

# The analysis and evaluation of the factors influencing the Lithuanian non-life insurance market

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**Abstract.** The paper analyses the factors influencing the Lithuanian non-life insurance market and their evaluation methods. The econometric models, describing the non-life insurance market, the vehicle insurance market and the property insurance market, are composed. Those factors that were not included in the regression analysis, were distinguished and evaluated by applying expert assessment. Conclusions are presented at the end of the article.

**Keywords:** insurance, non-life insurance market, economic factors, expert assessment.

## I. INTRODUCTION

The insurance market has a significant impact on the economic development of Lithuania, as well as of any other country, as the insurers perform the risk transfer and loss prevention functions. It ensures the stability in both daily life and business. In Lithuania the insurance market has been growing rapidly since the Restoration of Independence and during the last decade has reached the fastest growth. However, compared with other European Union countries, the insurance development rates are much lower, therefore the insurance sector should be given more attention, especially non-life insurance, as in Lithuania it occupies the major part of the insurance market.

Relevancy of the topic. During the period of economic boom, the Lithuanian non-life insurance market was growing more rapidly, however, after the beginning of the global economic crisis, in Lithuania the non-life insurance market decline was significantly higher than the whole economy. Although in 2010 it was possible to see signs of recovery in other sectors, the Lithuanian non-life insurance market was further shrinking and only in early 2011 positive growth was recorded; the sum of contributions signed in 2011 grew by 12,5 percent compared with the same period of the previous year.

In the presence of these changes, it is relevant to figure out how macroeconomic factors influence changes in the Lithuanian non-life insurance market and how they can be evaluated.

The article focuses not only on macroeconomic factors and their assessment, but also on the assessment of other possible factors, which the author considers to be important.

**The problem of the research.** What are the macroeconomic factors and how is the non-life insurance market functioning? How to identify and assess the significance of the factors?

**The aim of the article** - to assess what factors influence the Lithuanian non-life insurance market, to compose the models describing the Lithuanian non-life insurance market and its individual sectors.

## II. THE FACTORS INFLUENCING THE NON-LIFE INSURANCE MARKET AND THEIR EVALUATION METHODS

The link between the economic growth and the non-life insurance sector growth was examined by several scholars. The importance of the non-life insurance market to the economic growth was analysed by Outreville (1990) as well as Ward and Zurbruegg (2002). Summing up the works of these authors, it can be stated that the non-life insurance activity for the risk transfer, financial intermediation and employment enlargement contribute to economic growth. The performed theoretical and empirical studies suggest that the country's financial development influences economic growth. Insurance is one of the branches of financial sector, therefore the evaluation of the factors that affect the insurance market would allow to find out what contributes to the development of financial services, and thus to economic growth. In respect of this, the theoretical literature analyses the insurance market and its separate types. Brown et al. (2000), Ward and Zurbruegg (2002) and Esho et al. (2004) conducted empirical studies, where they examined the factors that influence the non-life insurance. Summing up the works of these authors it could be stated that *the non-life insurance market is influenced by the economic, legal and social factors.*

**An econometric assessment.** The aim of the investigation is to define and evaluate the key factors affecting the Lithuanian non-life insurance market. The non-life insurance sums of contribution were selected for the examination. There is no consensus and no single research methodology among the scholars, who deal with this problem, which factors may affect the life or non-life insurance markets.

One part of the investigation, i. e. econometric examination, was performed using regression analysis by the least squares method. This method was chosen because it allows to evaluate how much each factor affects separately, and how it works together with other factors. When analysing the factors, which could be included in

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the study, the problem arises, i. e. in order to include a certain factor, discussed in the theory, in the model, the right measured equivalent is necessary, i. e. the best approximation must be found. In the creation of the research model, possible factors were determined that were included in the regression analysis.

The Lithuanian non-life insurance market consists of three major insurance groups: Compulsory Motor Third Party Liability Insurance (MTPLI), vehicle insurance and property insurance. According to the literature analysis, it is appropriate to compose three models, which will contribute to the identification of the factors that affect the whole Lithuanian non-life insurance market, the vehicle insurance market and the property insurance market, in the analysis including the previously selected factors.

