

Measuring Risk Aversion Behavior Using Szpiro's Approach: Case Study in Indonesia's Life Insurance Industry

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Abstract

Life insurance industry shows promising benefits for Indonesia's economic and social sector, yet its penetration continues to decrease since 2016 despite income growth. This study addresses the phenomenon by analyzing the risk preference of Indonesian consumers using Szpiro's approach to measure risk aversion, then analyzes the effect of risk aversion on life insurance demand in Indonesia. We use data from Indonesia Insurance Statistics from 2006 to 2022 with annual period. Augmented Dickey Fuller test were conducted for stationarity test, Ordinary Least Square is used to estimate time series data, and Klein's rule is used to address multicollinearity problem in regression analysis. Evidence is presented in support of the positive effect of risk aversion on life insurance demand. The degree of relative risk aversion in Indonesia is estimated at 0.0915 with risk aversion value in 2022 of 0.1402, indicating that Indonesian people is a risk-averse consumers. This finding helps explain the low demand phenomenon, given that other developed countries have a substantially higher level of risk aversion, as shown in a previous study by Szpiro. Moreover, since Indonesia is a non-high-income country with risk-averse consumers, the opportunity to enhance life insurance demand remains open. These findings will help policymakers in demand and pricing analysis.

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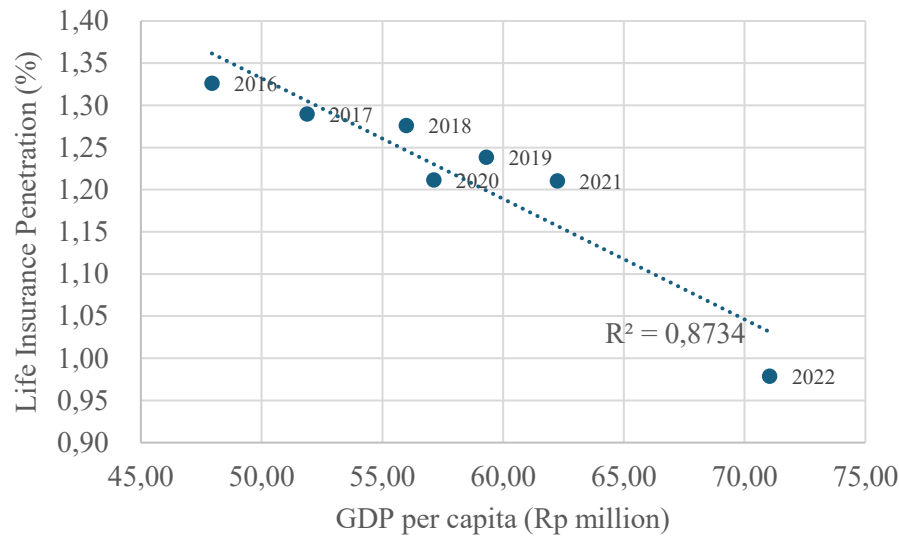
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1. INTRODUCTION

Life insurance industry in Indonesia has shown promising contribution to economic and social sectors [1]. Premiums for life insurance reached Rp 191.73 trillion in 2022, with total assets of Rp 582 trillion and a sum insured of Rp 4,685.4 trillion [2]. The existence of this trillion-rupiah market shows people's great effort to avoid risk, because life insurance is a solution for risk-averse individuals facing uncertain lifetimes by exchanging the uncertainty of financial loss for a fixed premium payment [3]. Life insurance allows the risk-pooling mechanism to reduce the likelihood of financial distress through diversification that significantly important for households in non-high-income countries that only have limited savings and safety funds [4].

However, the penetration of life insurance, or revenue to Gross Domestic Product (GDP), in Indonesia has continued to decline since 2016, from 1.33% to 0.98% in 2022. This decrease even occurs as people's income, GDP per capita, continues to increase from Rp 47.94 million to Rp 71.3 million in the same period (Figure 1.). This condition contradicts the common view that an increase in income should boost the demand for life insurance because premiums become more affordable and more assets need protection [5]. Moreover, the increase in income should raise consumers' levels of risk aversion, which will increase insurance demand [6], as predicted in the increasing relative risk aversion (IRRA) hypothesis that risk aversion is a function of income with decreasing utility, such that paying premiums in exchange for uncertainty will maximize their utility [7].



