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Selection of Financial Performance Determinants for Non-Life Insurance Companies Using Panel Data Analysis

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ABSTRACT

The performances of insurance companies can be investigated using multivariate analyses where the specific financial variables are used. The results of the analysis may change according to the method and the variables used in. Widely used input and output variables can be determined through the literature review or some approaches. However, before to performance measurement, variable selection using statistical methods is important with regard to determining significant variables. In this study, determinants that measure the financial performance of 30 non-life insurance companies operating in a five-year period in Turkey are investigated by correlation analysis, regression analysis and a five-year panel data analysis. Because of inconsistency in the results of regression analysis, variables are selected according to panel data analysis. Results of panel data models based on all variables and only significant variables are compared. It is noticed that the model with financial ratios instead of trasformed variables using some transformations explains the financial performance better.

Keywords: *Financial Performance, Financial Determinant, Insurance Company, Regression Analysis, Panel Data Analysis.*

Jel Classification*: C33, G22, L25.*

Hayat-Dışı Sigorta Şirketleri İçin Finansal Performans Belirleyicilerinin Panel Veri Analizi Kullanılarak Seçimi

ÖZET

Sigorta şirketlerinin performansları, belirli finansal değişkenlerin kullanıldığı çok değişkenli analizler yardımıyla incelenebilir. Analiz sonuçları, kullanılan yönteme ve değişkenlere göre değişebilir. Yaygın olarak kullanılan girdi ve çıktı değişkenleri literatür taraması veya bazı yaklaşımlar yardımıyla belirlenebilir. Ancak, performans ölçümünden önce, değişken seçimini istatistiksel yöntemler kullanarak yapmak anlamlı değişkenlerin belirlenmesi açısından önemlidir. Bu çalışmada, Türkiye'de beş yıllık dönemde faaliyet gösteren 30 hayat-dışı sigorta şirketinin finansal performansını ölçen belirleyiciler korelasyon analizi, regresyon analizi ve beş yıllık panel veri analizi ile incelenmiştir. Regresyon analizi sonuçlarındaki tutarsızlıktan dolayı, değişkenler panel veri analizine göre seçilmiştir. Tüm değişkenler ve sadece anlamlı değişkenlerle kurulan panel veri modelleri karşılaştırılmıştır. Bazı dönüşümler yardımıyla değiştirilen değişkenler yerine, finansal oranların kullanıldığı modelin finansal performansı daha iyi açıkladığı görülmektedir.

Anahtar Kelimeler: *Finansal Performans, Finansal Belirleyici, Sigorta Şirketi, Regresyon Analizi, Panel Veri Analizi*

JEL Sınıflandırması: *C33, G22, L25.*

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1. INTRODUCTION

Performance analyses of units are crucial in service sector in terms of effective service. According to the results of performance analyses, some regulations and modifications can be required in the asset and resource management. The financial variables that accurately measure performance, should be decided for a precise performance analysis. The results of the analysis can change according to the methods and the variables used in these methods.

Insurance sector is one of the most important service sector in developing countries such as Turkey. According to the recently published "Insurance and Private Activities Report in Turkey" which is published in 2015 by Republic of Turkey Prime Ministery Undersecretariat of Treasury, Turkish insurance sector, in line with the economic development, shows a significant progress and continues to grow. Depending on the premium growth in real terms, the sector continues to grow rapidly and the insurance sector has been maintaining its financial soundness while growing rapidly. According to solvency ratios, companies have financial strength and the ability to meet their liabilities. Besides solvency margin, insurance companies can test themselves using some performance analyses. The performance analyses of companies are important especially for the managers of companies.

Performance of insurance companies can be evaluated using multivariate methods by which specific financial variables are defined. Multivariate methods can be listed as Data Envelopment Analysis (DEA), Principal Component Analysis (PCA), Tobit Regression Analysis, Stochastic Frontier Analysis (SFA), Malmquist Total Factor Productivity, Grey Relation Analysis (GRA), Technique for Order Performance by Similarity to Ideal solution (TOPSIS), Analytic Hierarchy Process (AHP), Fuzzy Analytic Hierarchy Process (FAHP) and Camels Model.

