Available online at http://www.iorajournal.org/index.php/ijgor/index

International Journal of Global Operations Research

e-ISSN: 2722-1016
p-ISSN: 2723-1739

Vol. 6, No. 1, pp. 34-39, 2025

Calculation of Passenger Type Car Insurance Based on Frequency Data and Claim Size

Ika Wandira[1*]

[1]*Universitas Padjadjaran, Jatinangor, West Java, Indonesia*

**Corresponding author email: ika21003@mail.unpad.ac.id*

Abstract

Calculation of motor vehicle insurance risk premiums is an important aspect in the insurance industry, which functions to determine the amount of premium to be paid by the policyholder. This study aims to analyze how the calculation of risk premiums is carried out using claim frequency data and claim amounts as the main basis for determining fair premiums and in accordance with the risks faced by insurance companies. Through this calculation model, insurance companies can estimate the amount of risk faced and set proportional premiums. The data used in this study are assumption data that refer to historical claims to provide an overview of accurate and realistic premium calculations in the context of motor vehicle insurance. The results of the calculation of motor vehicle insurance risk premiums with Total Loss Only (TLO) protection are influenced by the frequency and amount of claims. Analysis of claim data for the 2015-2020 period shows an increasing trend in the average claim amount from IDR 8,000,000 to IDR 10,000,000, while the average annual premium is relatively stable at IDR 1,200,000. Risk premiums increase as the number of claims increases, so companies need to allocate sufficient funds to cover these risks. In addition, the increasing frequency of claims each year indicates a higher risk for the company.

Keywords: Motor vehicle insurance, claim frequency, claim amount.

1. Introduction

Car insurance is one of the important insurance products in the insurance industry in Indonesia, with the main objective of protecting vehicle owners from the risk of financial loss caused by accidents, damage, or loss of vehicles. In order to provide appropriate protection to policyholders, insurance companies must determine premiums that are in accordance with the level of risk faced (Sari et al., 2023). Car insurance premiums, especially for the Total Loss Only (TLO) insurance type, are calculated based on two main factors, namely the frequency of claims and the amount of claims (Verbelen, 2018). TLO insurance provides protection only in cases where the vehicle is totally damaged or completely lost, which requires more specific calculations regarding the potential for major losses that can occur.

In calculating TLO insurance premiums, the Financial Services Authority (OJK) plays an important role in regulating and supervising the insurance industry in Indonesia, including in terms of premium calculations and risk management carried out by insurance companies (Ahmad, 2022). OJK sets various guidelines that must be followed by insurance companies in managing risk, including in terms of calculating premiums based on the frequency of claims and the amount of claims that occur in the market. Therefore, it is important for insurance companies to have a premium calculation method that can reflect the actual risk and ensure the sustainability of the company while remaining profitable for policyholders.

Claim frequency refers to how often claims occur in a certain period, while the claim amount is the amount of payment made by the insurance company to the policyholder for the claim submitted (Kingma, 2023). These two factors greatly influence determining the right premium for motor vehicles, especially for the TLO type of insurance which only covers total damage or loss of the vehicle. Analysis of historical claim data will provide a clearer picture of the potential loss that must be borne by the insurance company and the amount of premium that needs to be charged to the policyholder.

This study aims to analyze and calculate the calculation of motor vehicle insurance risk premiums, especially those using TLO insurance, by considering claim frequency data and claim amount as the main factors. It is hoped that the results of this study can contribute to the understanding of how insurance companies set fair premiums and in accordance with the level of risk faced, as well as how historical claim data can be used to formulate optimal premium policies.

2. Literature Review

Car insurance is an important form of protection for vehicle owners to anticipate the risk of loss caused by accidents, damage, or loss (Ramlah et al., 2022). The type of insurance often chosen by car owners is Total Loss Only (TLO) insurance, which provides protection only for total losses, either due to accidents resulting in total damage or loss of the vehicle as a whole. The calculation of premiums for TLO insurance is highly dependent on two main factors, namely the frequency of claims and the amount of claims, each of which plays an important role in calculating risk exposure and determining fair and appropriate premiums for policyholders and insurance companies.

