



**COMPARISON OF PREMIUM RESERVE
CALCULATION ON TERM LIFE INSURANCE
USING PREMIUM SUFFICIENCY AND NEW
JERSEY METHOD**

UNDERGRADUATE THESIS

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

**By:
VINESIA TJIAN
021202000023**

**FACULTY OF BUSINESS
ACTUARIAL SCIENCE STUDY PROGRAM
CIKARANG
SEPTEMBER 2023**

PANEL OF EXAMINER APPROVAL

The Panel of Examiners declare that the undergraduate thesis entitled **Comparison of Premium Reserve Calculation On Term Life Insurance Using Premium Sufficiency and New Jersey Method** that was submitted by Vinesia Tjian majoring in Actuarial Science from the Faculty of Business was assessed and approved to have passed the Oral Examination on September 23th, 2023.



Dr. Edwin Setiawan Nugraha, S.Si., M.Sc

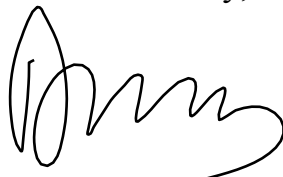
Chair - Panel of Examiner



Maria Yus Trinity Irsan, S.Si., M.Si

Examiner I

Promoted by,



Dr. Dadang Amir Hamzah, S.Si., M.Si

Advisor

Recommended by,



Maria Yus Trinity Irsan, S.Si., M.Si
Head, Acturial Science Study Program

STATEMENT OF ORIGINALITY

In my capacity as an active student of President University and as the author of the undergraduate thesis/final project/business plan stated below:

Name : Vinesia Tjian
Student ID number : 021202000023
Study Program : Actuarial Science
Faculty : Faculty of Business

I hereby declare that my undergraduate thesis/final project/business plan entitled "Comparison of Premium Reserve Calculation on Term Life Insurance using Premium Sufficiency and New Jersey Method" is, to the best of my knowledge and belief, an original piece of work based on sound academic principles. If there is any plagiarism, including but not limited to Artificial Intelligence plagiarism, is detected in this undergraduate thesis/final project/business plan, I am willing to be personally responsible for the consequences of these acts of plagiarism, and accept the sanctions against these acts in accordance with the rules and policies of President University.

I also declare that this work, either in whole or in part, has not been submitted to another university to obtain a degree.

Cikarang, September 27th, 2023



Vinesia Tjian

SCIENTIFIC PUBLICATION APPROVAL FOR ACADEMIC INTEREST

As a student of the President University, I, the undersigned:

Name : Vinesia Tjian
Student ID number : 021202000023
Study program : Actuarial Science


for the purpose of development of science and technology, certify, and approve to give President University a non-exclusive royalty-free right upon my final report with the title:

Comparison of Premium Reserve Calculation on Term Life Insurance Using
Premium Sufficiency and New Jersey Method

With this non-exclusive royalty-free right, President University is entitled to converse, to convert, to manage in a database, to maintain, and to publish my final report. There are to be done with the obligation from President University to mention my name as the copyright owner of my final report.

This statement I made in truth.

Cikarang, September 27th, 2023



Vinesia Tjian

ADVISOR APPROVAL FOR JOURNAL/INSTITUTION'S REPOSITORY

As an academic community member of the President's University, I, the undersigned:

Advisor Name : Dr. Dadang Amir Hamzah, S.Si., M.Si
Employee ID number : 0405108602
Study program : Actuarial Science
Faculty : Business

declare that following thesis :

Title of thesis : Comparison of Premium Reserve Calculation on Term
Life Insurance Using Premium Sufficiency and New
Jersey Method
Thesis author : Vinesia Tjian
Student ID number : 021202000023

will be published in **journal / institution's repository / proceeding / unpublsh**

Cikarang, September 28th, 2023



Dr. Dadang Amir Hamzah, S.Si., M.Si

PLAGIARISM REPORT

Thesis - Vinesia Tjian (021202000023)

ORIGINALITY REPORT

7 %	7 %	4 %	2 %
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	e-journal.president.ac.id Internet Source	3 %
2	ejournal.uin-suska.ac.id Internet Source	1 %
3	orcid.org Internet Source	1 %
4	archive.org Internet Source	1 %
5	docslide.us Internet Source	1 %
6	documents.cabq.gov Internet Source	1 %
7	industri.fatek.unpatti.ac.id Internet Source	1 %