The most used method for performance analysis is DEA and it has been used in quite a lot of study (Hao and Chou, 2005; Tone and Sahoo, 2005; Yang, 2006; Harton, 2010; Altan, 2010; Dalkılıç, 2012; Karadağ Erdemir and Tatlıdil, 2017). Zhu (1998), Shanmugam and Johnson (2007) and Yıldırım (2009) used PCA as a method of measuring financial performance. Tobit Regression Analysis (Kılıçkaplan and Karpat, 2013), SFA (Akan and Çalmaşur, 2011) and Malmquist Total Factor Productivity (Dalkılıç, 2012) have also been used for performance analysis. Especially in recent years, multi criteria decision-making techniques have been widely used for performance analysis. Öner Kaya (2015) analysed the financial performance of the non-life insurance companies treded in Istanbul Stock Exchange (BIST) using GRA. Gajavelli (2016) used both GRA and TOPSIS to evaluate the profitability of the Indian non-life insurance companies. Ksenija et al. (2017) used FAHP and TOPSIS for the assessment the efficiency of insurance companies. Shahzad et al. (2018) used Camels Model to determine bank-specific, financial and macroeconomic determinants of the performance of banks in Pakistan.

Decision of input and output variables is one of the most important aspects of these kind of analysis and results may change depending on the variable selection. The financial variables can be determined through the literature review and performance analyses are carried out. In aforenamed methods, the financial variables should be separeted as input and output variables. Widely used input variables in the studies about financial performance of

insurance companies are Shareholder's Equity, Assets, Shareholder's Equity/Total Assets, Shareholder's Equity/Technical Provisions, Loss Ratio, Gross Written Premiums, Total Liabilities, Total Expenditures, Technical Provisions, Paid in Capital, Volume of Capital, Age of Company, Size of Company, Financial Assets and Investment for the Benefit of Life-Ass. Who Bear the Investment Risk, Payables Due to Main Operations, Technical Reserves and Provisions (Net), Cash and Cash Equivalents, Current Assets, Balance on Technical Account, Insurance Leverage Ratio, Expense Revenue Ratio, Market Share, Current Ratio, Equity Assets Ratio, Total Premium Production Assets Ratio, Return on Equity (ROE), Price of Labour etc. Return on Assets (ROA) is widely preferred as the output variable in the studies to incicate the profitability of companies (Malik, 2011; Almajali et al., 2012; Boadi et al., 2013; Mehari and Aemire, 2013, Khan, 2015). The other output variables which are used in the studies about financial performance of insurance companies are Total Technical Reserves and Provisions, Net Profit or Loss for the Financial Year, Return on Investment, Investment Income, Return on Equity, Receivables from Operations, Gross Paid Losses, Net Claims Incurred, Balance on Technical Account, Total Premium Production, Earned Premiums, Technical Reserves and Provisions (Net), Technical Profit/ Earned Premiums etc. As it is seen, these variables are generally firm specific factors. Some variables can be selected as both input and output variables. It is a prerequisite that the variables are determined correctly for an accurate performance analysis.

Dalkılıç (2012: 74) measured efficiency of non-life insurance companies using DEA and analysed productivity of non-life insurance companies using Malmquist Total Factor Productivity method and she selected input and output variables by examining the past studies in Turkey and other internationally studies. Altan (2010: 195) mentioned three input-output determination approaches such production, mediation and profit approaches and in his study input and output variables were selected according to production approach.

