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Surrender analysis of life insurance in Iran at two micro-corporate and macroeconomic levels

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Abstract:
To increase the share of life insurance from the written insurance premium of commercial insurance and also considering the necessity of keeping life insurance customers by insurance companies, it is necessary to investigate the causes of surrendering life insurance and provide solutions to prevent it. Based on this, the aim of this paper is to investigate the surrender of life insurance and analyze the corporate and economic factors affecting it in Iran's insurance industry. In order to respond to this goal, the effort is to first identify the micro-corporate factors as well as the economic factors affecting the surrender of life insurance and evaluate and analyze the effectiveness of each factor. Then, the information available in this field is examined separately for Iran's insurance companies and analyzed at micro and macro levels, and finally, operational solutions and necessary measures to reduce surrendering the life insurance are presented. Based on the results, number of agents and brokers, insurer size and interest rate are most effective on surrender indices. Also, inflation rate, unemployment rate, gold and currency market indicators are the main economic variables that impact on surrender indices.

Keywords: Life insurance, Surrender Analysis, Macroeconomic, Micro-Corporate.
JEL Classifications: 91B64, 62P20, 97M30.

1 Introduction

In life insurance, each of the parties to the contract can withdraw from its continuation, depending on the type of withdrawal, it is referred to by different titles such as termination, surrender, and lapse of the insurance policy, which have several definitions. Termination of the insurance policy often occurs from the side of the insurer in cases such as non-compliance with the principle of good faith, non-payment of insurance premiums by the policyholder, financial fraud, and money laundering. Surrender of the insurance policy refers to the unwillingness of the policyholder to continue the policy and its cancellation on the part of the policyholder in life insurance with savings, and on the other hand, the laps of the policy occurs when the policyholder intentionally states something untrue, and in this case, the insurance

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contract is void. In some texts related to the surrender of life insurance, two words "laps" and "surrender" indicate the withdrawal of the insurance policy by the policyholder [4, 12]. Based on this, the policyholder can submit the surrender request to the insurer at any time during the policy period, and the insurer is obliged to pay the policy's surrender value to the policyholder if the cash value is formed.

With increasing competition in the market, the surrender of life insurance policies has become a significant issue for organizations. One of the reasons is that attracting new customers is much more expensive and difficult than keeping existing customers, so it is said that selling a product to a new customer is about five times more expensive than selling a product to an existing customer. In order to manage this issue, organizations seek to find the economic and insurer factors that influence surrender to prevent this with preventive measures such as designing products by the current economic conditions and changing existing products. Based on this, to identify the factors affecting the surrender of life insurance, it has always been tried to examine their significance using the available data, and based on that, suggestions are made to improve the current situation. The models that can be used to analyze the surrender of life insurance can be selected based on the type of hypothesis affecting the surrender (emergency fund hypothesis, interest rate hypothesis, policy replacement hypothesis) and the type of data used (time series, cross-sectional, pooled or panel) [6, 9]. For example, when it is important to examine the insurer's variables over section (such as company/branch/country/province) and time, panel regression should be used, but when the importance of the influence of a series of variables on the surrender of life insurance during a period is important, time series regression models can be used.

Now, we mention a brief history of the surrender analysis of life insurance. Russell et al. [12] modeled life insurance's surrender as a function of liquidity needs as household liquidity constraints, interest rates/investment arbitrage opportunities, and life insurance market dynamics, and analyzed surrendering at the state level to correlate with macroeconomic variables. Barucci et al. [1] investigated the drivers of life insurance's surrender in one of the Italian life insurance companies. In this research, two approaches have been used for modeling, one based on the role of macroeconomic variables in the surrender using the panel model and the other based on the role of micro variables of the insurance contract and some macroeconomic variables using linear regression. Hwanf [6] examined the economic and corporate determinants of the surrender in Taiwan's life insurance companies for the period of 2009-1999. The model used is the ordinary least square regression, which the dependent variable is the surrender rate and the independent variables are selected from economic and corporate variables. Haefeli and Ruprecht [5] investigated the behavior of life insurance's surrender under normal and difficult conditions (financial crisis). Kiesenbauer [7] studied the determinants of surrender in life insurance in Germany. In this research, the logistic regression model was used on macroeconomic and corporate variables during the years 1997 to 2009