Exclude quotes On

Exclude matches < 1%

Exclude bibliography On

ANTI-PLAGIARISM REPORT

AI Scan



This text is likely to be written by a **human**

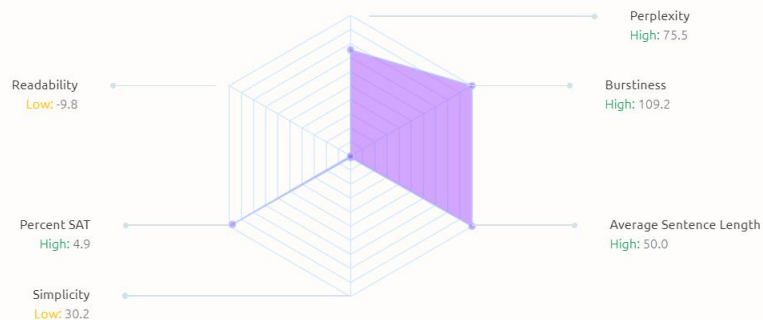
There is a **13%** probability this text was entirely written by AI ⓘ

Sentences that are likely written by AI are **highlighted**.

COMPARISON OF PREMIUM RESERVE CALCULATION ON TERM LIFE INSURANCE USING PREMIUM SUFFICIENCY AND NEW JERSEY METHOD UNDERGRADUATE THESIS Submitted as one of the requirements to obtain Sarjana Aktuarial By: VINESIA TJIAN 021202000023 FACULTY OF BUSINESS ACTUARIAL SCIENCE STUDY PROGRAM CIKARANG SEPTEMBER 2023 ii PANEL OF EXAMINER APPROVAL The Panel of Examiners declare that the undergraduate thesis entitled Comparison of Premium Reserve Calculation On Term Life Insurance Using Premium Sufficiency and New Jersey Method that was submitted by Vinesia Tjian majoring in Actuarial Science from the Faculty of Business was assessed and approved to have passed the Oral Examination on September 23th, 2023. Maria Yus Trinity Irsan, S.Si., M.Si Chair - Panel of Examiner Dr. Edwin Setiawan Nugraha, S.Si., M.Sc Examiner I Promoted by, Dr. Dadang Amir Hamzah, S.Si., M.Si Advisor Recommended by, Maria Yus Trinity Irsan, S.Si., M.Si Head, Actuarial Science Study Program iii STATEMENT OF ORIGINALITY In my capacity as an active student of President University and as the author of the undergraduate thesis/final project/business plan stated below: Name: Vinesia Tjian Student ID number: 021202000023 Study Program: Actuarial Science Faculty: Faculty of Business I hereby declare that my undergraduate thesis/final project/business plan entitled "Comparison of Premium Reserve Calculation on Term Life Insurance using Premium Sufficiency and New Jersey Method" is the work of my

2/15 sentences are likely AI generated. ⓘ

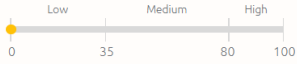
Writing Analysis



These measurements have been normalized on a scale of 1–100 for display on this chart.

Readability: -9.8

Sentences with short words and low amount of syllables have high readability scores.



Percent SAT: 4.9 %

Measures what percentage of words are SAT words, terms from a standardized college admissions exam known for its labyrinthine vocabulary lists.



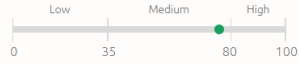
Simplicity: 30.2 %

Measures what percentage of words are in the 100 most common words in the English language.



Perplexity: 75.5

How familiar a piece of text is to large language models like ChatGPT.



Burstiness: 109.2

Unique score developed by GPTZero in 2022 that correlates to variance in writing. Humans generally vary their writing patterns over time.



Average Sentence Length: 50.0 words

Unique score that correlates to variance in writing, where humans generally vary writing patterns.



ABSTRACT

Some life insurance companies can experience losses that can even lead to bankruptcy due to not being able to pay claims. This event can be anticipated by having a reserve fund that has been prepared and calculated properly. There are several types of insurance, one of which is term life insurance where the insurance pays benefits if the insured died before the insurance period ends. The purpose of this research is to calculate the amount of term life insurance premium reserves using the Premium Sufficiency and New Jersey methods since several other researchers have also tried to calculate using these methods, such as Aprijon (2020), Filemon (2022), and others, but none of those researchers have compared these two methods. The Premium Sufficiency method calculates the reserve using gross premium assumptions, while the New Jersey method calculates the reserve using adjusted net premium. This research is a quantitative research that will use some assumptions and also secondary data to calculate the premium reserve using both methods, and using Microsoft Excel to help on the calculation and the visualization of the results. In short term, for insurance companies that have limited funds at the beginning of the insurance contract period will be more suitable to use the New Jersey method because the reserves in the initial year are 0 so that the insurance company can use the existing funds to pay additional costs. While in long term, since the overall Premium Sufficiency reserve value from year to year is smaller than the New Jersey reserve value, insurance companies that in the future need larger funds to pay for other company needs will be more suitable to use the Premium Sufficiency method because the funds that need to be set aside as reserves are smaller, so that the remaining funds that are not set aside are greater than the New Jersey method and can be used for other needs. It can also be seen that at the end of the period the premium reserve accumulated using the Premium Sufficiency method is smaller than using the New Jersey method, where the amount of premium reserve using Premium Sufficiency and New Jersey method consecutively for male are Rp. 113.200.444,943 and Rp 124.761.949,747, while for female are Rp. 70.183.195,271 and Rp. 82.491.748,159.