Instead of determining significant variables by literature review or some approaches, statistical methods such as correlation analysis, regression analysis, meta analysis and panel data analysis can be used. Malik (2011: 319) investigated the financial determinants of profitability in insurance companies of Pakistan using regression analysis. In his study, the information of 35 life and non-life insurance companies in the period of 2005-2009 was used. According to the results of the study, there were no relationship between profitability and age of the company while there was positive association between size of the company and profitability. Mehari and Aemiro (2013: 251) used the regression analysis to determine the firm-specific factors on the profitability of insurance companies in Ethiopia. According to the results of regression analyses; company size, tangibility and leverage were statistically significant and positively related with ROA while, loss ratio was statistically significant and negatively related with ROA. Çerkezi (2015: 6) investigated the financial variables affecting the performance of insurance companies in Albania by multivariate regression analysis and correlation analysis. Capon et al. (1990) gave a literature review about the using of the meta analysis to find the determinants of financial performance.

Although the usefulness of regression analysis for performance analysis, there are some disadvantages in some aspects. First, regression analysis gives the results for annual data and cross-sectional (horizontal section) data. In addition, significant indicators that indicate the financial performance of a company can change from year to year and it can affect the results of regression. Analyzing the performance of companies over a period is

more rational than annual basis. In this case, variables that show financial performance over a specific period can be tested by panel data analysis.

Adams and Buckle (2003: 137) analyzed the financial determinants of insurance and reinsurance companies in Bermuda between the year 1993-1997 using panel data analysis. According to the study, it was noticed that performance is positively related to underwriting risk, however, the size of companies and the scope of their activities were not found to be important. Curak et al. (2011) used panel data analysis to determine the variables, which affect the performance of insurance companies in Croatia. Kozak (2011) determined the financial determinants of the performance of insurance companies in Poland by panel data analysis. Öner Kaya (2015: 525) investigated the firm-specific factors affecting the profitability of Turkish non-life insurance companies using panel data analysis and correlation analysis. The information of 24 non-life insurance companies operating in Turkey from the period 2006–2013 was used and the size of the company, age of the company, loss ratio, current ratio and premium growth rate were found as the firm-specific factors, which affect the profitability. Öner Kaya and Kaya (2015) determined the firm-specific factors of 17 life insurance companies in Turkey between 2008 and 2013 using panel data analysis. Khan (2015) wrote a master thesis about the determination of variables which influence the profitability of non-life insurers in Portugal, for the period between 2004 and 2013. According to the thesis, the determinants of the financial performance in the Portuguese non-life insurance market were found as company age, premium growth, loss ratio, tangibility and management competence index.

In this study to find the determinants that measure the financial performance of 30 non-life insurance companies in a five-year period (2010-2014) in Turkey are investigated by correlation analysis, regression analysis and a five-year panel data analysis for each year.

The remainder of this paper is organized as follows. First, linear regression analysis and panel data analysis are explained briefly in the following Section 2. Then an application study is carried out to decide the financial determinants that evaluate the performances of insurance companies in the Section 3 and concluding remarks are given in the last section.

2. METHODS

Regression analysis is a frequently used statistical method for explaining the relationship among variables. It is widely used in many fields of applied sciences such as statistical, actuarial, financial, economic studies. In regression analysis, according to the most used terminology, y and x are defined as dependent variable and independent variable, respectively. Other common terms are outcome of interest and explanatory variable, endogenous variable and exogenous variable, output and input, explained variable and predictor variable or regressand and regressor. There are many different types of regression modeling techniques depending the type or the number of dependent variable and the used strategy. This study focuses on linear regression analysis for annual data and panel data regression analysis for long-term data to explain the relationship between the variables.

2.1. Linear Regression Analysis

Simple linear regression is the most widely used regression type and focuses how variables, an x and a y are related. Basic linear regression model can be setted univariately by Equation (1) as follows.

$$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i \qquad i = 1, \dots, n \qquad (1)$$

Equation (1) states the error representation of the linear model and it is assumed that, $\{x_1, \dots, x_n\}$ are nonstochastic variables. $\{\varepsilon_1, \dots, \varepsilon_n\}$ are independent random variables where $E(\varepsilon_i) = 0$ and $Var(\varepsilon_i) = \sigma^2$. Indıcator n corresponds the sample size.