Source: OJK (research team processed)

Figure 1. Life Insurance Penetration and GDP per capita in Indonesia (2016 – 2022)

Insurance purchases are often seen as an ideal place to examine the theory of choice under uncertainty [8]. The basic premise is that risk attitude can be measured and lead to predictions about insurance purchases and other analyses [9]. Understanding risk aversion also enhances customer engagement and satisfaction by aligning products with consumer preferences [10]. Empirical studies to measure risk preference have been conducted, yet their difficulty has also been mentioned, especially in developing countries [11]. Bokern et al. [12] also show that there is a growing need for the quantification of risk preference regulation requirements, but unvalidated scientific measurements of risk preference are often found in financial institutions.

Thus, the question arises: how has the risk preference of Indonesia's consumers been? And how does this risk preference affect life insurance purchases? To the best of the author's knowledge, there is still limited research on consumers' risk preference and life insurance purchases (hereafter LIP) in the Indonesian context. Rapi et al. [1] have analyzed LIP determinants in Indonesia, showing that economic and demographic factors significantly affect LIP but do not analyze its risk preference. Tanjung and Cahyanti [13], using survey data, find the significant effect of financial literacy and trust on LIP in Indonesia, but the study focuses on the role of financial education. Jameaba [14] finds that risk aversion has grown in Indonesia but in the context of the Deposit Insurance Corporation (IDIC) establishment.

Furthermore, the quantification of risk is often used in actuarial studies [15], but previous studies are still limited in analyzing risk aversion topics and LIP behavior. Motte and Hainaut [16] show that optimal hedging strategies for insurers also depend on the risk aversion of insurers. Maccheroni et al. [17] define risk aversion as a preference for purchasing insurance at actuarially fair premiums, so the propensity to purchase life insurance is equivalent to Rothschild-Stiglitz's (1970) notion of risk aversion. Dehn-Toftehøj et al. [18] also propose the measurement of risk aversion with individual preference following the Constant Relative Risk Aversion (CRRA) utility function. However, these studies do not focus on LIP issues.

Therefore, this study fills the existing gap by answering the two previous questions. This study aims to (1) measure consumer risk aversion behavior in Indonesia, and (2) analyze the effect of risk aversion on LIP in Indonesia. This study uses Szpiro's approach [19] to measure risk aversion with secondary data from Indonesia Insurance Statistics provided by the Financial Services Authority from 2006 to 2022 in an annual period. Szpiro's approach is arguably the most prominent method for risk aversion measurement at the country level [20] and has been used in various studies, such as Rapi et al. [8] in nineteen countries and Szpiro [21] in

seventeen countries, as well as Szpiro and Outreville [22] in twenty nine countries. However, the majority of these countries are high-income and do not include Indonesia.

LIP has been studied for over fifty years, beginning with a seminal study from Yaari on the theory of life insurance demand [6]. Yaari's theory [4] explains that life insurance demand is an individual's preparation for bequests and retirement and consumer is assumed a risk-averse. Karni and Zilcha [23] developed Yaari's theory and argued that risk aversion increases and that income has a positive effect on the demand for life insurance. Lewis [24] expanded upon Yaari's theory by adding a risk aversion factor explicitly to the model.

Risk aversion can be interpreted as the condition when consumers prefer receiving a sure expected payoff over accepting a gamble [25]. Risk aversion is arguably the main reason consumers buy insurance because risk-averse consumers experience diminishing utility as income increases, such that the decision to purchase life insurance under conditions of uncertainty will maximize their utility [26]. This idea can be traced back to Friedman and Savage [27], who showed that consumers' behavior toward risk can be analyzed by their risk preference, where risk-averse individuals will purchase life insurance.

Arrow [4] measure relative risk aversion, $R_R(Y)$, by $R_R(Y) = -Y \frac{U''(Y)}{U'(Y)}$, with Y is wealth and $U(Y)$ is total utility of wealth Y , with consumers prefer option that makes $E[U(Y)]$ larger. $U(Y)$ is an increasing function of Y , so that $U'(Y)$ is a marginal utility of wealth, with $U'(Y) > 0$, and, for risk averse consumers, $U''(Y) < 0$. Consider consumers with wealth Y_0 that offered a chance to win or lose an amount of h at fair odds. A risk averse consumers prefer certain income, $U(Y_0) > (\frac{1}{2})U(Y_0 - h) + (\frac{1}{2})U(Y_0 + h)$ or $U(Y_0) - U(Y_0 - h) > U(Y_0 + h) - U(Y_0)$. The utility differences shows equal changes in wealth decrease as wealth increase, so that $U'(Y)$ is decrease as Y increase. Thus, $\frac{d}{dw}(R_R(Y)) = \frac{d}{dw}\left(-Y \frac{U''(Y)}{U'(Y)}\right) > 0$.