**Expert assessment.** Such factors as religion, culture, legal system, etc. are distinguished in the articles dealing with the factors influencing non-life insurance market. Since the object of this research is the non-life insurance market of only one country, it is complicated to include these factors in the econometric model. As the educational level of residents in the country may be associated with the risk avoidance level (educated people are more aware of insurance benefits and are less likely to take risks), this indicator was included in the regression analysis. However, are other factors less important? In order to carry out a comprehensive assessment of the factors affecting Lithuanian non-life insurance market, the following question was raised: "How to evaluate the influence of the factors which are not included in the econometric models?" In order to answer this question, the method of expert assessment was chosen.

### III. MODELS DESCRIBING THE LITHUANIAN NON-LIFE INSURANCE MARKET

The article includes correlation - regression analysis of the Lithuanian non-life insurance market and the factors that affect it. It was also separately analysed which factors have influence on the signed insurance contributions in the vehicle insurance and property insurance. Statistical data of the independent variables are taken from the Lithuanian Department of Statistics Indicators Database and from the database of the Bank of Lithuania. The data on signed contributions are collected from the Lithuanian Insurance Supervisory Commission database of announced indicators.

**Non-life insurance market model.** The quarterly data of the signed non-life insurance contributions for the period from the fourth quarter of 2004 to the fourth quarter of 2011 are used in the analysis. The research was conducted applying an open source program - R. Hereinafter the following abbreviations are used:

Y – signed non-life insurance contributions (million litas);

X1 – Gross Domestic Product (GDP) per capita;

X2 – the number of road traffic accidents;

X3 – the unemployment rate in the country;

X4 – the number of first time registered vehicles (except motorcycles and mopeds);

X5 – consumer price index (the change in the same quarter of the previous year);

X6 – newly built apartments;

X7 – issued mortgage loans for households (million litas);

X8 – educational level (the portion of young people (20-24 year old) with secondary and higher education);

According to the performed analysis, the correlation coefficients between non-life insurance contributions and each of the independent factors were calculated. Results are presented in Table 1.

TABLE 1. CORRELATION COEFFICIENTS AND THEIR T STATISTICS

Factor	Correlation coefficient	t statistics
X1	<b>0,789</b>	<b>6,803</b>
X2	-0,239	-1,303
X3	-0,278	-1,531
X4	<b>0,593</b>	<b>3,906</b>
X5	<b>0,735</b>	<b>5,736</b>
X6	<b>0,423</b>	<b>2,474</b>
X7	<b>0,800</b>	<b>6,669</b>
X8	0,330	1,850

When the correlation coefficient module is greater than 0,8-0,9, the correlation is considered to be very strong. In the investigated case, there is no correlation of such strength, however, it can be assumed that factors X1, X4, X5, X7 have a strong relation with the non-life insurance contributions. The correlation coefficient value of factor X6 indicates that the connection between the number of newly built apartments and the number of signed contributions is weak in the non-life insurance. However, these factors will be included in the further investigation of the model for a more detailed description of Y.

Table 1 highlights *t* statistic values that are statistically significant. Thus, a statistically significant relationship exists between the non-life insurance contributions and the following variables: GDP, the number of first time registered vehicles in the country, consumer price index and the remainder of issued mortgage loans for households. A statistically significant correlation, although not so strong, exists between among the non-life insurance contributions and the number of apartments.

Pair regression models with and without a free member were composed. In most of the models with a free member, it was statistically insignificant, therefore only

three equations of these pair regression equations deserve attention, i. e. those, whose coefficient of determination is  $R^2 > 0,4$ . These equations are presented in Table 2.

TABLE 2.  
PAIR REGRESSION MODELS WITH A FREE MEMBER

Regression equation	$R^2$
$Y = 0,0414 * X1 - 14,006$	0,6231
$Y = 15,34 * X5 + 193,34$	0,5403
$Y = 0,031 * X7 + 129,50$	0,6402

Therefore, the second step was to compose pair regression models without a free member. In the models, presented in Table 3, the coefficients are statistically significant and the coefficient of determination  $R^2$  is much better than in the aforementioned case.

TABLE 3.  
PAIR REGRESSION MODELS WITHOUT A FREE MEMBER

Regression equation	$R^2$
$Y = 0,393 * X1$	0,973
$Y = 0,173 * X2$	0,803
$Y = 20,18 * X3$	0,691
$Y = 0,0055 * X4$	0,949
$Y = 43,506 * X5$	0,765
$Y = 0,123 * X6$	0,878
$Y = 0,056 * X7$	0,950
$Y = 2,962 * X8$	0,933

The obtained results coincide with the results of the correlation analysis, i. e. factors X1, X5 and X7 have the strongest connection. Pair regression equations, composed between these factors and the non-life insurance contributions, also have the highest  $R^2$  statistics, i. e. these are the best models.