Car insurance premiums are calculated based on a risk analysis based on the frequency of claims and the amount of claims that occur. The frequency of claims describes how often claims are filed in a certain period, while the amount of claims indicates the amount of payment made by the insurance company to the policyholder per claim that occurs (Bagariang and Raharjati, 2033). Therefore, insurance companies need to have accurate claim data to make more precise risk estimates and determine appropriate premiums (Konrad et al., 2020). Understanding the claim pattern and claim amount can provide a clearer picture of the risks that will be faced by insurance companies in a certain period. Several studies have shown that the amount of claims tends to increase along with inflation and increasing vehicle prices and repair costs. In addition, vehicle age and geographic location factors also play a role in determining the amount of claims that may occur. Therefore, insurance companies must consider historical claim data as a whole, including data on the frequency of claims and the amount of claims that occur, in order to formulate more realistic and accurate premium calculations.

3. Materials and Methods

3.1. Materials

The material used in this study involves two main factors in calculating motor vehicle insurance premiums, namely claim frequency and claim amount. Claim frequency refers to the number of claims that occur in a certain period, while the claim amount describes the value of the payment made by the insurance company for each claim submitted. These two factors are very important in calculating the potential losses that will be borne by the insurance company and determining the appropriate premium amount for the policyholder. As a basis for calculation, the data used in this study is motor vehicle claim data covering the period between 2015 and 2020.

Table 1: Expenditure and income of company XYZ

Year	Policy Amount	Total Premium Amount (IDR)	Claim Amount	Total Claim (IDR)
2015	3200	3,840,000,000	90	720,000,000
2016	3500	4,200,000,000	95	850,000,000
2017	3800	4,560,000,000	100	1,000,000,000
2018	4200	4,800,000,000	110	1,080,000,000
2019	4200	5,040,000,000	120	1,200,000,000
2020	4500	5,400,000,000	130	1,300,000,000
Total	23400	27,840,000,000.00	645	6,150,000,000.00

3.2. Methods

The researcher used a risk premium calculation method introduced by an actuarial scientist named Ozgurel in 2005. The data used in this study is the assumption data of recorded motor vehicle insurance obtained from XYZ Insurance Company for the period 2015-2020. The data used in its application is data on the number of policies ordered per year, the total premium amount (IDR) per year, the number of claims per year, and the total claims (IDR) per year for motor vehicle insurance with the Total Loss Only (TLO) protection type.

3.2.1. Average Annual Claim Size (MCS)

MCS (Mean Claim Size) is the average size of claims paid by an insurance company for each claim that occurs in a year. MCS is calculated by dividing the total amount of claims paid by the number of claims that occurred in that year.

$$MSC = \frac{Total\ claims}{claim\ amount} \tag{1}$$

The higher the MCS value, the greater the average claims paid, which can affect the calculation of risk premiums.

3.2.2. Average Annual Premium (AOP)

AOP (Average Outstanding Premium) is the average value of premiums received by an insurance company for each policy insured in a given year. AOP is calculated by dividing the total amount of premiums received by the company by the number of policies insured in that year.

$$AOP = \frac{Total\ premium\ amount}{Number\ of\ policies} \tag{2}$$

AOP provides an overview of how much each policy's premium contributes to covering claims and the insurance company's operating costs.

3.2.3. Annual Risk Premium (RP)

RP (Risk Premium) measures the premium required to cover claims that occur. It is a figure that represents the potential costs that an insurance company must bear each year based on claims received.

$$RP = \frac{Total\ claims}{Number\ of\ policies} \tag{3}$$

This risk premium is very important in determining how much money the insurance company should receive to cover potential claims that may occur during the year.

3.2.4. Company Premium Ratio to Risk Premium Per Year (k)

k is a ratio that describes how much premium is received by the insurance company compared to the amount of risk premium that should be received to cover claims that occur.

$$k = \frac{Total\ premium\ amount}{RP} \tag{4}$$

This ratio shows the company's efficiency in setting premiums sufficient to cover claims and still generate profits.