in 133 German insurance companies for five different categories of life insurance products. Poufinas and Michaelide [11] reviewed the determinants of surrender in life insurance using the linear regression, the dependent variable of which is the surrender rate of an insurance company in Greece and independent variables of macroeconomics are considered. Kim [8] modeled the surrender rate using economic variables. The model used in this research is the logit and log-log regression model, the dependent variable of which is the logarithm of the surrender rate, and the independent variables are related to economic and insurer characteristics. Eling and Kiesenbauer [2] have investigated the effect of factors related to the insurance product and factors related to the policyholders on the surrender of insurance policies, considering more than two million insurance policies between the years 2000 and 2010. Fier and Liebenberg [3] considered the economic and insurance models in the voluntary surrender of life insurance policies. By collecting the relevant data, the researchers have entered into the investigation of the factors influencing the surrender in the field of households and using a longitudinal data panel model, they have provided evidence on the impact of these factors on the surrender. Nolte and Schneider [10] studied the influencing factors, specifically financial literacy, on insurance policy's surrender using panel data collected in Germany since 2001.

In this paper, the surrender of life insurance in Iran is examined at two levels of the micro-company (insurer) and the macro-economy. In this regard, indicators are defined based on the number and value of surrender payments, and the significance of variables related to the insurer and variables related to the macroeconomics are evaluated through panel regression and time series, respectively. Also, in this research, the geographical area includes the insurance companies in Iran providing life insurance products and the time area of the research is 2008 to 2019. The data of this research is collected using the information received from insurance companies as well as the information contained in the statistical yearbook of Iran's insurance industry. The dependent variable in the investigated models are the indicators defined for the surrender of life insurance and the independent variables of this research include macroeconomic variables such as interest rate, inflation rate, unemployment rate, stock market indicator, currency and gold market indicators, national income indicator, aging ratio and insurer variables such as the age of the insurance company, the size of the insurance company, the number of agents, brokers and branches of the insurance company, the rate of participation in benefits, etc.

The rest of the paper is outlined as follows. Section 2 offers a brief review of the impact of surrender in life insurance. Section 3 presents the methodology of surrender analysis in this paper. In Section 4, the results of modeling are described. Finally, a conclusion is provided in Section 5.

2 Surrender in Life Insurance

Several factors are effective in the surrender of life insurance (customer churn), which can be divided into different categories such as macroeconomic variables, insurance policy variables, policyholder/insured variables, and insurer variables. Considering that the purpose of this research is to examine macroeconomic and corporate factors affecting the surrender of life insurance, other categories are not considered in this paper. Insurance companies cannot play a significant role in controlling all the macro factors mentioned, therefore, to reduce the surrender rate, planning should be done to reduce the effects of these factors on the surrender rate, as well as monitoring and reviewing the factors affecting this rate within the company. If these factors are not identified and appropriate solutions are not used to reduce their impact, the risks of life insurance surrender will have a short-term and long-term impact on the insurance industry, which can be summarized as follows [4]:

- Stopping the flow of written insurance premiums and the insufficiency of mathematical reserves to cover administrative and underwriting costs.
- Changing the insurance company's portfolio to high-risk customers due to the reluctance of these customers to surrender based on a shorter lifespan and the surrender of low-risk customers.
- Occurrence of problems in the liquidity of insurance companies and the reduction of assets, as well as the inability to pay obligations.
- Negative effects on operations and work processes and non-utilization of capital.

