Modification Of Prospective Life Insurance Reserve Prospective Calculations Using TheZillmer Method

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Abstract

The calculation of the premium reserve can be modified to avoid losses in the early years because in the first year there are many expenses that must be borne by the company so that it has difficulties in calculating the amount of the premium reserve. This situation forces the company to look for additional sources of funds to cover the costs of the initial year which will then be repaid from gross premiums in subsequent years. Additional sources of funds to cover initial year costs can be obtained by modifying premium reserves or what is known as modification reserves. Not a few insurers have suffered losses due to inaccurate calculations in the calculation of premium reserves. This study aims to modify the calculation of prospective whole life insurance premium reserves using the Zillmer method. Modification of premium reserves is calculated using the 2019 Indonesian Mortality Table with an interest rate of 3.50%. Based on the results of data analysis on the value of prospective premium reserves and the modified value of premium reserves using the Zillmer method, the results are the same, namely for male age (x) = 48 years, the prospective reserve value is IDR 213.253,05 and the modified premium reserve value using the Zillmer method is IDR 213.252,93 then for female age (y) = 69 years the prospective reserve value is IDR 8.698.949,01 and for the modified premium reserve value using the Zillmer method is IDR 8.698.948,89.

1. INTRODUCTION

Life and general insurance companies must meet the requirements for the level of financial soundness referred to in the Financial Services Authority Regulation Number 71 of 2016, namely the level of solvency, technical reserves, investment adequacy, equity, guarantee funds, and other provisions relating to financial soundness. If the company's financial condition is bad or unhealthy, if no action is taken for several periods, it can cause the company to experience financial distress or financial difficulties, where the company has insufficient premium reserves to meet the company's obligations. The company's obligations in question are that the company fails to pay claims and benefits to customers which ultimately results in the company going bankrupt [9].

In life insurance, the amount of compensation depends on premium income. This premium will be paid by the insured periodically according to the type of contract and will stop if he dies or because the insurance contract has ended. In carrying out their duties, insurance companies require costs such as medical examination fees for insured people, agent commission payments, making insurance policies and so on. Therefore, the premium presented by life insurance companies to the public is the gross premium which consists of net premium and loading. However, loading or fees paid through premiums are not sufficient to finance insurance company expenses in the early years of the policy. This situation forces the company to seek additional sources of funds to cover the initial year's costs which will then be repaid from the gross premium in the following years. To overcome this problem, the insurance company must have a reserve fund [14].

There are two forms of calculating premium reserves, namely prospective reserves and retrospective reserves. Prospective reserves use gross premiums as the basis for calculation, while retrospective reserves use net premiums. The calculation of the premium reserve can be modified to avoid losses in the early years because in the first year there are many expenses that must be borne by the company so that it has difficulties in calculating the amount of the premium reserve. Not a few insurers have suffered losses due to inaccurate calculations in calculating premium reserves

Modification of premium reserves aims to calculate premium reserves according to actual conditions. The premium paid by policyholders is the gross premium. So, the premium reserve that corresponds to the actual situation is the premium reserve whose calculation is based on the gross premium. One method of calculating reserves that contains a prospective concept is the Zillmer.

2.   RESEARCH METHOD

This research uses quantitative research. According to [2] explaining a quantitative approach is a research approach that uses numbers, starting from collecting data, interpreting data, to presenting research results. Quantitative research is a type of research whose specifications are systematic, planned, and clearly structured from the start to the making of the research design, both regarding research objectives, research subjects, research objects, data samples, data sources, and methodology.

2.1 Data Sources
The data used in this research is secondary data. In general, secondary data is data collected from pre-existing data, and has been used by previous researchers. According to [8], secondary data is data obtained or collected by someone who conducts research from existing sources. This secondary data is used to support primary information, where this data can be obtained from library materials, books, journals and so on. The data used is the policy data of PT Bhineka Life Padang's life insurance customers. In research, PT Bhinneka Life Padang is located at Jl. Imam Bonjol No. 21 Behind Pondok Kec. Padang Selatan City of Padang.