In the case of several independet variables, linear regression extended to multiple linear regression that can be setted by Equation (2) as follows.

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik} + \varepsilon_i \qquad (2)$$

$$y_i = \boldsymbol{x'}_i \boldsymbol{\beta} \quad , \quad i = 1, \dots, n$$

In multiple linear regression, in addition to the assumptions of simple linear regression $\{x_{i1}, \dots, x_{ik}\}$ are nonstochastic variables where indicator k represents the number of input variables. More detailed information about parameter estimation and goodness of fit testing processes can be found in Frees (2009: 70).

2.2. Panel Data Analysis

Panel data, also known as longitudinal data are composed of cross-section of subjects that observed repeatedly over time. Panel data analysis represents a combination of regression and time series analysis. Cross-sectional and dynamic patterns can be studied simultaneously by using panel data analysis. A panel data model is a special case of the multiple linear regression given by Equation (2).

There are two types of panel data models: fixed and random effects models. The Hausman test can be used to determine the type of model, which is fit, better the data statistically (Baltagi, 2005: 66). The Hausman test assumes that the null hypothesis is "Random effects model fits better the data." while he alternative hypothesis is "Fixed effect model fits better the data."

A fixed effects panel data model is given by Equation (3) as follows.

$$y_{it} = \alpha_i + \beta_1 x_{it,1} + \beta_2 x_{it,2} + \cdots + \beta_k x_{it,k} + \varepsilon_{it} \qquad (3)$$

$$y_{it} = \boldsymbol{x'}_{it} \boldsymbol{\beta} \quad , \quad t = 1, \dots, T_i \quad , \quad i = 1, \dots, n$$

where, y_{it} is the dependent variable for the i^{th} subject during the t^{ht} time period, $t = 1, \dots, T_i$. Indicator n and indicator k shows the number of inputs and the sample size, respectively. $\{\beta_1, \dots, \beta_k\}$ are common to each subject and the subject-specific parameters $\{\alpha_i\}$ vary by subject. More detailed information about panel data analysis can be found in Frees (2009: 289).

3. APPLICATION

3.1. The Data

In this study, the data in "Insurance and Private Activities Reports in Turkey" which was published by Republic of Turkey Prime Ministery Undersecretariat of Treasury between the years 2010-2014 is used (https://www.hazine.gov.tr/, 2016). According to the reports, there are 30 non-life insurance companies between 2010 and 2014 in Turkey. These non-life insurance companies are Ace, Aksigorta, Allianz, Anadolu, Ankara, Atradius, Aviva, Axa, Bnp Cardif, Coface, Demir, Dubai Star, Ergo, Euler Hermes, Eureko, Generali, Groupama, Güneş, Halk, Hdi, Işık, Liberty, Mapfre, Neova, Ray, Sbn, Sombo Japan, Türk Nippon, Ziraat and Zurich.

3.2. Determinants of Financial Performance

In order to select the variables for determining the financial performance of 30 companies, 10 variables, including 1 dependent and 9 independent variables are selected according to the literature review. These variables are chosen from the ones that are widely used in financial performance studies. The variables used as financial determinants are given in Table 1.

Table 1. Dependent and Independent Variables

Dependent Variable
Y= Return On Assets **(ROA)**
Independent Variables
X_1= Gross Written Premiums **(GWP)**
X_2= Company Size **(CS)**
X_3= Insurance Leverage Ratio **(ILR)**
X_4= Expense Revenue Ratio **(ERR)**
X_5= Market Share **(MS)**
X_6= Current Ratio **(CR)**
X_7= Equity Assets Ratio **(EAR)**
X_8= Total Premium Production Assets Ratio **(PAR)**
X_9= Return On Equity **(ROE)**

ROA has been generally used as dependent variable in the previous financial performance studies (Malik, 2011; Almajali et al., 2012; Boadi et al., 2013; Mehari and Aemiro, 2013, Khan, 2015). Therefore, ROA is taken as dependent variable in this study and the others are considered as independent variables. Most of these variables are financial ratios, however logarithmic transformation is applied to non-financial ratio variables. The formulas of financial variables are summarized in Table 2.