Based on this, surrender modeling is one of the key issues for life insurance. Surrender of life insurance is modeled with difficulty because it is affected by various factors such as macroeconomic variables and financial markets, characteristics of the insurer, product, and behavioral characteristics of the policyholders/insured. In general, life insurance's surrender models can be classified into the following two general categories: model dependent on financial markets and macroeconomic variables (dynamic surrender component) and model independent of the financial markets and dependent on the characteristics of the insurer or the insurance policy or the insured/policyholder [13]. In this research, these approaches for surrender modeling have been investigated.

3 Methodology

In this research, to investigate the surrender of life insurance policies, the data related to the surrender by year from 2008 to the end of 2019 in Iran's insurance

industry and by insurance companies (17 insurance companies with a high share of Iran's insurance industry) are considered. The symbols used in this research are described in Table 1. In this paper, two approaches are used to analyze the

Table 1: Symbols of the Variables Used in the Models

Category	Symbol	Definition
Surrender Indices	ASVP	Average surrender value paid per policy surrendered
	SVWP	Surrender value paid to written life insurance premiums
	SNIFP	Ratio of the number of surrenders to the number of in flow insurance policies
	SNIP	Ratio of the number of surrenders to the number of issued life insurance policies
Insurer Variables	Agent	Number of agents
	Broker	Number of brokers
	Branch	Number of branches
	Loginsurerage	Inverse logarithm of company age
	Insurersize	Size of the insurance company (written life insurance premium)
	Parrate	Interest rate specific to life insurance
Economic Variables	Inflation	Inflation rate
	Interest	Interest rate
	GDP	Gross domestic product
	Stock	Stock market indicator
	Gold	Gold market indicator
	Currency	Currency market indicator (market's dollar price)
	Agedependency	Age dependency ratio
	Unemployement	Unemployment rate

surrender of life insurance in Iran. In the first approach, using the panel model, the significance of micro-corporate variables on the surrender of life insurance at the level of companies and over time is examined, and in the second approach, the impact of macroeconomic variables on the surrender indicators is evaluated.

3.1 First Approach

The panel regression models that we are trying to estimate are as follows. These models investigate the significance of insurance company variables affecting life insurance surrender indices.

(i) **Panel model 1:**

$$\begin{aligned} ASVP_{it} &= a(1) * Agent_{it} + a(2) * Branch_{it} + a(3) * Broker_{it} \\ &+ a(4) * Insurersize_{it} + a(5) * Parrate_{it} \\ &+ a(6) * Loginsurerage_{it} + a(7) \end{aligned}$$

(ii) **Panel model 2:**

$$\begin{aligned} SVWP_{it} &= b(1) * Agent_{it} + b(2) * Branch_{it} + b(3) * Broker_{it} \\ &+ b(4) * Insurersize_{it} + b(5) * Parrate_{it} \\ &+ b(6) * Loginsurerage_{it} + b(7) \end{aligned}$$

(iii) **Panel model 3:**

$$\begin{aligned} SNIFP_{it} &= c(1) * Agent_{it} + c(2) * Branch_{it} + c(3) * Broker_{it} \\ &+ c(4) * Insurersize_{it} + c(5) * Parrate_{it} \\ &+ c(6) * Loginsurerage_{it} + c(7) \end{aligned}$$

(iv) **Panel model 4:**

$$\begin{aligned} SNIP_{it} &= d(1) * Agent_{it} + d(2) * Branch_{it} + d(3) * Broker_{it} \\ &+ d(4) * Insurersize_{it} + d(5) * Parrate_{it} \\ &+ d(6) * Loginsurerage_{it} + d(7) \end{aligned}$$

where index i belongs to the insurance company and index t belongs to the year.