3.2.5. Average Claim Frequency (m)

Average claim frequency m (Claim Frequency) measures how often claims occur in the number of policies in existence in a given year. This is important for evaluating how often an insurance company should pay claims.

$$m = \frac{Total\ number\ of\ claims}{Number\ of\ policies} \tag{5}$$

The higher the value of m, the more frequently claims occur, which can affect the amount of premium that needs to be set to cover more frequent claims.

4. Results and Discussion

This analysis is based on data on the frequency of claims and the amount of motor vehicle insurance claims recorded by XYZ Insurance Company for the period 2015-2020. The calculation results are as follows:

Table 2: Results of MCS, AOP, RP, k, m calculations per-year

Year	MCS (IDR)	AOP (IDR)	RP (IDR)	k (IDR)	m
2015	8,000,000.00	1,200,000.00	225,000.00	17,066.67	0.2015625
2016	8,947,368.42	1,200,000.00	242,857.14	17,294.12	
2017	10,000,000.00	1,200,000.00	263,157.89	17,328.00	
2018	9,818,181.82	1,142,857.14	257,142.86	18,666.67	
2019	10,000,000.00	1,200,000.00	285,714.29	17,640.00	
2020	10,000,000.00	1,200,000.00	288,888.89	18,692.31	

4.1. Calculating the Growth Rate in Average Claims (r)

To calculate the growth rate in the average claim amount (r) with the TLO protection type for motor vehicles for the period 2015-2020, the MCS value for 2016-2020 is needed. After knowing all the MCS values for 2015-2020, the growth rate in the average claim amount can be calculated and with the assumption of geometric growth.

$$MSC_i = (1 + r)^1 MSC_i$$

The average MCS claim amount in 2015 was IDR8,000,000. and 5 years later it became IDR10,000,000. So, r can be calculated from:

$$10.000.000 = (1 + r)^5 8{,}000{,}000.$$

The number 10,000,000 shows the average claim size for 2020 for motor vehicles, the number 5 shows the time period, and the number 8,000,000 shows the average claim size for 2015, so that we get:

$$10{,}000{,}000 = (1 + r)^5 8{,}000{,}000$$

$$\frac{10{,}000{,}000}{8{,}000{,}000} = (1 + r)^5$$

$$\frac{10{,}000{,}000^{\frac{1}{5}}}{8{,}000{,}000} = ((1 + r)^5)^{\frac{1}{5}}$$

$$1.25 = (1 + r)$$
$$r = 1.25 - 1$$
$$r = 0.25$$
$$r = 25\%$$

It can be seen that r = 25% is obtained, this figure shows that the average growth rate of large claims for XYZ company for the period 2015-2020 for motor vehicles is 25%. This figure shows that the growth rate increased by 25%.

Table 3: Number of claims and total claim amount 2015-2020

No	Year	Average Claim Amount (IDR)	Number of Policies	Total Claims	Ci (IDR)	Total Claim Amount (IDR) / TCS
1	2015	8,000,000.00	3,2	90	645	5,465,526,316
2	2016	8,947,368.42	3,5	95	70,546.875	6,683,388,158
3	2017	10,000,000.00	3,8	100	7,659,375	7,589,744,318
4	2018	9,818,181.82	4,2	110	8,465,625	8,388,664,773
5	2019	10,000,000.00	4,2	120	8,465,625	8,465,625,000
6	2020	10,000,000.00	4,5	130	90,703,125	4,535,156,250

Calculating the claim frequency rate as the ratio of the number of claims that will be exposed to risk produces a very useful relationship for estimating the number of claims each year. The number of claims is denoted by $C_i$in Table 3. Calculated using the formula:

$$C_i = m_i \times n_i$$

4.2. Risk Premium Calculation Results

Based on the values in Table 3. the risk premium will be calculated based on the planning assumption with the type of TLO protection for motor vehicles for the period 2015-2020. The risk premium is calculated using the following, namely by dividing the Total Claim based on the assumption by the Number of Policies.