Table 2: The Formulas of Dependent and Independent Variables

Variables	Formulas
$Y = ROA$	Net Profit/Total Assets
$X_1 = GWP$	Log (Total Gross Premium)
$X_2 = CS$	Log(Total Assets)
$X_3 = ILR$	Net Technical Provisions/Shareholders' Equity
$X_4 = ERR$	Expenses/Net Revenue
$X_5 = MS$	A percentage value taken from the reports directly
$X_6 = CR$	Total Current Assets/Total Short Term Liabilities
$X_7 = EAR$	Total Shareholders' Equity/Total Assets
$X_8 = PAR$	Total Premium Production/Total Assets
$X_9 = ROE$	Net Profit/Total Shareholders' Equity

3.3. Analyses

The numerical values of output and input variables are calculated for 30 Turkish non-life insurance companies between 2010 and 2014 as in Table 2. Correlation and regression analyses are performed using IBM SPSS Statistics 22 while panel data analyses are carried out by EViews 6. For each year, the results of correlation matrix and regression analysis are investigated. Correlation matrix is analysed for the purpose of determination of the independet variables which are correlated with ROA. Independent variables that are correlated with ROA for five years are summarized in Table 3, instead of giving all correlation matrices for each year seperately.

Table 3. The Results of Correlation Analyses for 2010-2014

Year	Variables correlated ROA
2010	ILR, MS, EAR, ROE
2011	CS, ERR, CR, EAR, PAR
2012	GWP, ERR, EAR, ROE
2013	$GWP, CS, ILR, ERR, MS, EAR, ROE$
2014	$GWP, CS, ILR, ERR, MS, EAR, PAR, ROE$

In Table 3, the correlated variables are selected according to the strong correlation. The independent variables listed in Table 3 change year by year. Therefore, variable selection according to the correlation matrix is irrational within a certain period. In this stage, for variable selection, regression analyses including 9 independent variables are carried out for each year. The results of regression analyses are given in Table 4.

Table 4: The Results of Regression Analysis for 2010-2014

Year	Dependent Variable	Sig. IndependentVariables	Sig.	R^2
2010	*ROA*	*ILR, EAR, ROE*	0.000	0.895
2011	*ROA*	*ERR, EAR*	0.000	0.924
2012	*ROA*	*ERR, EAR, ROE*	0.000	0.883
2013	*ROA*	*ROE*	0.000	0.881
2014	*ROA*	*ILR, ERR, EAR, ROE*	0.000	0.800

According to the significance values, all regression models are significant and according to the R^2 values, the significant independent variables explain a major part of the variation of ROA. Although the independent variables show similarities in some years, they generally vary from year to year as in the results of correlation matrices. Therefore, the choice of variables by correlation and regression analyses, is difficult. In this case, a five-year panel data analysis can be a good alternative to determine the financial variables in the five-year period.

Firstly, a five-year panel data analysis with all variables (1 dependent and 9 independent) is carried out using the information of 30 non-life insurance companies. The results of Hausman test is given in Table 5.

Table 5. The Results of Hausman Test

Correlated Random Effects - Hausman			
Pool: ROA			
Test-Cross Section			
Test Summary	**Chi-Sq. Statistics**	**Chi-Sq. d.f.**	**Prob.**
Cross-section random	75.239201	9	0.0000

According to the result of Hausman Test, the fixed effects model fit better the data ($p=0.0000<0.05$). Furthermore, the R^2 values of both fixed and random effects models are compared. While the R^2 value of fixed effects model is 0.766, the R^2 value of random effects model is 0.490. For both models, same independent variables are found insignificant. The results of fixed effects panel data model with 9 variables are given in Table 6 as follows.