3.2 Second Approach

Another goal of this research is to investigate the significance of macroeconomic variables on the indices of life insurance's surrender in the insurance industry and to achieve this, the data of 17 insurance companies in Iran has been analyzed cumulatively. It is important to mention that the number of observations in this section is small due to the aggregate state of insurance companies from 2008-2019, and it may cause problems in the implementation of the regression. As mentioned in the previous sections, macroeconomic variables considered in this research include interest rate, inflation rate, unemployment rate, stock market indicators, gold and foreign exchange, GDP and aging ratio. Also, considering the small number of observations (12 annual observations from 2008-2019) and the high number of variables, it is certainly not possible to include all these variables in the model at the same time. In this regard, to evaluate the variables together,forward stepwise regression is used to check significance. This method is such that at the beginning, the variable that has the highest correlation with the dependent variable (i.e. surrender indices) is entered into the model and its significance is evaluated. If the significance is confirmed, the next variable will enter the model and the significance of these two variables is evaluated together, and the variable that does not have a significant effect on the dependent variable is removed from the model, and in the same way, other variables are added and subtracted to the model until the final model be obtained. It should be mentioned that, in investigated models, the research team tried to present the best model among the investigated models, and in these models, some variables of the model were taken as logarithms to reduce the effect of uncertainty of variance, and also, the inflation rate with a delay is considered in the model due to its long-term impact. Therefore, the investigated models for all 4 surrender indices are as follows, using forward stepwise regression, the significance of macroeconomic variables has been investigated.

(i) **First economic model:** In this model, the logarithm of the ASVP variable is the dependent variable, and the economic variables listed in Table 1 are independent variables, some of which have been entered in the model in the form of a logarithm. This model is considered as follows:

$$\begin{aligned}\log(\text{ASVP}_t) &= \text{Inflation}_t + \text{Inflation}_{t-1} + \log(\text{Interest}_t) + \log(\text{Currency}_t)\\ &+ \log(\text{Stock}_t) + \text{Unemployment}_t + \text{Gold}_t + \log(\text{GDP}_t)\\ &+ \log(\text{Agedependency}_t) + c\end{aligned}$$

(ii) **Second economic model:** In this model, the logarithm of the SVWP variable is the dependent variable, and the economic variables listed in Table 1 are independent variables, some of which have been entered in the model in the form of a logarithm. This model is considered as follows:

$$\begin{aligned}\log(\text{SVWP}_t) &= \text{Inflation}_t + \text{Inflation}_{t-1} + \log(\text{Interest}_t) + \log(\text{Currency}_t)\\ &+ \log(\text{Stock}_t) + \text{Unemployment}_t + \text{Gold}_t + \log(\text{GDP}_t)\\ &+ \log(\text{Agedependency}_t) + c\end{aligned}$$

(iii) **Third economic model:** In this model, the logarithm of the SNIFP variable is the dependent variable, and the economic variables listed in Table 1 are independent variables, some of which have been entered in the model in the form of a logarithm. This model is considered as follows:

$$\begin{aligned}\log(\text{SNIFP}_t) &= \text{Inflation}_t + \text{Inflation}_{t-1} + \log(\text{Interest}_t) + \log(\text{Currency}_t)\\ &+ \log(\text{Stock}_t) + \text{Unemployment}_t + \text{Gold}_t + \log(\text{GDP}_t)\\ &+ \log(\text{Agedependency}_t) + c\end{aligned}$$

(iv) **Fourth economic model:** In this model, the logarithm of the SNIP variable is the dependent variable, and the economic variables listed in Table 1 are independent variables, some of which have been entered in the model in the form of a logarithm. This model is considered as follows:

$$\begin{aligned}\log(\text{SNIP}_t) &= \text{Inflation}_t + \text{Inflation}_{t-1} + \log(\text{Interest}_t) + \log(\text{Currency}_t)\\ &+ \log(\text{Stock}_t) + \text{Unemployment}_t + \text{Gold}_t + \log(\text{GDP}_t)\\ &+ \log(\text{Agedependency}_t) + c\end{aligned}$$

where index t belongs to the year.

4 Results

In this section, the model fitting results are presented separately from the two approaches mentioned in the previous section.

4.1 Panel Regression Results on First Approach

Stationarity is one of the prerequisites for estimating a suitable regression model. Therefore, the stationarity test or the unit root test of panel data is performed for the variables of the above models, respectively, and the Levin, Lin and Chow (LLC) unit root test is used for the surrender's indices. Table 2 shows the results.

