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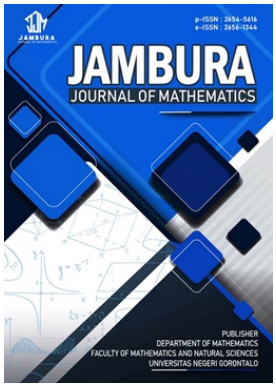

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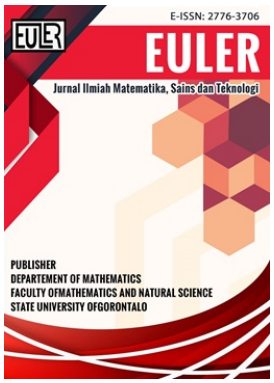

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Research Article

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Observation of Calculated Lapse Rate for Sharia Life Insurance Data : A Study Case

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ABSTRACT. *Modeling a lapse rate is an important subject for life insurance companies because a lapse rate can impact the premium pricing, the reserves, and profitability. In this paper, we calculate the lapse rate and implement a similar approach proposed by the Life Insurance Marketing and Research Association (LIMRA) and the Society of Actuaries (SOA). We analyze lapse rate data from one Sharia insurance company in Indonesia, covering an eight-year period with a total of more than one hundred thousand policyholders. Sharia insurance is aimed at managing contributions based on Sharia principles for mutual assistance and protection by providing compensation to participants/policyholders for losses due to an uncertain event or by providing payments based on the death or the survival of participants. We observe the lapse rates by the face amount group, by genders, and by premium payment frequencies. We found three conclusions, which are mostly that the lower the face amount group, the higher the lapse rate; the lapse rate is not significantly different by gender; and the lapse rate for quarterly payment frequency is higher than for other frequencies.*

1. Introduction

According to Indonesian Law Number 4 of 2023 about Development and Strengthening of the Financial Sector [1], Sharia Insurance is a collection of agreements, consisting of agreements between the Sharia insurance company and the policyholders and agreements among the policyholders, aimed at managing contributions based on Sharia principles for mutual assistance and protection by (a) providing compensation to participants or policyholders for losses, damages, expenses incurred, loss of profits, or legal liability to third parties that may be suffered by participants or policyholders due to an uncertain event; or (b) providing payments based on the death of participants or payments based on the survival of participants with benefits whose amounts have been determined and/or based on the results of fund management.

Indonesia is the second largest Muslim population in the world [2] and has significant potential to penetrate in Sharia-compliant financial [3]. The sharia insurance industry experienced significant growth from 2010 to 2017, an average of around 5%, exceeding the growth of conventional insurance companies [4]. The contribution of Sharia Life Insurance experienced a significant increase from 5.80% in 2017 to 11.80% in 2022 [3]. However, in the midst of this growth, sharia insurance companies face various challenges that affect their stability, one of which is the high lapse rate.

When someone pays the insurance premium for a product for the first time, the insurance policy will be issued. The insurance contract will remain active according to the applicable terms and conditions until the maturity date. However, a policyholder has an option to terminate his insurance policy before the maturity date. A life insurance policy lapses when the policyholder misses the premium payment, and a specific tolerated period has ended. The specific period is called the grace period, and it depends on the company rules; it could be one or two months or it could be more. Surrender is a situation when the policyholder voluntarily ends his insurance policy.

LIMRA and SOA define an insurance policy lapse as "termination for nonpayment of premium, insufficient cash value, full surrender of a policy, transfer to reduced paid-up or extended term status, and terminations for unknown reason" [5]. According to [6], lapse activity can adversely impact the insurer if it is greater than expected. The insurers may face operational challenges in various ways; for example, the insurers may face the losses because it has incurred the acquisition cost; policy lapses and surrenders might force insurers to liquidate high-yield investments to meet the surrender value requests from policyholders; and high lapsation can affect the pricing strategies. Besides, according to [7], managing the lapse rate is a key objective for insurance companies to ensure long-term profitability.

Among the research that discusses the lapse behavior of policyholders in Indonesia is conducted by Hein et al. [8]. They used the Generalized Linear Model (GLM) on the two datasets they had. Based on the results of the analysis on one of the datasets, they found that emergency funds and interest rates had an effect on the lapse risk. However, in other data sets, there is not enough evidence to conclude the same thing.

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Other research using data in Indonesia was also conducted by Siregar et al. [9]. The econometric approach used is a probit model to see the contribution between age, marital status, income, and number of members against the possibility of terminating a policy. The results obtained are that the determining factors of age, marital status, income, and number of family members contribute to reducing the possibility of lapse.