Thus, individuals increase insurance demand because the utility of potential loss relative to an increase in wealth becomes higher. It's called the increasing relative risk aversion (IRRA) hypothesis. This idea has been examined in various studies [28], such as Rapi et al. [8], which show a significant effect of risk aversion on LIP across 19 selected countries, and Lim et al. [10] in the context of South Korea. Thus, it is expected that risk-averse consumers will purchase insurance or have a positive effect on life insurance demand.

H_1 : Risk aversion has positive effect on life insurance demand.

The next section will explain the methodology of this study. This study involved two phases: the first phase is the measurement of risk aversion, and the second phase will examine the effect of risk aversion on LIP. We follow Rapi et al. [8] by using a stationarity test before measuring risk aversion with Szpiro's approach [19]. Then we compared results using the h optimum, h^* , and $h = 1$ conditions, and discuss the implications of the results, comparing them with previous studies. Lastly, we write the conclusion.

2. METHODS

This research uses Szpiro's approach and utilizes secondary data from the Indonesian Insurance Statistics Report (SPI) of OJK from 2006 to 2022. Each report contains data for the last five years with annual frequency. The unit of observation is the Indonesian life insurance industry. Eviews 10 is employed to facilitate data estimation and produce the graphs. The dependent variable is life insurance demand, measured by penetration, the ratio of premiums to GDP, while the independent variable is risk aversion, measured using Szpiro [19]. The data used to measure risk aversion includes premiums, claims, and income on a per capita basis and uses a five-year average to overcome possible noise.

The data are estimated using the ordinary least squares (OLS) method. OLS is a technique for estimating parameters of linear regression models by minimizing the sum of the squared deviations of actual and estimated data [29]. OLS has also been used in various studies on life insurance [30]. OLS in this study

based on Juanda [29]. Unit root test using Augmented Dickey Fuller test, that comparison of Prob values against α . When the criteria are met, they are marked ***, **, and *, namely if $\text{Prob} < \alpha = 1\%, 5\%, \text{ and } 10\%$.

Then, Klein's rule is used to detecting multicollinearity in regression analysis [31]. This method compared the variance inflation factors (VIF) from main regression model with auxiliary regression equation. The formula of VIF is $VIF = \frac{1}{(1-R^2)}$, where R^2 is R squared. If the VIF is more than 10, then there is a severe multicollinearity problem in the model.

Szpiro [19] [21] developed an approach to measure risk aversion. Consider consumer has sum of insured, U , with W is income, λ is loading, and $R(W)$ is risk aversion function, the formula of sum insured is $U = W - \frac{\lambda}{R(W)}$. If risk aversion function is $R(W) = \frac{c_p}{W^h}$, where c_p is coefficient of risk aversion based on premium and h is power of income. If P is life insurance premium, Q is claim, thus $\lambda = \frac{P}{Q} - 1$. If p is premium rate, $P = p \cdot W$. $U = pW - \frac{p\lambda}{R(W)} = pW - p \frac{1}{c_p} (\lambda W^h)$. If $p_0 = p$ and $p_1 = -p \frac{1}{c_p}$, thus $P = p_0 W + p_1 (\lambda W^h)$, where p_0 and p_1 is parameter. The task is to find value of h with p_0 and p_1 that give the best fit or in other word find h optimum (h^*).

Szpiro [19] [21] also analyse using condition Constant Relative Risk Aversion (CRRA), that is using $h = 1$, if there is a severe multicollinearity problem in the model. Pratt [32] shows $R(W) = \frac{c_p}{W}$ ($h = 1$) is one of alternative functional forms for $R(W)$. CRRA also widely used in other researches [33] [34]. To find value of c in each year t , the formula is rewrite become, $P_t = p_t W_t - p_t \frac{1}{c_t} (\lambda_{t_i} W_t^{h_t})$. If, $p_{0,t} = p_t$ and $p_{1,t} = -p_t \frac{1}{c_t}$, where p_{0,t_i} and $p_{1,t}$ is parameter. We get,

$$(1) \quad P_t = p_{0,t} W_t + p_{1,t} (\lambda_{t_i} W_t^{h_t}) + \varepsilon$$

where, t is year - $t = 2002, \dots, 2022$, P_t is life insurance premium in year- t , W_t is GDP per capita in year- t , h_t is power in year t , λ_t is loading in year - t .