Table 2: Results of Unit Root Test on Variables

Category	Variable	Statistic	p-value	Result
Surrender Indices	ASVP	−14.16	0.00	Stationary
	SVWP	1.77	0.97	Non-Stationary
	SNIFP	−7.75	0.00	Stationary
	SNIP	0.66	0.25	Non-Stationary
Insurer Variables	Agent	−42.08	0.00	Stationary
	Broker	−5.92	0.00	Stationary
	Branch	−13.17	0.00	Stationary
	Loginsurerage	−11.88	0.00	Stationary
	Insurersize	1.58	0.94	Non-Stationary
	Parrate	−10.09	0.00	Stationary

Considering that the p-value of the unit root tests in the SNIFP variable is less than 0.05, it is concluded that the statistical assumption of having a unit root is rejected and therefore this variable is stationary. On the other hand, the SVWP and SNIP variables are insignificant based on the p-value at a significant level of 5%, which become stationary after taking the logarithm. Therefore, in the following, instead of these variable, we use their logarithm in the model. In the following, the influence of the insurer's variables affecting the surrender of life insurance are examined. Among the variables of the insurer that are effective on the surrender of life insurance, the variables of the number of agents, the number of active brokers, the number of branches, the logarithm of the company's age, and the fixed profit rate are stationary at a significant level of 5 percent, and on the other hand, the variable of the size of the insurance company is not stationary at this level. which is stationary by taking the logarithm of this variable. Therefore, instead of this variable, we will use its logarithm in the models.

In choosing a composite data model, there are two general modes of aggregated (pooled) and panel data analysis, which can be distinguished with appropriate tests. In the case that the data is aggregated, the width from the origin is the same for all sections, in which case the data is analyzed by the aggregated method. In the second case, the width from the origin is different for all sections, in this case, the panel method is chosen. F-Limer's test is used to identify the two mentioned cases. Therefore, before estimating the model, it should be checked whether the model is panel or aggregated, or in other words, whether the model has effects (fixed or random) or not. In this test, the null hypothesis, which means that the width of

the origins is the same, is placed against the alternative hypothesis, which means that the width of the origins is unequal. If the null hypothesis is accepted, it means that the width of the origins is the same for different sections, and the ability to aggregate data and use the aggregated regression model is statistically verified, and the research hypotheses are tested using the aggregated data method. But if the null hypothesis is rejected, the panel data method is accepted and the research hypotheses are tested using the panel data method. The results of this test, which examines the similarity of the width from the origin in the above models in terms of section and period separately, are shown in Table 3. Since the p-values of the

Table 3: Results of F-Limer's Test on 4 Models

Model	Section		Period		Result
	F-statistic	p-value	Chi2 statistic	p-value	
Model 1	8.90	0.00	43.14	0.00	Panel in section and period
Model 2	6.96	0.00	31.92	0.00	Panel in section and period
Model 3	7.41	0.00	12.32	0.34	Panel in section, aggregated in period
Model 4	7.14	0.00	25.98	0.00	Panel in section and period

F-Limer's test in four models are less than 0.05, therefore, the null hypotheses of the existence of pooled or aggregated regression (regression without fixed or random effects) are rejected, and therefore, the appropriate models for estimating under study have fixed or random effects and they are not aggregated. Also, in the third model, periodic/time effects should be considered aggregated. If, based on the results of F-limer's test for each of the hypotheses, the use of the panel data method is accepted, to determine which method (fixed or random effects) is more suitable for estimation, Hausman's test is used. In this test, the acceptance of the null hypothesis means the superiority of the model with random effects (there is no correlation between individual effects and explanatory variables) and the confirmation of the alternative hypothesis means the superiority of the model with fixed effects (there is a correlation between individual effects and explanatory variables). In this regard, the results of Hausman's test for the above-mentioned four models for the section and period are shown separately in Table 4. Considering that the p-values of Hausman's test in all 4 models are less than 0.05, as a result, the statistical assumptions that the four models have random effects are rejected at a significance level of 5%. Therefore, it is concluded that the models have fixed effects on sections (insurance companies) and period (year), and with these assumptions, panel regression models are estimated.