In order to compose a more accurate model, describing the non-life insurance market, more variables should be included. A multiple regression analysis defines a number of methods how to select the factors to be included in the regression equation. One of the proposed methods is to include all the available independent variables, and then to eliminate statistically insignificant ones. It also proposes to rely on the results of the correlation analysis and in the multiple regression equation to include only those factors that had the highest correlation coefficients. Referring to the results of the correlation analysis, X1, X4, X5 and X7 are included in the multiple regression equation. The statistics of the resulting regression equation is very high, however, neither a free member nor the coefficient of factor X7 is statistically significant. After the removal of these members from the equation, the final regression equation is obtained.

$$Y = 0,025 * X1 + 0,0012 * X4 + 8,042 * X5, \quad R^2 = 0,985,$$

This model, describing the non-life insurance market, is the best in respect of the coefficient of determination; in addition, the remainder of the model satisfies the regression model assumptions, therefore the model can be considered appropriate. The model was tested by calculating the sum of signed contributions in the third quarter of 2011 in accordance with the model and by comparing it with the actual sum. The calculated sum in accordance with the model was 11,28 percent higher than the actual one. Thus, although the obtained value differs from the actual one, it falls in the intervals of predicted confidence. For this reason, the model prediction can be considered satisfactory.

**The model of vehicle insurance market.** The vehicle insurance is the second largest group of insurance contributions in the Lithuanian non-life insurance market. The tendencies of this group insurance contributions differ from the general non-life insurance contribution market, therefore a separate analysis was performed and the relationship between the vehicle insurance contributions and the selected factors, described in chapter 3.1., was identified. Two factors were removed from the general list of factors, i. e. the number of apartments and the sum of issued loans, since, in author's opinion, these factors have influence not on the vehicle insurance but on the property insurance market.

Hereinafter K is referred to as signed vehicle insurance contributions (million litas);

Table 4 shows calculated  $t$  statistics in order to determine the significance of the correlation coefficient of each pair of variables.

TABLE 4.  
Correlation coefficients and their  $t$  statistics.

Factor	Correlation coefficient	$t$ statistics
X1	<b>0,650</b>	<b>4,535</b>
X2	0,233	1,268
X3	<b>-0,725</b>	<b>-5,577</b>
X4	<b>0,775</b>	<b>6,496</b>
X5	<b>0,797</b>	<b>6,996</b>
X8	<b>0,579</b>	<b>3,764</b>

Table 4 highlights  $t$  statistic values that are statistically significant. Almost all correlation coefficients not only show a stronger relationship than the average, but also are statistically significant.

The obtained results show that the strongest connection is between the vehicle insurance contributions and the number of vehicles in the country as well as the consumer price index. A strong inverse relationship is between unemployment and the vehicle insurance contributions. A strong positive correlation exists between GDP and the signed contributions in the vehicle insurance; it can be explained by the fact that the vehicle insurance is highly dependent on the economic situation in the country.

Pair regression equations, which define the relationship between the signed vehicle insurance contributions and each of the independent variables, were composed. As in



the case of the signed non-life insurance contributions analysis, two types of pair regression equation were composed. It was found out that, after including a free member in the equation, in most cases it is statistically insignificant or their coefficient of determination  $R^2$  is very low.

The only pair regression equation with a free and statistically significant member is  $K = 49,176 + 5 * X5$ . The statistics of the coefficient of determination of this equation is  $R^2 = 0,63$ . In all other pair equations with free members, they are insignificant ones, therefore the pair regression equations without a free member were composed. They are presented in Table 5.