Models 1 and 2 were estimated with OLS using Eviews10. To get value p_{0,t_i} and p_{1,t_i} , h_{t_i} has range $\{-5, +5\}$ with *step size* 0,1. The result of h optimum (h^*), h with minimum Sum of Squared Residuals (SSR), is used. This research simplifies Szpiro's [19] approach by does not use a step size of 0.01, but 0.1.

This study rejects models that have serious multicollinearity. If the optimal h does not have serious multicollinearity problems, then the h^* is used. But, if the h^* result has severe multicollinearity problems and the h^1 does not have one, then the result of h^1 is used.

h^* is based on premiums and claims in the year t , denote $h_{p,t}^*$. h^1 based on premiums in year t_i , denote by $h_{p,t}^1$. The results are converted to obtain a risk aversion coefficient based on the premium and the h^* of year t , that is $c_{p,t}^* = -\frac{p_{0,t}^*}{p_{1,t}^*}$. Risk aversion function based on premium and the h^* of year t , $R(W)_{p,t}^* = \frac{c_{p,t}^*}{W_t^{h_{p,t}^*}}$.

Models 1 also enable analysis of the influence of income and expenses on life insurance demand. Szpiro [21] believes that income has a positive effect and expenses have a negative effect on insurance demand. Income is seen as the main determinant of demand for life insurance that have positive influence, which has been proven theoretically and empirically for over fifty years [35] [36]. Santerre [37] argues that loading is an alternative of price measure and increasing loading will reduces demand.

Thus, the risk aversion coefficient, c , is expected to be positive. A positive c value means that consumers are risk averse, while a negative c value means that a risk taker [21].

Models 2 were built to test the effect of risk aversion. Hypothesis of this study is proven if selected risk aversion coefficient, $c_{p,t}^s$, has same sign with α_1 from model 2.

$$(2) \quad \text{Log}(Y_{t_i}) = \alpha_0 + \alpha_1 R(W)_{p_{t_i}} + \varepsilon$$

Where, t_i is year - t ($t = 2002, \dots, 2022$), Y_t is life insurance penetration in year t , $R(W)_{pt}$ is risk aversion based on premium in year t .

Table 1. summarizes the operational variables in this study, where variables X_1, X_2, X_3 , and X_4 are used to measure the value of risk aversion or X_5 . Loading or λ is $\lambda = \frac{A}{Q} - 1 = \frac{X_1}{X_2} - 1$. **Figure 2.** shows the framework of this research, risk aversion based on Szpiro, influencing the demand for life insurance. that measured by life insurance penetration.

Table 1. Operational Variable of risk aversion and LIP

Dependent Variable	Code	Measure	Source	H1
Penetration	Y_1	$Y = \frac{\text{Premium}}{\text{GDP}}$	Secondary data • Premium: OJK • GDP: OJK • Population: OJK	
Independent Variable	Code	Measure	Source	H1
Premium per capita	X_1	$P = \frac{\text{Premium}}{\text{Population}}$	Secondary data • Premium: OJK • Claim: OJK • GDP: OJK • Population: OJK	
Claim per capita	X_2	$Q = \frac{\text{Claim}}{\text{Population}}$		
GDP per capita	X_3	$I = \frac{\text{GDP}}{\text{Population}}$		
Loading	X_4	$\lambda = \frac{A}{Q} - 1$		
Risk aversion	X_5	$c_t = \frac{\text{Relative}}{\text{Risk Aversion}_t}$		+



Figure 2. Research Framework

3. RESULT AND DISCUSSION

Table 2. shows statistic descriptive for these variables. This study has data from 2002, but due to the mechanism of five year average, this study only has 17 data point with variables based on **Table 1**. Over the last twenty-one years, the average life insurance penetration in Indonesia is 1.16% or increase of 59% since 2002. The average life insurance premium is Rp 104.5 trillion or increase by 1576% since 2002 while GDP per capita has increased by 704 % to Rp 71.3 million. The average life insurance premiums per capita and claims per capita from 2002 to 2022 are Rp 407.1 thousand and Rp 292.9 thousand with an average GDP per capita of Rp 35.22 million. The average life insurance loading reached 62.19%.