Table 6: The Results of the Fixed Effects Panel Data Model (9 variables)

Dependent Variable: ROA
Method: Panel Least Squares
Sample: 2010-2014
Test-Cross Section
Included Observations:5

Cross-section included: 30				
Total pool (balanced) observations: 150				
Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.195479	0.175414	1.114386	0.2675
GWP	0.002922	0.013535	0.215866	0.8295
CS	-0.001561	0.001821	-0.857116	0.3932
ILR	0.006486	0.002278	2.846914	0.0053
ERR	0.149568	0.023477	6.370680	0.0000
MS	0.018327	0.013659	1.341786	0.1824
CR	0.028558	0.013075	2.184246	0.0310
EAR	0.296762	0.056650	5.238534	0.0000
PAR	-0.319961	0.045009	-7.108871	0.0000
ROE	0.025611	0.008463	3.026347	0.0031

According to the results given in Table 6; GWP, CS and MS are found insignificant (p=0.0000>0.05). Thereafter, panel data analysis is repeated by only 6 significant variables. The results of fixed effects panel data model with 6 variables are given in Table 7.

Table 7. The Results of the Fixed Effects Panel Data Model (6 variables)

Dependent Variable: ROA				
Method: Panel Least Squares				
Sample: 2010-2014				
Test-Cross Section				
Included Observations:5				
Cross-section included: 30				
Total pool (balanced) observations: 150				
Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.252606	0.031319	8.065538	0.0000
ILR	0.004606	0.002325	1.998639	0.0481
ERR	0.147815	0.022264	6.639277	0.0000
CR	0.029328	0.011959	2.452384	0.0158
EAR	0.291753	0.054752	5.328651	0.0000
PAR	-0.308513	0.043199	-7.141625	0.0000
ROE	0.018723	0.008636	2.168131	0.0323

The R^2 value of fixed effects model with 6 significant variables is 0.7788. Therefore, the R^2 value is risen and this model explains well profitability of this 30 non-life insurance companies. A brief summary of the fixed effects model and the random effects model with all 9 variables and the fixed effects model with only 6 significant variables is given in Table 8.

Table 8. The Comparison of Models

Panel Data Models	Dependent Variable	Independent Variables	Sig.	R^2
Model 1 (Random Effects)	ROA	$GWP, CS, ILR, ERR, MS, CR, EAR, PAR, ROE$	0.0000	0.4900
Model 2 (Fixed Effects)	ROA	$GWP, CS, ILR, ERR, MS, CR, EAR, PAR, ROE$	0.0000	0.7660
Model 3 (Fixed Effects)	ROA	$ILR, ERR, CR, EAR, PAR, ROE$	0.0000	0.7788

All models are found significant however the highest R^2 value is calculated for the fixed effects panel data model with 6 significant variables (Model 3). According to panel data analysis, it is found that determinants of financial perfomance of insurance companies are ILR, ERR, CR, EAR, PAR and ROE. Non-financial ratio variables are omitted from the model.

4. CONCLUDING REMARKS

In performance analysis studies, determining the variables that will accurately measure performance is crucial. In this study, firstly, to find the financial determinants of the performance of non-life insurance companies correlation and regression analyses are carried out for each year. Since the results of correlation and regression analyses change over the years, variables could not be selected effectively. As an alternative, variables that measure the performance for a five-year period are analyzed by panel data analysis. Significant financial determinants are specified and the performance analysis can be carried out by applying performance measurement methods. It is noticed that, significant variables are generally financial ratios. Using financial ratios instead of transformed variables, using some transformations is more logical for the comparison of financial performance of insurance companies.

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