The fitting results of panel models 1-4, in which the dependent variable is the surrender indices, are shown in Table 5. Based on the results of Table 5, the values of Fisher's statistic and p-values indicate the significance of the models in general, at a significance level of 5%. Also, the coefficient of determination and adjusted coefficient of determination in 4 models show that the models have provided ac-

Table 4: Results of Hausman's Test on 4 Models

Model	Type	Chi2 statistic	P-value	Result
Model 1	cross section	120.33	0.00	fixed effects
	period	28.81	0.00	fixed effects
Model 2	cross section	29.84	0.00	fixed effects
	period	43.85	0.00	fixed effects
Model 3	cross section	18.92	0.00	fixed effects
	period	14.01	0.03	fixed effects
Model 4	cross section	25.93	0.00	fixed effects
	period	47.06	0.00	fixed effects

Table 5: Panel Regression Results in the 4 Models

Dependent variable	Independent variable	Coeff.	Statistic	P-value	Significance	Goodness of fit
	Agent	6213.693	4.942926	0.0000	Yes	
	Branch	−54502.17	−0.821932	0.4135	No	$F = 18.60$
	Broker	9324.927	2.948213	0.0041	Yes	$p - value = 0.000$
$ASVP$	Loginsurersize	-4400090	−5.187908	0.0000	Yes	$R^2 = 0.87$
	Loginsurerage	−131823.9	−1.278099	0.2048	No	$R^2 adjusted = 0.83$
	Parrate	−47644006	−5.996518	0.0000	Yes	$DW = 1.09$
	C	−19096749	−2.631970	0.0101	Yes	
	Agent	0.000159	2.026216	0.0469	Yes	
	Branch	−0.009230	−2.127826	0.0371	Yes	$F = 8.29$
	Broker	0.000222	1.186557	0.2397	No	$p - value = 0.000$
$LogSVWP$	Loginsurersize	−0.209181	−3.676299	0.0005	Yes	$R^2 = 0.80$
	Loginsurerage	−2.680336	−3.990590	0.0002	Yes	$R^2 adjusted = 0.70$
	Parrate	−0.021808	−2.389154	0.0198	Yes	$DW = 1.55$
	C	−2.260849	−2.806187	0.0066	Yes	
	Agent	0.0000283	0.838527	0.403	No	
	Branch	0.001079	0.881335	0.3804	No	$F = 7.10$
	Broker	−0.0000913	−1.060587	0.2916	No	$p - value = 0.000$
$SNIFP$	Loginsurersize	−0.034384	−1.449648	0.1505	No	$R^2 = 0.60$
	Loginsurerage	−0.743616	−3.7655794	0.0003	Yes	$R^2 adjusted = 0.52$
	Parrate	−0.003956	−1.335784	0.1848	No	$DW = 1.58$
	C	−0.442996	−3.897896	0.0002	Yes	
	Agent	0.0000134	0.064366	0.9489	No	
	Branch	−0.016767	−1.458563	0.1494	No	$F = 8.25$
	Broker	−0.000229	−0.460957	0.6463	No	$p - value = 0.000$
$LogSNIP$	Loginsurersize	−0.090516	−0.618504	0.5384	No	$R^2 = 0.79$
	Loginsurerage	−5.060866	−2.946584	0.0044	Yes	$R^2 adjusted = 0.70$
	Parrate	−0.049633	−2.056859	0.0437	Yes	$DW = 1.59$
	C	−5.389684	−2.549018	0.0131	Yes	

ceptable fits. In these models, the values of Durbin-Watson (DW) statistic were calculated, which are within the allowed range and show that the residuals do not have a significant correlation and fitted models are appropriate.

