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Error Correction Model:
Application to Insurance Assets in Indonesia

Debrina Vita Ferezagia

Insurance Laboratory, Universitas Indonesia.
debrinaferezagiaa@gmail.com

Abstract

The purpose of this study is to examine the effect of long-term and short-term expenditure per capita and the population of Indonesia on total assets of the insurance industry by error correction model. The data used are time series data for 13 years from 2002 to 2015. The results of cointegration test indicate that there is a long-term relationship between expenditure per capita, population with total assets insurance's industry. Relationships obtained in the form of long-term and short-term relationships. The implication of this research is public awareness in insurance which indicated by expenditure for insurance can increase insurance growth in Indonesia

Keywords : Insurances, Asset Industry, Expenditure, Error Correction Model (ECM)

1. INTRODUCTION

The shift of Indonesian society's insight to financial planning and self-protection from the possibility of risks increased from year to year. Risk is a situation where there are possibilities that deviate from the expected goal (Vaughan, 1982). Risk can occur anywhere and anytime, so it has no element of certainty. Indonesian people begin to understand that one way to minimize the loss to be borne in the event of a risk is to be transferred to a third party.

Mehr and Cammack (1980) state that a transfer of risk is referred to as insurance. In other words, insurance is a guarantee or protection. The insurance industry in Indonesia continues to increase significantly. This can be seen from the total insurance industry assets that have continued to rise for the last 10 years. A significant increase of up to 210% in just 5 years (2010-2015), resulting in total assets of the insurance industry becoming the second largest after the banking industry.

However, the penetration rate and density of the new insurance industry reached 2.63% of GDP. This level of penetration and density is relatively low when compared to neighboring countries such as Singapore, Malaysia and Thailand which reach more than 5%. The low level of national insurance penetration is due to several things including the lack of level of insurance literacy among the people of Indonesia.

Indonesia has the fourth largest population in the world. However, 85% of Indonesians do not have access to insurance. Indonesia's per capita spending on insurance also continues to increase every year. This fact shows that Indonesia is still a chance to develop the potential of the insurance industry.

Based on this background, the researcher wanted to see the pattern of awareness of the insured community and the development of industrial assets from 2002-2015. In addition, researchers wanted to measure the short-term and long-term relationships of per capita expenditure in insurance, the total population of the total assets of the insurance industry. The method used is Error Correction Modeling (ECM).

One of the purposes in this study is expected to support government programs in insurance literacy towards Indonesian society as well as predictions in the future. In addition, this study is expected to contribute to science with the application of ECM model in insurance.

2. MATERIALS AND METHODS

2.1 Data

The data used in this research is time series data for 13 years that is year 2002 until 2015. The data obtained comes from the publication of each year of *Statistik Perasuransian Indonesia* (Indonesian Insurance Statistics) by *Otoritas Jasa Keuangan* (OJK). The variables used are total assets, per capita expenditure and indonesian population.

2.2 Method

Research on the prospects and competitiveness of the insurance sector in Indonesia has been studied by Sigit Setiawan (2015). In this research using descriptive and comparative approach. The ECM method for insurance has also been studied previously by Boon (2005) with gross domestic product variables, total asset insurance, and stock prices. Boon has been research with scope in Singapore.

According to the Statistics Indonesia, average expenditure per capita is the cost incurred for the consumption of all household members for a month either from purchasing, granting or production itself divided by the number of household members in the household. Population includes all residents of the entire geographic territory of Indonesia, who have stayed for six months or longer, and those who intended to stay even though their length of stay was less then six months. Assets are the wealth (resources) owned by a business entity that can be clearly measured using a unit of

money and a sorting system based on how quickly the changes are converted into units of cash

Unit root test is one way to test the stationarity of a time series data. Unit root test is used to observe whether the value of a particular coefficient of the estimated variable has a value of one or not. Unit root test can be explained from the model below (Damodar, 2009):

$$Y_t = \delta Y_{t-1} + e_t$$

where e_t is a random or stochastic residual with mean zero, constant variance and unrelated as assumed by OLS (*Ordinary Least Square*). e_t is random which can be said as white noise. If δ=1 then random variable *Y* has the unit root. If the time series data has the unit root then it is said the data is random walk and data that has the nature of random walk is not stationary.

The cointegration test was popularized by Engle and Granger. The cointegration approach is closely related to testing the possibility of a long-term equilibrium relationship between economic variables as required by economic theory. The cointegration approach can also be viewed as a theory test and is an important part of the formulation and estimation of a dynamic model. In the concept of cointegration, two or more non-stationary variables time-series will be cointegrated when the combination is linear as time passes, although it can happen each variable is not stationary. If the time series variable is cointegrated then there is a stable relationship in the long run, if two series is not stationary consisting of X_t and Y_t cointegrated, then there are special representations as follows (Damodar, 2009):

$$Y_t = \beta_0 + \beta_1 X_t + \varepsilon_t$$

where $\varepsilon_t = Y_t - \beta_0 - \beta_1 X_t$, ε_t (*error term)* stationary, I(0).

To know the time series of stationary or nonstationary can be used regression. The cointegration test used in this study is a cointegration test developed by Johansen. Johansen test uses trace statistic analysis and critical value at confident level α = 5 %. The null hypothesis is that if the statistic trace value is greater than the critical value at the confident level α = 5% or the probability value (p-value) is smaller than α = 5% then cointegration is indicated.