2.2 Population dan Sample
According to [19] population is defined as a generalization area consisting of objects or subjects that have certain qualities and characteristics set by researchers to study and then draw conclusions. The population in this study is all life insurance customers of PT Bhinneka Life Padang in 2022, a total of 16 populations.

The sample according to [19] is part of the number and characteristics possessed by the population. The sample collection method (sampling method) used is purposive sampling. Purposive sampling is a sampling technique with certain considerations. This means that sampling is based on certain considerations or criteria that have been formulated in advance by researchers [19]. The sample criteria for this study are the year the customer joins, namely 2022 with a whole life insurance policy and the type of product is Bhineka Assuranse Estate Plus with a total of 14 samples.

2.3 Variable Definitions and Research Operations
1. Definition of Research Variables

According to [19] Research variables are everything in whatever form the researcher determines to be studied so that information is obtained about it, then conclusions are drawn. There are two kinds of variables that will be examined in this study, namely [6]:
   a. The independent variable or independent variable (x) is a variable that is thought to have an effect on the dependent variable or dependent variable, and its effect on the dependent variable is investigated or tested. The independent variable in this study is prospective premium reserves
   b. The dependent variable or dependent variable (y) is the most affected variable in the relationship between two variables, or it is also commonly called the effect variable which is expected to occur later after the occurrence of the independent variable. The dependent variable in this study is the Zillmer method.

2. Variable Operational Definition

Operational research variables are attributes or properties or values of objects or activities that have certain variations that have been determined by researchers to be studied and then drawn conclusions [19]. The operational variables in this study are (i) stating the interest rate, (α) stating the loading fee, (a_x) stating the initial annuity value and the Indonesian mortality table for 2019.

3. RESULTS AND DISCUSSION

Data Description

The data needed to calculate the modification of prospective lifetime insurance premium reserves using the Zillmer method is in the form of customer data for PT Bhinneka Life Padang lifetime insurance policy holders consisting of male gender (x) and female (y), age (x), sum assured (R). Whole life insurance at PT Bhinneka Life Padang is insurance with fixed premium payments and is paid annually as long as the policyholder is still alive (premium payments are limited to 10 years) (PT Bhinneka Life Padang, 2022).

Calculating Prospektif Premium Reserves

Prospective premium reserves are obtained by first determining the commutation value from the 2019 Indonesian mortality table (TMI) for men and women with an interest rate of 3.50%, the initial life annuity value for life insurance, net single premium, and the amount of the annual premium net whole life insurance.

Based on the determination of the commutation value D_x, D_y, N_x, N_y, C_x, C_y, M_x, M_y with an interest rate of 3.50% then in terms of the equation formula (2.11) to calculate the initial life annuity for the initial age (x) = 48 years is as follows:

$$\ddot{a}_x = \frac{N_x}{D_x}$$
$$\ddot{a}_{48} = \frac{N_{48}}{D_{48}}$$
$$= \frac{354683,43}{18278,21}$$
$$= 19,40471$$

So, the value of the initial life annuity for whole life insurance from (x) = 48 years is 19.40471

For the initial age (y) = 60 years is as follows:

$$\ddot{a}_y = \frac{N_y}{D_y}$$
$$\ddot{a}_{69} = \frac{N_{69}}{D_{69}}$$
$$= \frac{109166,23}{7928,12}$$
$$= 13,76950$$

So, the value of the initial life annuity for whole life insurance from (y) = 69 years is 13.76950.

1. Calculating net single premium

Calculation of the net single premium from whole life life insurance for male age (x) = 48 years and female age (y) = 69 tahun years based on equation (2.12) as follows:

$$A_x = \frac{M_x}{D_x}$$
$$A_{48} = \frac{M_{48}}{D_{48}}$$
$$= 0,34380$$

So, the net single premium value of whole life insurance for age (x) = 48 years is 0.34380

$$A_y = \frac{M_y}{D_y}$$
$$A_{69} = \frac{M_{69}}{D_{69}}$$
$$= 0,53432$$

So, the net single premium value of whole life insurance for age (y) = 69 years is 0.53432.