Table 2. Statistic descriptive

Variable	Y_1	X_1	X_2	X_3	X_4
Mean	1.1644	0.4118	0.2834	41.0884	0.5921
Median	1.2087	0.4063	0.2689	41.9433	0.5487
Maximum	1.3261	0.7179	0.6078	71.0308	1.1106
Minimum	0.8237	0.0864	0.0427	15.0369	0.1811
Std. Dev.	0.1305	0.2187	0.1805	17.0188	0.2535
Skewness	-1.1012	0.0050	0.3531	0.0458	0.5200
Kurtosis	3.8497	1.6372	1.9872	1.8264	2.7166
Observations	17	17	17	17	17

Note: Penetration (Y_1); Premium per capita (X_1); Claim per capita (X_2); Income (X_3); Loading (X_4)

The average life insurance penetration for the last seventeen years is 1.16%, with average of life insurance premium and claim per capita is Rp 411.8 thousand and Rp 283.4 thousand. The average of GDP per capita is Rp 41.08 million and average of loading is 59.21%. All data has not high variation. The average life insurance premiums per capita and claims per capita from 2002 to 2022 are Rp 407.1 thousand and Rp 292.9 thousand with an average GDP per capita of Rp 35.22 million. The average life insurance loading reached 59.21%. All variables do not show high data variation. Stationarity test shows that each variables has significant in level or first differences. Thus all variables can be used for further analysis (**Table 3.**).

Table 3. Stationarity test using ADF for model 1

Variable	t-Stat	Prob
Premium	-2.4121	0.0198
D(Premium)	-0.6861	0.4027
Income	-4.5519	0.0134
D(Income)	-4.6594	0.0125
Loading* Income, h^*	-1.6132	0.0983
D>Loading * Income), h^*	-1.9659	0.0500
Loading * Income, $h=1,0$	-2.4236	0.1521
D>Loading * Income), $h=1,0$	-2.1172	0.0371

Table 4. shows the results for h^* and h^1 and **Figure 3.** shows the relation between h and SSR. It is find that h optimum, h^* , is - 0.1 with SSR 0.0145. Risk aversion function for model 1 with h^* is, $R(W)_{p,t}^* = \frac{0.0915}{w_t^{-0.1}}$. While for CRRA condition, $h=1$, SSR is 0.025 and risk aversion function, $R(W)_{p,t}^1 = \frac{3.0703}{w_t}$.

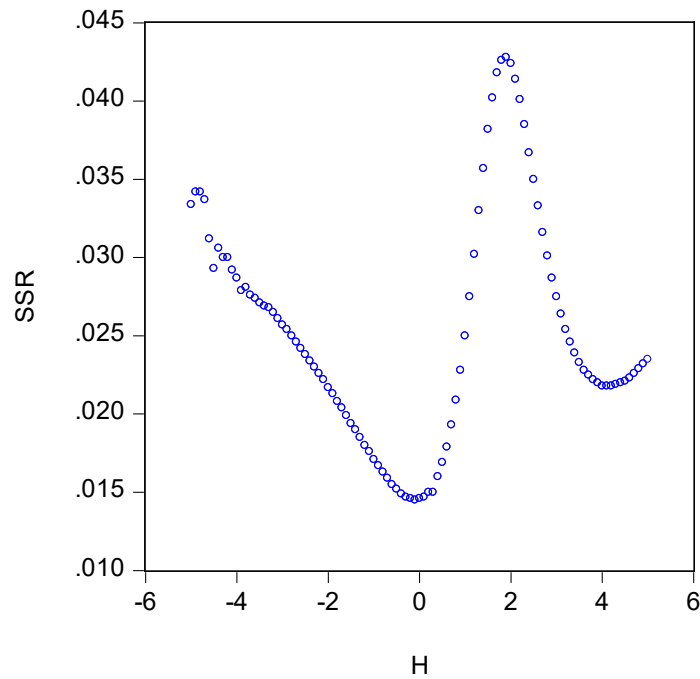


Figure 3. Relationship between h and SSR

Table 4. Results for h^* and h^1

h	$p0$	$p1$	c	SSR	R-squared
-0.10	0.011	-0.124	0.091	0.015	0.9809
1.00	0.012	-0.004	3.070	0.025	0.9673

Next, we tested for multicollinearity in model 1 and found there is no severe multicollinearity problem because the VIF is lower than 10 (**Table 5**). Thus, selected h based premium, h_p^S , is -0.1. It is not necessary to analyze the model using the CRRA condition. **Figure 4**. shows the relationship between income and risk aversion. The results indicate that risk aversion diminishes as income increases.