The research conducted by Hein refers to research conducted by Eling et al. [10]. Eling et al. analyzed what factors determine the lapse of a policy based on data from an insurance company in Germany. They found several characteristics, such as product type, contract age, age, and gender, were important factors in lapse rates.

Another methodology used to predict the lapse decision by policyholders in life insurance is the Random Forest Methodology conducted by Azzone et al [11]. They demonstrate that non-economic factors have a major influence on lapse decisions, while economic or financial factors have a more limited impact. Manteigas and Antonio [12] conducted the research to get predictions of lapse in mortgage life insurance by using machine learning models, namely Logistic Regression, Random Forest, Neural Networks, and Extreme Gradient Boosting (XGBoost), where XGBoost outperforming the others. Alcaide and Diogo [13] also used the machine learning techniques to predict the lapse rate in life insurance, namely Random Forest model, Bagged Classification Tree, C5.0, and Boosting models, where the Random Forest model was the most effective approach for predicting lapse risk.

Research mentioned above was conducted to know what factors determine the lapse of a policy, but not the lapse rate per policy year as conducted by LIMRA and SOA. Lapse rate assumption per policy year is needed as an assumption in calculating the premium pricing, the reserves, and profitability. Therefore, in this paper, we calculate the lapse rate and implement a similar approach proposed by LIMRA and SOA.

Based on the description of the method in [5], we develop a mathematical model for calculating the lapse rate of LIMRA and SOA. The model is implemented into data of Sharia Life Insurance products. Due to required data being used should be deep in detail, they is rarely to find, so in this paper it is coming from a Sharia company. We examine the influence of the face amount group, genders, and premium payment frequencies on the lapse rate. Hopefully, the insurance company could use the research results as for analyzing some anticipation to reduce this rate.

In [14], the authors showed the lapse rate of the conventional life insurance policies and family takaful(Shariah Insurance) certificates in Malaysia, using a panel data of year 2017-2021 from samples of the related companies. The mean of lapse rate data is 3.80% for the conventional product and 7.12% for the takaful product. The lapse rate of Sharia Insurance product is higher that of the conventional product.

In general, the lapse rates of life insurance in Indonesia based on the official data from Otoritas Jasa Keuangan (Financial Services Authority) Republic of Indonesia [15] were fluctuating; they were 5.70% (2013), 3.70% (2014), 4.20% (2015), 24.70% (2016), and 2,30% (2017), or 8.10% in average. The companies data was not classified into conventional and Sharia, so we cannot compare between the conventional and sharia products.

2. Methods

2.1. Methodology

The methodology used to calculate the lapse rate follows the similar approach proposed by LIMRA and SOA. Let $APLR$ be the Annualized Policy Lapse Rate, NL be the number of policies lapsed during the year, and NL be the number of policies exposed to lapse during the year. The Annual lapse rate is calculated as follows:

$$\text{APLR} = 100 \times \frac{NL}{NE}. \tag{1}$$

In [5], "the number of policies exposed to lapse is based on the length of time the policy is exposed to the risk of lapsation during the year. Lapses contribute exposure for the full 12 months. Terminations due to death, expiry, maturity or conversion are not included in the amounts lapsing and contribute exposure for only the fraction of the year they were in force."

Based on the general description in eq. (1), we construct the detailed formulation as follows. Define t_{join} as the beginning date of the insurance cover, T_1 as the beginning date of the study period, T_2 as the end date of the study period, and t_{end} as the end date of the insurance participant or the end date of study period whichever earlier. We have $t_{join} \leq T_1 < T_2 \leq t_{end}$.

Define m_k as the number of policies for k-th policy year, L_k as the total of lapse count for k-th policy year, E_k as the total of exposure count for k-th policy year, and LR_k as the lapse rate of k-th policy year.

$$L_k = \sum_{i=1}^{m_k} L_i^k(t), \tag{2}$$

where

$$L_i^k(t) = \begin{cases} 0 & \text{, if policy is active or has non-lapse termination in } k\text{-th policy year, where t} \in [T_1, T_2], \\ 1 & \text{, if policy is lapse in } k\text{-th policy year where } t \in [T_1, T_2], \end{cases}$$

$$E_k = \sum_{i=1}^{m_k} E_i^k(t), \tag{3}$$

where N is the number of days in one year (365 or 366), and

$$E_i^k(t) = \begin{cases} \frac{t_{end} - t_{join} - (k-1)\times N}{N} & \text{, if policy is active or has non-lapse termination in } k\text{-th policy year where } t \in [T_1, T_2], \\ 1 & \text{, if lapse in } k\text{-th policy year where } t \in [T_1, T_2]. \end{cases}$$

For $\Delta T = \lceil T_2 - t_{join} \rceil$ which is the year difference between T_2 and t_{join}, we get:

$$LR_k = \frac{L_k}{E_k}, k = 1, 2, ..., \Delta T. \tag{4}$$

Figure 1. Case 1 with no lapse

Figure 2. Case 2 with lapse at 20 Aug 2011

Figure 3. Case 3 with termination other than lapse

We illustrate the calculation of exposure and lapse count based on three cases, as in Figure 1, 2 and 3. For these examples, the study period begins on 1 January 2010, and ends on 31 December 2011. Blue arrows show the beginnings and ends of years in the study period; orange arrows show the join date and anniversary dates of a participant; and green arrows show the date of lapse and non-lapse termination occurrences.