2. πCalculating the net annual premium

Calculation of the net annual premium for whole life insurance for a male age (x) = 48 years with a sum insured of IDR 15.000.000 and for a woman (y) = 69 years with a sum of IDR 300.000.000 based on equation (2.13) The calculation of the net annual premium is as follows:

$$P_x = R\frac{A_x}{\ddot{a}_x}$$

$$P_{48} = IDR\ 15.000.000\ \frac{A_{48}}{\ddot{a}_{48}}$$

$$= IDR\ 265.760,05$$

So, the net annual premium value of whole life insurance for age $(x) = 48$ years is IDR 265.760,05

$$P_y = R\frac{A_y}{\ddot{a}_y}$$

$$P_{69} = IDR\ 300.000.000\ \frac{A_{69}}{\ddot{a}_{69}}$$

$$= IDR\ 11.641.460,00$$

So, the net annual premium value of whole life insurance for age $(y) = 69$ years is IDR 11.641.460,00.

3. Calculating prospective premium reserves

After obtaining the cash value of the initial annuity for life, the net single premium for life insurance, and the net annual premium for life insurance, the value of the prospective reserves in the first, second, and so on years will be calculated. Based on the prospective reserve formula contained in equation (2.14).

a.   Calculating the prospective male age reserve premium $(x) = 48$ years
     Calculation of prospective reserves at the end of the first year is as follows:

$${}_tV_x = R.A_{x+t} - P_x\ddot{a}_{x+t}$$
$${}_1V_{48} = IDR\ 15.000.000\ A_{48+1} - P_{48}\ddot{a}_{48}$$
$$= IDR\ 15.000.000\ A_{49} - P_{48}\ddot{a}_{49}$$
$$= IDR\ 213.253,05$$

So the first final prospective premium reserve with $t = 1$ whole life insurance is IDR 213.253,05.
Calculation of prospective reserves at the end of the second year is as follows:

$${}_2V_{49} = IDR\ 15.000.000\ A_{48+2} - P_{48}\ddot{a}_{48+2}$$
$$= IDR\ 15.000.000\ A_{50} - P_{48}\ddot{a}_{50}$$
$$= IDR\ 218.457,17$$

So, the second final prospective premium reserve with $t = 2$ whole life insurance is IDR 218.457,17.

The results of calculating prospective lifetime insurance premium reserves for the third, fourth and so on are presented in Table 1 which was calculated using the help of Microsoft Excel.

Tabel 1. Prospektive premium reserves for $(x) = 48$ years with $t = 10$

t	A_x	P_x	${}_tV_x$ (IDR)
1	0,34380	265760,05	213253,05
2	0,35313	276908,30	218457,17
3	0,36255	288497,39	223530,33
4	0,37205	300534,99	228926,55
5	0,38163	313054,26	234086,75
6	0,39128	326058,67	239014,96
7	0,40098	339551,87	244161,24
8	0,41073	353563,68	249557,41

9	0,42054	368127,46	256131,35
10	0,43043	383334,55	264425,80

b. Calculating the prospective female age reserve premium $(y) = 69$ years
Calculation of prospective reserves at the end of the first year is as follows:

$${}_tV_y = R.A_{y+t} - P_y ä_{y+t}$$
$${}_1V_{69} = IDR\ 300.000.000\ A_{69+1} - P_{69} ä_{69+1}$$
$$= IDR\ 300.000.000\ A_{70} - P_{69} ä_{70}$$
$$= IDR\ 8.698.949,01$$

So, the first final prospective premium reserve with $t = 1$ whole life insurance is IDR 8.698.949,01.
Calculation of prospective reserves at the end of the second year is as follows:

$${}_2V_{69} = IDR\ 300.000.000\ A_{69+2} - P_{69} ä_{69+2}$$
$$= IDR\ 300.000.000\ A_{71} - P_{69} ä_{71}$$
$$= IDR\ 9.147.730,97$$

So, the second final prospective premium reserve with $t = 2$ whole life insurance is IDR 9.147.730,97.
The results of calculating prospective lifetime insurance premium reserves for the third, fourth and so on are presented in Table 1 which was calculated using the help of Microsoft Excel.