Table 5. Results of multicollinearity test for h^*

Variable	R-squared	VIF
Premium	0,9810	-
Income	0,8222	5,6247
Loading*(Income ^h)	0,0463	1,0485

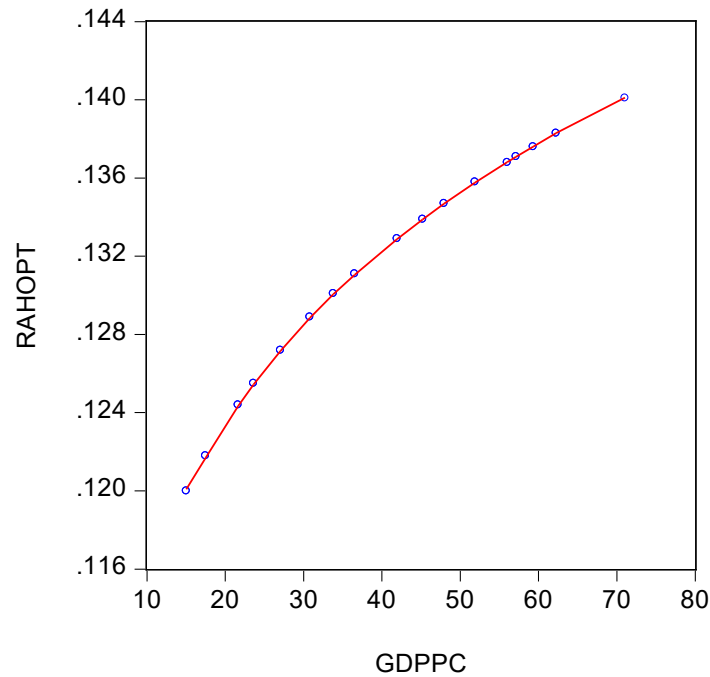


Figure 4. Relationship between income and risk aversion

The same procedures are done for risk aversion and penetration. From the ADF test, there is no unit root at level or first difference (**Table 6.**) so that all variables can be used.

Table 6. Stationarity test using ADF for model 2

Variable	t-Stat	Prob
Penetration	-3.6883	0.0156
D(Penetration)	-5.0192	0.0014
Risk aversion, h^*	-3.6438	0.0204
D(Risk aversion), h^*	-1.3541	0.5679

Table 7. shows that risk aversion has a positive significant effect on life insurance demand, which aligns with the hypothesis. Therefore, as people become more risk averse, they will purchase life insurance.

Table 7. Result for model 2 using OLS

Variable	Coefficient	Std. Error	t-Statistic
c	-1.11*	0.59	-1.88
$R(W)$	9.58*	4.50	2.13
R-squared	0.2324		
Adjusted R-squared	0.1812		
F-statistic	4.5411		
Prob(F-statistic)	0.0500		

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The Szpiro approach also enables proxy of life insurance demand from the claim side. If Q is claim and q is claim rate, then $Q = qU$ therefore $U = W - \frac{\lambda}{R(W)} = qW - q \frac{\lambda}{R(W)}$. If $c_0 = q$ and $c_1 = -\frac{q}{c}$, then $Q_t = c_0 W_t - c_1 \frac{\lambda_t}{R(W)_t}$. Moreover, the analysis can be expanded to determine the sum insured, U , the minimum U consumers are willing to pay, optimum loading, and the maximum underwriting profit. For example, the known risk aversion function is $R(W)_{p,t}^* = \frac{0.0915}{W_t^{-0.1}}$. Szpiro's (1986) formula for sum insured is, $U = W - \frac{\lambda}{R(W)}$. If consumer has income Rp 100 million and insurance loading, λ , is 40%, then the risk aversion value is, $R(W) = \frac{0.0915}{100^{-0.1}} = 0.145$. Thus sum insured for this consumer is, $U = 100 - \frac{0.4}{0.145} = 97.24$ or nearly 98% of his income.