For case 1 in Figure 1, there is no lapse occurring throughout the policy years. We have the exposure $\frac{365}{365} = 1$ for Policy Year 1, and $\frac{275}{365}$ for Policy Year 2. The lapse count for both Policy Years 1 and 2 are 0; so we have the annual lapse rates are 0% for both Policy Years 1 and 2.

For case 2 in Figure 2, a lapse occurs on 20 Aug 2011. The exposure for Policy Years 1 and 2 are respectively $\frac{365}{365} = 1$ and $\frac{365}{365} = 1$. The lapse count for Policy Year 1 is 0 and for Policy Year 2 is 1; so we have the annual lapse rates are 0% for Policy Year 1 and 100% for Policy Year 2.

In case 3, the policy holder had terminated the contract on 20 August 2011 due to death, maturity or expiry, so the exposure is based on how long the policy holder stays active. The exposure for Policy Years 1 and 2 are respectively $\frac{365}{365} = 1$ and $\frac{134}{365}$. However, the lapse count for both Policy Years 1 and 2 are both 0; so we have the annual lapse rates are 0% for both Policy Year 1 and 2. Then we apply the same approach for all policy holders and aggregate the results for each policy year to get annual lapse rates based on policy year.

2.2. Data

The data analyzed is a sample data from one sharia life insurance company in Indonesia. The data used is as of 31 April 2017, and the study period is from April 2009 to February 2017. The study period is assumed to be two months from the data cut-off to include a grace period. The grace period is the time given by the company to policyholders to pay premiums that are due in advance. The grace period can vary depending on the company rules, but here we assume the grace period is 2 months. The total number of policies used in this study was 117,726, with the number of policies based on issue year explained in Table 1. The numbers of data in 2009 and 2017 appear to be less than in other years because the study period carried out was not complete in one year. In the following section, we show the result of the implementation of the lapse rate model into the data.

Table 1. Number of policies based on issue year

Issue year	Number of Policies
2017	1,535
2016	12,698
2015	17,031
2014	19,492
2013	18,772
2012	17,513
2011	14,474
2010	11,130
2009	5,081

3. Results and Discussion

Using Eq. (2)–(4), the lapse rate observed by policy years can be seen in Table 2. The result shows that the lapse rate in the first two policy years is much higher than in subsequent years. There are many reasons for this phenomenon, one of them

might be the instability of the financial situation of payer of the insurance. For another potential reason, the life insurance might be a gift already paid in beginning period, for some people that is actually cannot afford the financial burden. In the next section, we analyze the result based on some categories, namely face amount, gender, and premium payment frequency.

Table 2. Lapse rate result

Policy Year	Lapse Rate
1	15.70%
2	15.10%
3	6.00%
4	7.80%
5	6.00%
6	6.10%
7	6.40%
8	6.00%

3.1. *Face Amount Category*

A face amount is the amount that the insurance company will pay to the insured if the insured event happens. We analyze the result by the Face Amount category. We categorize the face amount into four groups, namely below 50 million IDR, between 50 million and 100 million, between 100 million and 250 million, and greater and equal than 250 million IDR. The result is shown in Figure 4. It shows that there is a fairly large difference in lapse rate values in groups 1 and 2, namely from 6.30% to 24.30% for group 1 and from 5.60% to 21.60% for group 2. Meanwhile, in groups 3 and 4, the difference in lapse rate values was not as far as in groups 1 and 2. If we look at per each policy year, it is shown that overall the lower the face amount group, the higher the lapse rate, except Policy Year four.