Tabel 2. Prospektive premium reserves for $(y) = 69$ years with $t = 10$ tahun

t	A_y	P_y	${}_tV_y$ (IDR)
1	0,53432	11641460,00	8698949,01
2	0,54783	12292082,47	9147730,97
3	0,56161	12997791,96	9637349,45
4	0,57569	13765953,05	10172790,84
5	0,59008	14605255,86	10754619,48
6	0,60477	15525557,84	11393527,51
7	0,61978	16539027,64	12099793,00
8	0,63511	17660560,83	12883766,43
9	0,65078	18908355,38	13759464,95
10	0,66679	20305028,34	14371996,98

Modification of Premium Reserve Calculation with Zillmer
Method After taking a few initial steps to complete the premium reserve calculation using the Zillmer method, namely calculating the initial lifetime annuity value $(ä_x)$ and the single net single premium for life insurance (A_x) so that the net annual premium value for whole life insurance can be calculated (P_x). Then the value of prospective premium reserves at the end of the t-year is calculated $({}_tV_x)$ and finally the value of reserves for life insurance premiums is calculated using the Zillmer method based on the prospective method $({}_tV^z)$ using the formula equation (2.17).

1. Calculating the modified prospective reserve premium using the Zillmer method for male age $(x) = 48$ years with $\alpha = 0,1216$.
    Calculation of modified prospective premium reserves using the Zillmer method at the end of the first year is as follows:

$${}_tV^z = {}_tV_y - \alpha \frac{ä_{y+t}}{ä_y}$$

$$_1V_{48}{}^z = {}_1V_{48} - \alpha\frac{\ddot{a}_{48+1}}{\ddot{a}_{48}}$$
$$= IDR\ 218.457,17$$

So, the modified value of prospective premium reserves using the Zillmer method at the end of the first year with $t = 1$ year is $IDR\ 218.457,17$.

The calculation of modified prospective premium reserves using the Zillmer method at the end of the second year is as follows:

$$_2V_{48}{}^z = {}_2V_{48} - \alpha\frac{\ddot{a}_{48+2}}{\ddot{a}_{48}}$$
$$= IDR\ 218.457,06$$

So, the modified value of prospective premium reserves using the Zillmer method at the end of the second year with $t = 2$ tahun sebesar $IDR\ 218.457,06$.

The results of the calculation of modification of the prospective lifetime insurance premium reserve using the Zillmer method for the third, fourth and so on are presented in Table 3 which was calculated using the help of Microsoft Excel.

Tabel 3. Prospective lifetime life insurance premium reserves using the Zillmer method for age $(x) = 48$ with $t = 10$ years

t	$_tV_x$ (Rp)	$_tV^z$(IDR)
1	213253,05	213252,93
2	218457,17	218457,06
3	223530,33	223530,21
4	228926,55	228926,43
5	234086,75	234086,63
6	239014,96	239014,85
7	244161,24	244161,12
8	249557,41	249557,31
9	256131,35	256131,24
10	264425,80	264425,70

2. Calculating the modification of prospective premium reserves using the Zillmer method for female age $(y) = 69$ years with $\alpha = 0,1216$.