TABLE 5.  
PAIR REGRESSION EQUATIONS AND R2  
STATISTICS VALUES

Regression equation	$R^2$
$K = 0,01068 * X1$	0,951
$K = 0,04946 * X2$	0,865
$K = 5,1145 * X3$	0,583
$K = 0,0015 * X4$	0,966
$K = 12,167 * X5$	0,795
$K = 0,808 * X8$	0,922

The performed analysis has showed that each independent variable has a greater or lesser connection with the signed contributions in the vehicle insurance. However, all these factors are operating simultaneously and have a respective impact on the insurance contributions. In order to find out which factors and how they influence, a multiple regression model was composed, which included several independent variables. For the construction of the model the methodology "from simple to complex" was applied, i. e. all independent variables with statistically significant correlations in the signed vehicle insurance contributions were included in the model. Then, referring to  $t$  statistics whether the coefficient at the independent variable is statistically significant or not, the independent variables, whose coefficients were statistically insignificant, were removed from the model, i. e. equal to zero. The resulting model is:

$$K = 0,0086 * X1 - 2,6021 * X3 + 0,0002 * X4 + 0,305 * X8, \\ R^2 = 0,9936;$$

This model is the best in terms of both the coefficient of determination, and model error. The model was tested by calculating the sum of signed contributions in the third quarter of 2011 according to the model and by comparing it with the actual sum. The calculated sum according to the model was 3,73 percent. higher than the actual one. The obtained result is great, i. e. the model perfectly describes the vehicle insurance contributions and it can be used for future predictions.

**The model of property insurance market.** The property insurance is another highly important group of insurance contributions in the Lithuanian non-life insurance market. When composing the model of the signed property insurance contributions, the factors, discussed in chapter 2.1., will be used; only two factors were removed, which, in author's opinion, have an impact on vehicle insurance categories, namely number of accidents on the road and the first time registered vehicles.

Hereinafter  $T$  is referred to as the signed property insurance contributions (million litas);

The calculated correlation coefficients and  $t$  statistics values, used to determine their significance, are provided in Table 6. The statistically significant (bold) correlation coefficients are between the property insurance contributions and  $X1, X5, X6, X7$ . The correlation coefficients between the signed property insurance contributions and GDP per capita as well as consumer price index and the issued loans are very strong and positive.

TABLE 6.  
CORRELATION COEFFICIENTS AND T  
STATISTICS.

Factor	Correlation coefficient	$t$ statistics
$X1$	<b>0,812</b>	<b>7,378</b>
$X3$	-0,084	-0,448
$X5$	<b>0,809</b>	<b>7,307</b>
$X6$	<b>0,456</b>	<b>2,718</b>
$X7$	<b>0,706</b>	<b>4,99</b>
$X8$	0,311	1,733

The pair regression equations with a free member were composed. The resulting regression equations with significant coefficients are presented in Table 7. Although the coefficients are significant in the models, the values of the coefficient of determination indicate that the equations do not sufficiently well describe the independent variable, i. e. the property insurance contributions. Another step was to compose the pair linear regression equations without free members. The obtained coefficients of determination are much closer to one, thus a linear relationship between the property insurance contributions and the respective factor pair equations is better described without a free member.

TABLE 7.  
PAIR REGRESSION EQUATIONS AND  
COEFFICIENTS OF DETERMINATION

Regression equation with a free member		Regression equation without a free member	
Equation	$R^2$	Equation	$R^2$
$T = 0,121 * X1 - 29,28$	0,66	$T = 0,0078 * X1$	0,94
Insignificant	-	$T = 4,0193 * X3$	0,68
$T = 4,801 * X5 +$	0,656	$T = 9,165$	0,83

29,96		*X5	
Insignificant	-	T = 0,0246 *X6	0,86
T=18,809 + 0,00777*X7	0,499	T = 0,0114*X7	0,93
Insignificant	-	T = 0,578 *X8	0,87

During the correlation analysis it was found out that GDP per capita, consumer price index, the number of newly built apartments and the issued loans for household have the strongest and statistically significant relationship with the property insurance contributions. These factors have been dealt with in the multiple regression equation. After having composed a model with all these variables, some coefficients were insignificant, therefore those factors were removed from the model. The final multiple regression equation is as follows:

$$T = 0,0055*X1 + 3,2844*X5, R^2 = 0,973.$$

This equation is the best in terms of the coefficient of determination, moreover the remainder of its model corresponds the model assumptions. The actual value of the signed contributions in the property insurance in the third quarter of 2011 is 53,98 million litas, which is 15,58 percent less than it was estimated according to the model. In this case the interval of prediction confidence is [51,019; 67,09], thus with the application of the model to the actual data the obtained value falls within the interval of confidence and the model can be considered appropriate for prediction.