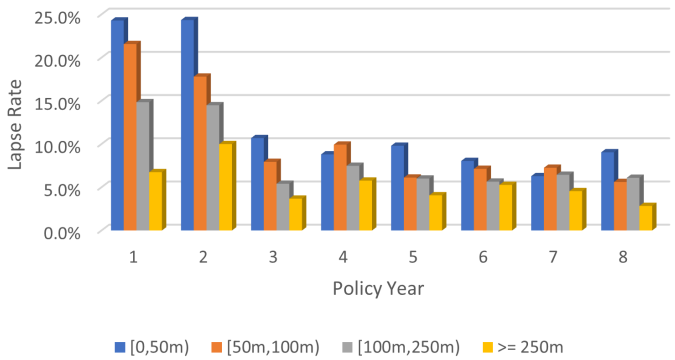

Figure 4. Lapse Rate by Face Amount

In Policy Years 1-2, the payers might have instability in their financial condition, except for the face amount in group 4. In the longer policy years, they might have stable financial condition. Generally for groups 3-4, the policy holders might think the high face amount worth enough to obtain, so they try to keep paying the insurance premium. The financial condition of the payers of these insurance is already stable to pay the premium, which is commonly also high.

3.2. *Gender Category*

Then, we analyze the result by gender, male and female. The result is in Figure 5. The minimum and maximum deviation rates for females range from 5.70% to 14.80%, while for males it ranges from 6.30% to 16.50%. We conclude that the lapse rate between males and females is not significantly different, but in general the lapse rate of males is higher than of females for all policy years. It might be because of the female's characteristic that is more submissive in paying the premium. For another reason, the payers of insurance might be the female's children or husband that make secure financially.

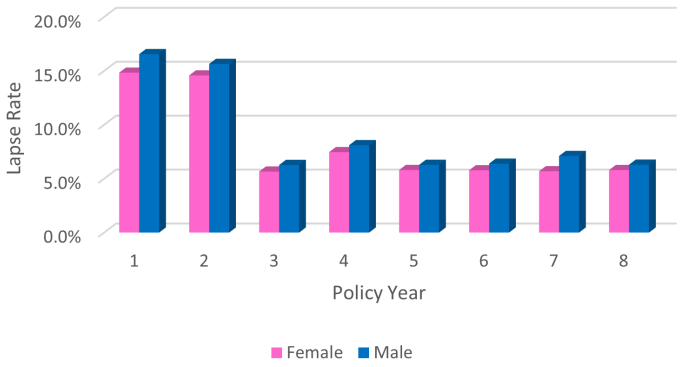

Figure 5. Lapse Rate by Gender

3.3. *Premium Payment Frequency Category*

We analyze the result based on premium payment frequency, namely annual, semiannually, quarterly, and monthly. The result is in Figure 6. The lowest lapse rate value is dominated by annual payments, with the smallest lapse rate being 1.20% to the highest 12.90%. The lapse rate for semiannual payments ranges from 4.50% to 21%, for quarterly payments it ranges from 7.10% to 31.50%, and for monthly payments it ranges from 5.50% to 20%. We conclude that the lapse rate for quarterly payment frequency is higher than for other frequencies.

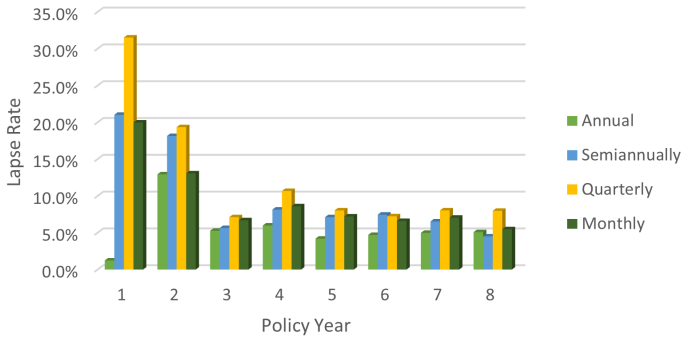

Figure 6. Lapse Rate by Premium Payment Frequency

Generally, the annual payment being the lowest lapse rate supports the reason of financial stability of the payers, where they can pay total amount for a year in the beginning of the year. For the quarterly payment, it has the highest lapse rate in Year Policy 1 because of this instability financial condition of the payers.

4. Conclusion

We calculated the lapse rate of Sharia life insurance data based on a similar approach proposed by LIMRA and SOA. We rewrite the proposed methodology into the mathematical equation, and it is our novelty. From the data we have, we found three conclusions, which are mostly that the lower the face amount group, the higher the lapse rate; the lapse rate is not significantly different by gender; and the lapse rate for quarterly payment frequency is higher than for other frequencies. The insurance company could take some management actions for reducing the lapse rates, for example giving easier regulations for paying the premium in the beginning years of the policy period, so the insurance payers could manage their financial instability if happen but they can continue to pay the premium.

The lapse rate calculation carried out is for the entire product, not separated per product. A product can be built with a different lapse rate character. Therefore, it is possible to calculate the lapse rate based on similar products.

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Data availability. The datasets used during this study contain confidential information and are not publicly available.

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