When two time variables are not stationary but mutually cointegrated it can be concluded that there is a long-term equilibrium relationship between the two variables. In the short term there is the possibility of an disequilibrium, and to solve it used correction with the Error Correction Model (ECM). ECM has several uses, but the most important use in econometrics is to overcome non-stationary time-series data and spurious regression. ECM Engle-Granger can be defined as follows (Damodar, 2009) :

$$\Delta Y_t = \alpha_0 + \alpha_t \Delta X_t + \alpha_2 EC_t + \varepsilon_t$$

where $EC_t = Y_{t-1} - \beta_0 - \beta_1 X_{t-1}$, $\Delta X_t = X_t - X_{t-1}$, $\alpha_1$is short-term coefficients,

$\beta_1$is long-term coefficients, and α_2 is coefficient of inequilibrium correction.

Coefficient of inequilibrium correction α_2 is an absolute value that explains how quickly the time it takes to get a equlibrium value. If the probability value of the coefficients α_2 smaller than 0.05, it indicated a short-term relationship.

3. RESULT AND DISCUSSION

3.1 Error Correction Models

The development of an equation model that illustrates the long-term equilibrium relationship in accordance with the prevailing theory:

$$Asset_t = \alpha_0 + \alpha_1 Expen + \alpha_2 Pop + e_t$$

The inequilibrium model described in the error correction term (ECT):

$$ECT_t = Asset_t - \alpha_0 - \alpha_1 Expen - \alpha_2 Pop$$

The stationary test results show that all variables are not stationary at the level. Root unit test results can be seen in Table 1. The next step is to do differencing, stationary test results at differencing levels. After the first differencing test can be seen that all variables significant or stationary on the first different.

Table 1. Unit Root Test Value at Level and Differecing

Variables	Unit Root Test			
	level		Ist Difference	
	ADF	Prob	ADF	Prob
Asset	-1.74524	0.386	-4.12734	0.0099
Expend	-3.16833	0.056	-4.63627	0.0044
Pop	0.14538	0.955	-5.05615	0.0023

Identify cointegrated data to see that the model used has a long-term relationship. Based on the test cointegration test, the value of Probability ECT (0.008), it can be concluded that there is long-term influence. After performing stationary test and cointegration test, further forming error correction model with the aim of obtaining estimation model which is useful to know short term relationship behavior including adjustment of error correction as reaction of inequilibrium. The resulting model is shown in table 2.

Table 2. Model Estimation

Variable	Coef.	SE	Prob.
C	0.079696	0.038104	0.0660
D(EXPEND)	0.111489	0.050604	0.0551
D(POP)	5.677797	2.085403	0.0235
ECT(-1)	-0.608672	0.280146	0.0579

ECT variables have a significant effect on the error rate of 10% and have a negative sign. So that there is enough evidence of a cointegration relationship or a long-term relationship between independent variables and dependent variables. In addition, the significance of ECT variables also means that the empirical models used in the study have valid model specifications. From the estimation result, it is known that the absolute value of ECT variable coefficient is 60.87% which explains that about 60.87% mismatch between actual value of total asset in the short term and total asset balance value in long term will be corrected at every quarter.

$$\mathbf{DAset_t = 0.079+0.111\ DExpenditure_t +5.677DPop_t-0.60867ECT_{t-1}}$$

The model obtained can be interpreted as every 1 rupiah increase in per capita expenditure of the Indonesian population for insurance will increase total assets of 0.111 trillion rupiah with other variables considered constant. If the population of Indonesia increased 1 million people, it will raise the total assets of the insurance industry of 5,677 trillion Rupiah.

Value of R^2= 58,15%, so it can be interpreted that the influence of per capita expenditure and population in Indonesia affects the total assets of the insurance industry by 58.15%, while the rest is influenced by other variables not described in this research model.

The dimensions of the error can be seen from the RMSE values. The smaller the RMSE value then the prediction will be closer to the actual value Based on the analysis results. RMSE value generated from the prediction of this model is quite small that is equal to 4.6%.

3.2 Classic Assumptions

The predicted model parameters will be valid if the classical assumption test is met. Normality test can be seen by jarque-bera values = 0.0837 and probability value = 0.959. It can be concluded that data normaly distributed. White Heteroscedaticity Test with Chi-square value is 4.3577 and P-value = 0.628. it can be concluded that the assumption of homoscedasticity is fulfilled. Non-autocorrelation test with Breusch-

Godfrey LM test value of Chi-square is 9.4184 with P-value = 0.009012. It can be concluded that there is no autocorrelation. The results of all tests show that all classical assumptions are met, so the model can be interpreted and valid.

4. CONCLUSIONS

There are long-term and short-term effects between insurance industry assets and population and per capita spending on insurance. The resulting model is:

$$DAset_t = 0.079 + 0.111\ DExpenditure_t + 5.677\ DPop_t - 0.60867\ ECT_{t-1}$$

The classical assumptions for this model have been met, so the model can be interpreted and valid.

The advice given is to increase the asset of the insurance company by increasing the public per capita expenditure for insurance. Thus, the public awareness is required in insurance.

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