4.2 Time Series Regression Results on Second Approach

As mentioned in Section 3.2, forward stepwise regression is performed on the economic models and after entering and removing the variables in different steps, the final models were considered and their significance are described in Table 6. In the

Table 6: Forward Stepwise Regression Results in the 4 Economic Models

Dependent variable	Independent variable	Coeff.	Statistic	P-value	Significance	Goodness of fit
log (ASVP)	log (Interest)	−1.426207	−8.961111	0.000	Yes	$F = 40.93$, $p - value = 0.000$
	Unemployment	−0.376946	−5.967507	0.000	Yes	$R^2 = 0.90$
	c	24.23403	24.06591	0.000	Yes	$DW = 2.44$
log (SVWP)	log (Agedependency)	9.459114	9.203285	0.000	Yes	$F = 88.97$, $p - value = 0.000$
	Gold	−0.000017	−2.454891	0.037	Yes	$R^2 = 0.95$
	c	−22.04030	−10.71937	0.000	Yes	$DW = 2.45$
log (SNIFP)	log (Currency)	0.460162	6.043601	0.000	Yes	$F = 18.96$, $p - value = 0.000$
	Inflation	−0.021540	−3.286830	0.009	Yes	$R^2 = 0.80$
	c	−6.423505	−8.623951	0.000	Yes	$DW = 2.04$
log (SNIP)	log (Agedependency)	0.9477	12.026	0.000	Yes	$F = 72.73$, $p - value = 0.000$
	Inflation	−0.035	−5.202	0.001	Yes	$R^2 = 0.94$
	c	−11.315	−14.678	0.000	Yes	$DW = 2.46$

investigated models, the values of Fisher's statistic and the p-values for the models indicate the significance of the models in general, at a significance level of 5%. In the above table, the coefficient of determination values show that all 4 models have provided an almost acceptable fit. In all 4 models, the values of Durbin-Watson statistic are within the allowed range and show that the residuals are not significantly correlated and the fitted models are suitable. It should be noted that in all 4 models, the normality of the residuals were checked through the Jarque-Barra statistic, and the normality of the residuals were confirmed in all economic models.

5 Conclusion

In this paper, life insurance's surrender in Iran's insurance industry was investigated in different dimensions (micro corporate and macroeconomics). In order to accurately compare insurance companies in terms of life insurance surrender, 4 indicators were defined as the average surrender value paid per policy surrendered, surrender value paid to written life insurance premiums, the ratio of the number of surrenders to the number of in-flow insurance policies, the ratio of the number of surrenders to the number of issued life insurance policies. To identify the economic and corporate factors influencing life insurance's surrender indices, two different approaches were investigated. In the first approach, through 4 different models using the panel data regression models, we investigate the significance of company variables such as company age, insurance company size (written life insurance premium), number of agents, active brokers and insurance company branches, and

fixed interest rate allocated to life insurance policies on the surrender in life insurance. The significant variables in each models are shown in Table 7. In the second

Table 7: Summary of Influencing Variables of Corporate Micro on Life Insurance Surrender

Model	Dependent Variable	Significant Micro Corporate Variables
Panel model 1	Average surrender value paid per policy surrendered	Number of agents Number of active brokers Logarithm of insurer's size Inverse logarithm of the insurer's age
Panel model 2	Surrender value paid to written life insurance premiums	Number of agents Number of active brokers Logarithm of insurer's size Inverse logarithm of the insurer's age Interest rate specific to life insurance
Panel model 3	Ratio of the number of surrender to the number of in flow insurance policies	Logarithm of insurer's size Inverse logarithm of the insurer's age
Panel model 4	Ratio of the number of surrenders to the number of issued life insurance policies	Logarithm of insurer's size Interest rate specific to life insurance

approach, we examined the significance of macro-economic variables on surrender indices, which due to the small number of observations and the high number of independent variables, forward stepwise regression models were used. The significant macroeconomic variables in four stepwise regression models is shown in Table 8. In