#### IV. EXPERT ASSESSMENT

Referring to the regression analysis and the theory of econometric models, the models describing the Lithuanian non-life insurance market were composed. However, not all factors affecting the non-life insurance market can be measured statistically. It was decided to additionally carry out the expert assessment in order to determine what factors, not included in the regression analysis, have impact on the Lithuanian non-life insurance market. The individual assessment method was applied in this research, i. e. survey questionnaires.

The expert assessment was conducted in two stages. In the first stage, during the discussion with one of the selected experts, the list of possible factors was composed. In the second stage, the experts were provided with the questionnaire, including the listed factors set out in the first stage, and were asked to evaluate them according to a five-point scale.

The experts were selected on the basis of their work experience in the non-life insurance companies and the brokerage companies as well as their positions. The expert (E0) interviewed in the first stage has an extensive experience in the field of insurance sales, is well versed in the non-life insurance market. The experts, for many years engaged in sales of insurance products (E1, E2, E3, E6),

the heads of the sales departments of the non-life insurance companies (E4, E5), the manager of the non-life insurance product marketing (E7), the assessor of the non-life insurance product risk (E8) were interviewed in the second stage.

In the second stage, the experts were asked to answer the following question: Are the following factors important to the growth of the Lithuanian non-life insurance market? (Please, evaluate: 5 - very important factor, 1 - not at all important factor). The average evaluation of each factor is presented in Figure 1.

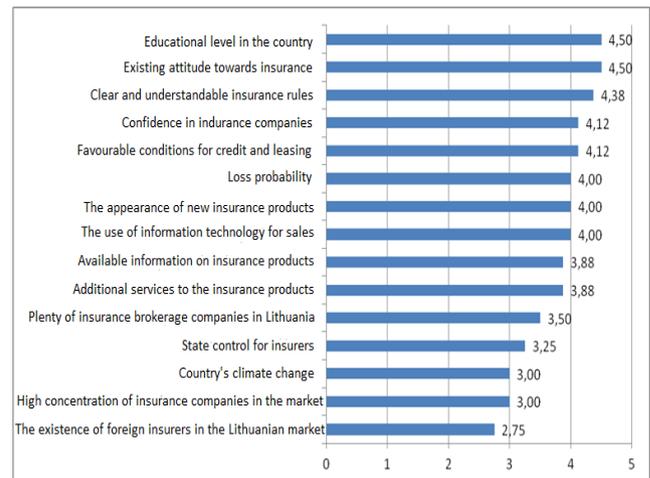


Fig 1. Factors influencing the growth of the Lithuanian non-life insurance market: expert assessment

It was found that the experts consider the educational level and the existing attitude towards insurance as having the greatest impact on the growth of the non-life insurance market. In experts' opinion, another important factor is clear and understandable insurance rules and the confidence in insurance companies. The compatibility testing of experts' opinions was carried out and the obtained results show that their opinions are compatible, therefore the results of the research are reliable.

#### V. CONCLUSIONS

1. The non-life insurance market is influenced by various factors, which can be divided into economic, legal and social.

2. The performed analysis has showed that until 2008 the Lithuanian non-life insurance market was developing rapidly and had high growth potential. However, due to the global financial crisis in 2009, in Lithuania the non-life insurance market decreased by 29,5 percent, and in 2010 declined by 4,7 percent. Fortunately, the double growth of the non-life insurance market in 2011 shows that the downturn is in the past.

3. In order to determine what factors have impact on the non-life insurance market, correlation – regression



analysis was carried out and the multiple regression equations were composed. The following was found out:

a) GDP per capita, the number of the first time registered vehicles in Lithuania and the consumer price index have the greatest impact on the non-life insurance market;

b) the signed vehicle insurance contributions depend on the GDP per capita, unemployment rates in the country for the first time, the number of the first time registered vehicles in Lithuania and the educational level in the country; the rising unemployment rate has a negative influence on the growth of the vehicle insurance contributions;

c) the property insurance contributions have a strong positive dependence only on the economic factors, i. e. GDP per capita and consumer price index.

4. The performed quantitative expert assessment helped to find out that the Lithuanian non-life insurance market is influenced by other factors, which were not included in the correlation – regression analysis. According to the experts, the following factors are the most important to the growth of the non-life insurance market: the educational level in the country, the attitude towards the insurance, clear insurance rules. The confidence in the insurance companies, the loss probability, favourable conditions for credit and leasing were mentioned as less important factors.

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