Table 4: Risk premium based on assumptions

No	Year	Number of Claims	Number of Policies (N)	Total Claim Amount (IDR)	Risk Premium (IDR)
1	2015	90	3.2	645	1,707,976.97
2	2016	95	3.5	705.47	1,909,539.47
3	2017	100	3.8	765.94	1,997,301.14
4	2018	110	4.2	846.56	1,997,301.14
5	2019	120	4.2	846.56	2,015,625.00
6	2020	130	4.5	907.03	1,007,812.50

4.3. Results of Calculation of Total Net Premiums

From the risk premiums obtained and if the value is applied during 2015-2020, the original number of policies (data in Table 1.) will result in the collection of the total amount of net premiums for motor vehicles for the period 2015-2015. The total net premium is calculated by multiplying the original number of policies by the planned risk premium or based on previously made assumptions, so that the results are obtained in Table 5.

Table 5: Total net premiums

No	Year	Number of Policies (N)	Planned Risk Premium (IDR)	Total Net Premium (IDR)
1	2015	3.2	1,707,976.97	5,465,526,316
2	2016	3.5	1,909,539.47	6,683,388,158
3	2017	3.8	1,997,301.14	7,589,744,318
4	2018	4.2	1,997,301.14	8,388,664,773
5	2019	4.2	2,015,625.00	8,465,625,000
6	2020	4.5	1,007,812.50	4,535,156,250
Total	-	23.4	-	41,128,104,815

The risk premium results can be used to estimate the total net premium obtained based on the planned assumptions. Because the total net premium is calculated by multiplying the risk premium results based on the assumptions by the original number of policies. The result of the total net premium with the type of TLO protection for motor vehicles for the period 2015-2020 is IDR41,128,104,815.

5. Conclusion

Based on the analysis of motor vehicle insurance claim data with Total Loss Only (TLO) protection from 2015 to 2020, it can be concluded that the frequency of claims and the number of claims have a significant influence on the calculation of risk premiums. The average number of claims experienced an increasing trend from IDR 8,000,000 to IDR 10,000,000, while the average annual premium remained stable at IDR 1,200,000. This shows that insurance companies must carefully allocate funds to cover the increasing risk along with the increasing number of claims. In addition, the ratio of premiums received by the company to risk premiums shows that although premiums remain stable, an increase in the number of claims can have an impact on the company's profitability. Therefore, an appropriate strategy is needed in determining premiums so that they continue to reflect actual risks and maintain the sustainability of the company. By using a risk premium calculation method that considers data on the frequency of claims and the number of claims, insurance companies can estimate the level of risk more accurately and set more proportional premiums.

References

Ahmad, S. D. (2022). Juridic Review Concerning Supervision of Financial Services Authorities in Insurance Companies Based on Law Number 40 of 2014 Concerning Insurance. *Enrichment: Journal of Management*, *12*(2), 1601-1609.

Kingma, L. (2023). *Assessing the Dependency Between Claim Frequency and Claim Severity for a Dutch Home Content Insurance Portfolio: A comparative case study of independent and dependent frequency-severity models* (Master's thesis, University of Twente).

Konrad, R., Zhang, W., Bjarndóttir, M., & Proaño, R. (2020). Key considerations when using health insurance claims data in

advanced data analyses: an experience report. *Health Systems*, *9*(4), 317-325.

Ramlah, R. (2022). Penerapan Ganti Rugi Asuransi Mobil Pada Kasus Kecelakaan Dan Pencurian PT. Asuransi Tri Pakarta. *OPTIMAL Jurnal Ekonomi dan Manajemen*, *2*(2), 223-232.

Sari, S., Lubis, F. A., & Syahriza, R. (2023). Operational Analysis of Partial Loss and Third Party on Automobil Assurance in PT. Askrida Syariah Branch Medan. *Moneter: Jurnal Keuangan dan Perbankan*, *11*(2), 208-216.

Verbelen, R., Antonio, K., & Claeskens, G. (2018). Unravelling the predictive power of telematics data in car insurance pricing. *Journal of the Royal Statistical Society Series C: Applied Statistics*, *67*(5), 1275-1304.

Bagariang, E. I., & Raharjanti, A. (2023, December). Calculation of Motor Vehicle Insurance Premiums Through Evaluation of Claim Frequency and Amount Data. In *Operations Research: International Conference Series* (Vol. 4, No. 4, pp. 157-162).