Keywords: *Life Insurance, Term Life Insurance, Premium Reserve, Premium Sufficiency Method, New Jersey Method*

ABSTRAK

Beberapa perusahaan asuransi jiwa dapat mengalami kerugian yang bahkan dapat berujung pada kebangkrutan karena tidak mampu membayar. Kejadian ini dapat diantisipasi dengan memiliki dana cadangan yang telah dipersiapkan dan diperhitungkan dengan baik. Terdapat beberapa jenis asuransi, salah satunya adalah asuransi jiwa berjangka dimana pihak asuransi membayarkan manfaat apabila tertanggung meninggal dunia sebelum masa asuransi berakhir. Tujuan dari penelitian ini adalah untuk menghitung besarnya cadangan premi asuransi jiwa berjangka dengan menggunakan metode Premium Sufficiency dan New Jersey karena beberapa peneliti lain juga sudah mencoba menghitung dengan menggunakan metode tersebut, seperti Aprijon (2020), Filemon (2022), dan lainnya, namun belum ada dari peneliti tersebut yang membandingkan kedua metode tersebut. Metode Premium Sufficiency menghitung cadangan dengan menggunakan asumsi premi bruto, sedangkan metode New Jersey menghitung cadangan dengan menggunakan premi neto yang telah disesuaikan. Penelitian ini merupakan penelitian kuantitatif yang akan menggunakan beberapa asumsi dan juga data sekunder untuk menghitung cadangan premi dengan menggunakan kedua metode tersebut, serta menggunakan Microsoft Excel untuk membantu dalam perhitungan dan visualisasi hasil perhitungan. Dalam jangka pendek, bagi perusahaan asuransi yang memiliki dana terbatas pada awal masa kontrak asuransi akan lebih cocok menggunakan metode New Jersey karena cadangan pada tahun awal adalah 0 sehingga perusahaan asuransi dapat menggunakan dana yang ada untuk membayar biaya-biaya tambahan. Sedangkan dalam jangka panjang, karena nilai cadangan Premium Sufficiency secara keseluruhan dari tahun ke tahun semakin kecil dibandingkan dengan nilai cadangan New Jersey, maka bagi perusahaan asuransi yang di kemudian hari membutuhkan dana yang lebih besar untuk membayar kebutuhan perusahaan yang lain akan lebih cocok menggunakan metode Premium Sufficiency karena dana yang perlu disisihkan sebagai cadangan lebih kecil, sehingga sisa dana yang tidak disisihkan sebagai cadangan lebih besar dari metode New Jersey dapat digunakan untuk kebutuhan yang lain. Dapat dilihat juga bahwa pada akhir periode cadangan premi yang terkumpul dengan menggunakan metode Premium Sufficiency lebih kecil dibandingkan dengan menggunakan metode New Jersey, dimana jumlah cadangan premi dengan menggunakan metode Premium Sufficiency dan metode New Jersey secara berurutan untuk pria adalah Rp. 113.200.444.943 dan Rp 124.761.949.747, sedangkan untuk wanita adalah Rp. 70.183.195.271 dan Rp. 82.491.748.159.

Kata kunci: *Asuransi Jiwa, Asuransi Jiwa Berjangka, Cadangan Premi, Metode Premium Sufficiency, Metode New Jersey*

ACKNOWLEDGEMENT

My sincere gratitude to Buddha for His blessing that made this thesis possible to be completed. The author would also like to say thank you to President University that provides Actuarial Science major so that it is possible for the author to learn more about the actuary field.

During the author's journey to write this thesis, the author has received lots of supports from many parties, and thus the author would like to express her gratitude to:

1. The author's family for their endless prayers, love, and support.
2. Dr. Dadang Amir Hamzah, S.Si., M.Si as the researcher's thesis adviser for his time, patience, guidance, and suggestions for this thesis.
3. Mrs. Maria Yus Trinity Irsan, S.Si., M.Si. and Dr. Edwin Setiawan Nugraha, S.Si., M.Sc as the author's thesis examiners for their suggestions for the thesis.
4. All lecturers and staffs at President University, especially all of the Actuarial Science lecturers for their guidance, knowledge, patience, and motivations along the author's journey while studying at the university.
5. All of the author's Actuarial Science friends who have become the author's comrades-in-arms while undergoing studies in this major.
6. The members of Keluarga Mahasiswa Buddhis Ashokavardhana (KMBA) as the author's second family at the university.
7. Michelynn Sola Gratia, one of the author's best friends who was always there to provide encouragement, motivation, and support, both during the studies and during the process of writing this thesis.
8. The author's best friend, both the author's old friends from Makassar, as well as those whom the author becomes best friends with while in college, for their companion and support.