Szpiro's (1988) formula also help for coverage analysis. The minimum coverage, L , that consumer willing to take is $L > \frac{2\lambda}{R(W)}$. Thus, $L > \frac{2\lambda}{R(W)} = \frac{2(0.4)}{0.145} = 5.52$ or consumers buy insurance that covers a minimum risk of Rp 5.52 million. For example, if the company only provide insurance of Rp 4 million, then consumers must be convinced to provide a deductible, D , of Rp 1.52 million or this number can be a reference for subsidy.

This study find the level of risk aversion, c , in Indonesia is 0.091 with value of risk aversion, $R(W)$, in 2022 is 0.145 and risk aversion has positive effect on life insurance demand. This finding shows consumers in Indonesia is a risk averse. Compared with Szpiro [19], level of risk aversion in America between is 1.79. Szpiro and Outreville [22] shows level of risk aversion in some Asian countries are 4.89 (Japan), 3.09 (Korea), 3.98 (Malaysia), and 4.99 (Singapore). Therefore Indonesia has relative low level of risk aversion, but it is also become the reason why Indonesia has relative lower life insurance penetration than these countries. In 2022, life insurance penetration in Japan is 6.02%, Korea is 6.13%, Malaysia is 3.11% and Singapore 7.87%.

The finding of this study has added previous study from Rapi et al. [6] Tanjung and Cahyanti [13], and Altuntas et al. [38], that risk aversion as LIP determinant. The results also can help insurer in segmentation or predicting consumers of life insurance. Rapi et al [6] shows that non-high income countries, such as Indonesia, tends to purchase life insurance. Thus, given Indonesia as non-high income countries and risk averse consumers, the life insurance industry is predicted will raise in the future.

This study also supports the Increasing Relative Risk Aversion (IRRA) hypothesis, which many researchers often find ambiguous in results regarding the increase or decrease of risk aversion as income rises [39]. In economics, the theory is related to the view of life insurance as an inferior or normal good, despite being quite a narrow perspective because it implicitly assumes that consumers only face one risk and that the amount of risk remains constant [40]. Heo [41] also argues that it is impossible for individuals to make decisions alone in isolation, because the environment and external factors also affect decisions, as shown in the theory of resource management [42]. However, as demonstrated in this study and Rapi et al. [8], the IRRA hypothesis can explain LIP at the country level. What we need is to test the hypothesis in an individual context.

Szpiro's approach has the advantage of using historical data that is easily accessed on the internet. Some researchers use survey data to examine risk aversion. For example, Nestor and Ruben [43] used data from the Gallup World Poll and Nagy et al. [44] utilized a survey. Nestor and Ruben [43] show that the hypothesis that relative risk aversion is equal to one cannot be rejected, while Nagy et al. [44] demonstrate that attitude toward risk does not have a major effect on insurance demand and that loss aversion has more significant effect than risk.

This study also has limitations in data, using country-level data, and the methodological approach that estimates time series data using OLS. Our approach makes this study using small data sets that Martens and Dardenne [45] question predictive ability in this situation. Our study addresses the issues by using Augmented Dickey-Fuller test, Klein's rule, evaluating the p-value, and F-statistic. The results show that all variables are significant with Prob < 10%, with an R-squared for model 2 of 23%.

In addition, improving the quality of research can also be addressed by comparing it with other countries [8] and using individual data [46]. The analysis can also be extended by transforming the data with autoregression to solve multicollinearity problems and using other econometric approaches to estimate data, such as Generalized Autoregressive Conditional Heteroskedasticity (GARCH), which is often used in systemic risk analysis [47], and using a more advanced approaches, such as machine learning, to address individual analysis that involves big data [48].

4. CONCLUSIONS

This study shows that consumers in Indonesia tend to be risk-averse, as evidenced by the level of risk aversion in Indonesia of 0.0915 and the risk aversion value in 2022 of 0.145. This study also find that risk aversion behavior has significantly affected purchasing behavior in life insurance. The finding explains the low demand for life insurance in Indonesia, given the fact that other developed countries have a substantially higher risk aversion level, as shown in a previous study by Szpiro [21]. Moreover, as Indonesia is a non-high-

income country with risk-averse consumers, the opportunity to enhance life insurance purchases remains open. This study also demonstrates some applications of the results in demand and pricing analysis. There are some limitations in this study, such as using OLS and small data sets, as well as potential topics for further research, such as using individual data and machine learning approach to improves risk aversion measurement.

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