The calculation of modified prospective premium reserves using the Zillmer method at the end of the first year is as follows:

$$_1V_{69}{}^z = {}_1V_{69} - \alpha\frac{\ddot{a}_{69+1}}{\ddot{a}_{69}}$$
$$= IDR\ 8.698.948,89$$

So, the modified value of prospective premium reserves using the Zillmer method at the end of the first year with $t = 1$ years is $IDR\ 8.698.948,89$

The calculation of modified prospective premium reserves using the Zillmer method at the end of the second year is as follows:

$$_2V_{69}{}^z = {}_2V_{69} - \alpha\frac{\ddot{a}_{69+2}}{\ddot{a}_{69}}$$
$$= IDR\ 9.147.730,85$$

So, the modified value of prospective premium reserves using the Zillmer method at the end of the first year with $t = 2$ years is $IDR\ 9.147.730,85$

The results of the calculation of modification of the prospective lifetime insurance premium reserve using the Zillmer method for the third, fourth and so on are presented in Table 4 which was calculated using the help of Microsoft Excel.

Tabel 4. Prospective lifetime life insurance premium reserves using the Zillmer method for age
$(y) = 69$ with $t = 10$ years

t	$_tV_y$ (Rp)	$_t V^z$(IDR)
1	8698949,01	8698948,89
2	9147730,97	9147730,86
3	9637349,45	9637349,33
4	10172790,84	10172790,73
5	10754619,48	10754619,37
6	11393527,51	11393527,42
7	12099793,00	12099792,90
8	12883766,43	12883766,34
9	13759464,95	13759464,87
10	14371996,98	14371996,90

Discussion

This study discusses modifications to the calculation of prospective lifetime insurance premium reserves using the Zillmer method. The results of the modification of the prospective premium reserve calculation using the Zillmer method can be seen in the following table:

Tabel 5. Prospective premium reserves and modified premium reserves with the Zillmer method
for age $(x) = 48$ years with $t = 10$ years

t	$_tV_x$ (Rp)	$_t V^z$(IDR)
1	213253,05	213252,93
2	218457,17	218457,06
3	223530,33	223530,21
4	228926,55	228926,43
5	234086,75	234086,63
6	239014,96	239014,85
7	244161,24	244161,12
8	249557,41	249557,31
9	256131,35	256131,24
10	264425,80	264425,70

In Table 5 it can be seen that the results of calculating prospective premium reserves with the results of calculating modified premium reserves using the Zillmer method with the 2019 Indonesian mortality table using an interest rate of 3.50% obtain the same reserve results, namely for male age $(x) = 48$ years its worth $_1V_{48} = IDR$ 213.253,05 and $_1 V_{48}{}^z = Rp$ 213.252,93.

Tabel 6. Prospective premium reserves and modified premium reserves with the Zillmer method
for age $(y) = 69$ years with $t = 10$ years

t	$_tV_y$ (Rp)	$_t V^z$(IDR)
1	8698949,01	8698948,89

2	9147730,97	9147730,86
3	9637349,45	9637349,33
4	10172790,84	10172790,73
5	10754619,48	10754619,37
6	11393527,51	11393527,42
7	12099793,00	12099792,90
8	12883766,43	12883766,34
9	13759464,95	13759464,87
10	14371996,98	14371996,90

In Table 6 it can be seen that the results of calculating prospective premium reserves with the results of calculating modified premium reserves using the Zillmer method with the 2019 Indonesian mortality table using an interest rate of 3.50% obtain the same reserve results, namely for female $(y) = 69$ years is $_1V_{69} = IDR\ 8.698.949,01$ and $_1V_{69}{}^z = IDR\ 8.698.948,89$.

4. CONCLUSION

Based on the results of data analysis and discussion by modifying the calculation of reserves for life insurance premiums using the Zillmer method with an interest rate of 3.50% using the 2019 Indonesian capitalita table and the payment term $t = 10$ it can be concluded that the value of prospective premium reserves and the modified value of premium reserves using the Zillmer method produces the same value, namely for male age $(x) = 48$ years the value is equal to $_1V_{48} = IDR\ 213.253,05$ dan $_1V_{48}{}^z = IDR\ 213.252,93$ then for the age of female $(y) = 69$ years is equal to $_1V_{69} = IDR\ 8.698.949,01$ dan $_1V_{69}{}^z = Rp\ 8.698.948,89$.

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