9. Filemon Febrian Bintoro, as one of the author's senior in Actuarial Science major for for his time and energy that had been spared to help the author understand some of the theories related to the topic of the author's thesis.

The author realizes that this thesis is still far from perfect, thus the author is open to receive any constructive feedback or suggestion for future improvement. The author hopes that this thesis will not only be beneficial for the author, but also beneficial to every people who needs it.

TABLE OF CONTENTS

PANEL OF EXAMINER APPROVAL	ii
STATEMENT OF ORIGINALITY	iii
SCIENTIFIC PUBLICATION APPROVAL FOR ACADEMIC INTEREST	
iv	
ADVISOR APPROVAL FOR JOURNAL/INSTITUTION’S REPOSITORY	
v	
PLAGIARISM REPORT	vi
ANTI-PLAGIARISM REPORT	vii
ABSTRACT	ix
ACKNOWLEDGEMENT	xi
TABLE OF CONTENTS	xiii
LIST OF FIGURES	xvi
CHAPTER I – INTRODUCTION	1
1.1 Research Background	1
1.2 Problem of The Research	6
1.3 Research Questions	7
1.4 Objective of The Research	7
1.5 Scope and Limitation	8
1.6 Research Benefit	9
1.7 Outline of The Research	9
CHAPTER II – LITERATURE REVIEW	11
2.1 Literature Review	11
2.1.1 Insurance	11
2.1.2 Life Insurance	12
2.1.3 Interest	16
2.1.4 Basic Probability Theory	19

2.1.5 Random Variable	20
2.1.6 Probability Distribution Function	20
2.1.7 Cumulative Distribution Function	21
2.1.8 Expected Value	21
2.1.9 Survival and Distribution Function	22
2.1.10 Mortality Table	24
2.1.11 Commutation Function	25
2.1.12 Annuity	26
2.1.13 Curtate Future Lifetime	29
2.1.14 Actuarial Present Value (APV)	30
2.1.15 Life Annuity	33
2.1.16 Premium	35
2.1.17 Premium Reserve	38
2.1.18 Premium Sufficiency Method	38
2.1.19 New Jersey Method	43
2.2 Theoretical Framework	45
2.3 Research Gap	45
CHAPTER III – METHODOLOGY	47
3.1 Research Design	47
3.2 Sampling Plan	47
3.3 Research Instrument	48
3.4 Data Collection Design	48
3.5 Data Analysis Design	49
CHAPTER IV – ANALYSIS AND RESULT	52
4.1 Calculate The Commutation Function Value.....	52
4.1.1 Calculate The Commutation Function Value for Male	52
4.1.2 Calculate The Commutation Function Value for Female	53
4.2 Calculate The Premium Reserve Using Premium Sufficiency Method ...	55

4.2.1 Calculate The Initial Term Life Annuities	55
4.2.2 Calculate The Net Single Premium of Term Life Insurance	57
4.2.3 Calculate The Annual Net Premium of Term Life Insurance	59
4.2.4 Calculate The Premium Reserve Using Premium Sufficiency Method at The End of Year t for Participants at Age x-Years with n-Years of Coverage Period and m-Years Payment Period	60
4.3 Calculate The Premium Reserve Using New Jersey Method	63
4.3.1 Calculate The Net Single Premium of Term Life Insurance	68
4.3.2 Calculate The Initial Term Life Annuity	69
4.3.3 Calculate The Annual Net Premium of Term Life Insurance	72
4.3.4 Calculate The Premium Reserve Using New Jersey Method at The End of Year t for Participants at Age x-Years with n-Years of Coverage Period	73
4.4 Discussion	77
CHAPTER V – CONCLUSION	82
5.1 Conclusion	82
5.2 Recommendation	84
REFERENCES	85
APPENDIX	89
Appendix 1. Male Mortality Table	89
Appendix 2. Female Mortality Table	93
Appendix 3. Male Commutation Function Value	97
Appendix 4. Female Commutation Function Value	101
Appendix 5. Premium Sufficiency Reserve for Male	105
Appendix 6. Premium Sufficiency Reserve for Female	108
Appendix 7. New Jersey Reserve for Male	111
Appendix 8. New Jersey Reserve for Female	113

LIST OF FIGURES

Figure 3.1 Research Flowchart for Premium Sufficiency Method	50
Figure 3.2 Research Flowchart for New Jersey Method	51
Figure 4.1 Comparison of Premium Reserve for Male	78
Figure 4.2 Comparison of Premium Reserve for Female	79
Figure 4.3 Comparison of Premium Reserve for Male and Female	80