas Indonesia (TMI IV) dan metode Linear Least Squares (LLS) untuk mencari parameter Gompertz untuk mencari probabilitas kelangsungan hidup. Berdasarkan perhitungan yang dilakukan dalam penelitian ini, nilai premi dengan menggunakan asumsi Gompertz dipengaruhi oleh parameter pada asumsi Gompertz, suku bunga yang digunakan, dan umur Tertanggung. Dengan menggunakan metode LLS didapatkan parameter untuk wanita adalah 0.00006592 untuk  $B$  dan 1.083 untuk  $c$  dan parameter pria adalah 0.00009501 untuk  $B$  dan 1.082795 untuk  $c$ . Selain itu, nilai premi berdasarkan asumsi kematian Gompertz dengan metode Linear Least Squares (LLS) dengan usia yang sama yaitu 30 tahun untuk laki-laki lebih tinggi dari nilai premi untuk perempuan yaitu sebesar Rp 6.020.436,98 untuk laki-laki dan Rp 4.808.984,04 untuk wanita menggunakan asuransi seumur hidup dan nilai Rp 2.342.104,10 untuk pria dan Rp 1.644.897,21 untuk wanita menggunakan asuransi jiwa berjangka.

**Keywords:** Perhitungan Premi, Hukum Mortalita Gompertz, Asuransi Jiwa, Single Life

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The undergraduate Thesis can be finished appropriately and conveniently with the help and encouragement of diverse parties. The researcher presents her sincere appreciation to:

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Finally, the researcher recognizes that this thesis is still far from perfect. Therefore, the researcher looks forward to receiving constructive feedback and suggestion for future improvements. Hopefully, this thesis will be beneficial to a diverse group of people and can be served as a source of ideas for future thesis writing.

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