Table 8: Summary of Influencing Variables of Macro Economic on Life Insurance Surrender

Model	Dependent Variable	Significant Micro Corporate Variables
Economic model 1	Logarithm of average surrender value paid per policy surrendered	Logarithm of interest rate Unemployment rate
Economic model 2	Logarithm of surrender value paid to written life insurance premiums	Logarithm of aging ratio Gold market indicator
Economic model 3	Logarithm of ratio of the number of surrender to the number of in flow insurance policies	Logarithm of currency market indicator Inflation ratio
Economic model 4	Logarithm of ratio of the number of surrenders to the number of issued life insurance policies	Logarithm of currency market indicator Inflation ratio

the following, based on the discussions, some policy recommendations are presented in order to reduce the surrender of life insurance, which can be used in insurance companies. These solutions can be divided into two categories. The first category is solutions from a general point of view and the second category is solutions based on the results of examining the variables affecting surrender:

(i) First Category:

- Providing incentives and embedding new insurance coverages in old (in-flow) life insurance policies,

- Inquiring about the reasons for the policyholder's surrender by insurance companies at the time of policy surrender.

(ii) Second Category:

- Increasing the profit of participation in the benefits of life insurance deposits through diversified investment of life insurance reserves,
- Changing the nature of life insurance savings from cash to other assets,
- Indexation of life insurance to indices linked to inflation,
- Providing life insurance connected to the capital market to increase return on investment,
- Using insurance securities in investing life insurance resources,
- Using the secondary market of life insurance,
- Including coverages to compensate the income of the unemployed person in life insurance.

Conflict of Interest

The authors declare that they have no conflict of interest.

Bibliography

[1] Barucci, E., Colozza, T., Marazzina, D., Rroji, E., (2020). The determinants of lapse rate in the Italian life insurance market, *European Actuarial Journal*, vol. 10, 149-178.

[2] Eling, M., Kiesenbauer, D., (2014). What policy features determine life insurance lapse? An analysis of the German market. *Journal of Risk and Insurance*, vol. 81, no. 2, 241269.

[3] Fier, S., Liebenberg, A., (2013). Life insurance lapse behavior. *North American Actuarial Journal*, vol. 17, no. 2, 153167.

[4] Gemmo, I., Götz, M., (2016). Life insurance and demographic change: an empirical analysis of surrender decisions based on panel data, ICIR Working Paper Series No. 24/2016, SAFE Working Paper No. 240.

[5] Haefeli, D., Ruprecht, W., (2012). Surrenders in the life insurance industry and their impact on liquidity. The Geneva Association.

[6] Hwanf, Y. (2016). Empirical analysis of surrender dynamics in Taiwan life insurance companies. Bulletin Français d'Actuariat , vol. 16, 115-127.

[7] Kiesenbauer, D., (2012). Main determinants of lapse in the German life insurance industry,*North American Actuarial Journal*, vol. 16, 52-73.

[8] Kim ,C., (2005). Modeling surrender and lapse rates with economic variables. *North American Actuarial Journal*, vol. 9, no. 4, 56-70.

[9] Linton. N. A., (1932). Panics and cash values, *Transactions of the Actuarial Society of America*, vol 38, 365-394.

[10] Nolte, S., Schneider, J., (2017). Dont lapse into temptation: a behavioral explanation for policy surrender. *Journal of Banking and Finance*, vol. 79, 1227.

[11] Poufinas, T., Michaelide, G., (2018). Determinants of life insurance policy surrenders. *Modern Economy*, vol. 9, no. 18, 1400-1422.

[12] Russell. D. T., Fier, S. G., Carson, J. M., Dumm, R. E., (2013). An empirical analysis of life insurance policy surrender activity. *Journal of Insurance Issues*, vol. 36, no. 1, 35-57.

[13] Zians, J., Miller, A., Ducurior, F., (2016). Lapse rate models in life insurance and a practical method to foresee interest rate dependencies, A Reacfin White Paper on Life Insurance.

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