STATISTICAL METHODS FOR ASSESSMENT OF DEVELOPMENTS IN THE ROMANIAN INSURANCE MARKET

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Abstract

As expected, the Romanian insurance sector faced stagnation in 2013. Current economic conditions raise questions about future development in the field. What will 2014 bring for the further insurance sector?

The present paper has 3 parts. The first section presents an analysis of developments on the Romanian insurance market over the last few of years. The second chapter contains essential statistical techniques used for short-term gross written premium (GWP) forecasts on the market. Finally, the third section is dedicated to conclusions.

Keywords: *insurance market, gross written premiums (GWP), GDP, self-regression, correlation, mathematical statistics.*

1. Introduction

The first insurance market report was published in1997 by the relevant oversight body, which was the Insurance and Reinsurance Supervisory Authority (OSAAR). Seven years after the removal of state monopoly on insurance by dismantling ADAS, three new insurance companies, THE ROMANIAN INSURANCE – ASIROM, ASTRA, and CAROM – took over its active and passive assets, and the first privately-owned insurance company, UNITA, was established. OSAAR's annual report contained financial data on Romanian insurance companies.

Analyzing the respective data, one can see that the eleven years that passed until 2008 brought a 70% increase in GWP, which was a positive development on the insurance market, at least from the quantitative point of view. Between 1997 and 2008, the respective sector experienced an upward trend in value and volume, and a special dynamics. Although quantitative improvement was extremely visible, it wasn't the most important development in the field. This remarkable increase and change reflected the qualitative evolution of the insurance market, which was reaching maturity. A constant characteristic of this period was the transformation and dynamics of the insurance market, which was the most exposed to changes.

Five years after the financial crisis, its effects are still being felt across Romania and the whole world. But how did it exactly affect the insurance market? As expected, the Romanian insurance sector faced stagnation in 2013. Current economic conditions raise questions about future development in the field. What will 2014 bring for the further insurance sector? The present paper contains some answers to these questions, based on the statistical techniques used for short-term gross written premium forecasts on the market.

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2. CONTENT

2.1 Statistical Data on The Insurance Market

After an impressive growth of over 35% in general insurance industry, unparalleled in Europe, and a 25% increase in life insurance – the third in Europe, in 2008[1], the Romanian insurance market experienced a sharp decline in the following years. For example, in 2009, it faced a 48% decline in life insurance – the sharpest in Europe -, followed by a slight recovery.

In 2012, GWP for both life and general insurance amounted to 8,256,914,950 lei, increasing by 434,604,998 lei, as compared to the previous year, namely by 5.56% in nominal terms or by 0.58% in real terms. The data reflected the dependence of the Romanian insurance market on car insurance industry, which accounted for 62.81% of the total amount of GWP for general insurance, in 2012[2].

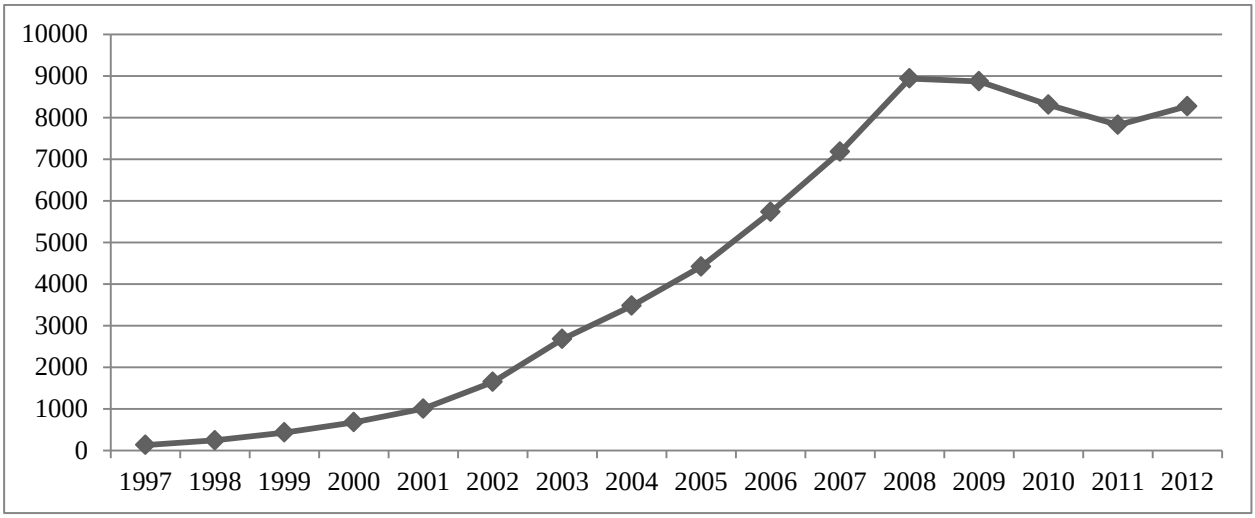
Table 1. *GWP dynamics for both life and general insurance, during 1997 - 2012*[3]

Year	GWP (milion lei)	Increase in nominal terms on an annual basis (%)	Inflation rate (%)	Increase in real terms, on an annual (%)
1997	130.4	Not available	Not available	Not available
1998	241.4	85.18	40.6	31.71
1999	427.3	76.99	54.8	14.33
2000	673.8	57.67	40.7	12.06
2001	1001.2	48.58	30.3	14.03
2002	1645.9	64.39	17.8	39.55
2003	2673.8	39.6	14.1	22.4
2004	3476.5	30.02	9.3	18.96
2005	4417.2	27.07	8.6	17.01
2006	5729.3	29.7	4.87	23.68
2007	7175.8	25.25	6.57	17.53
2008	8936.3	24.53	6.3	17.15
2009	8869.7	-0.74	4.74	-5.24
2010	8305.4	-6.36	7.96	-13.27
2011	7822.3	-5.81	5.8	-10.98
2012	8272.7	5.56	4.95	0.58

Based on the statistical data for the first eleven months of 2013, released early this year by the financial oversight body, GWP for both life and general insurance amounted to 7.45 billion lei, decreasing by 1% on an annual basis. GWP for general insurance totaled 5.93 billion lei, accounting for 79.56% of the total amount of GWP, and increasing by 0.97% on an annual basis. GWP for life insurance amounted to 1.52 billion lei, decreasing by 7.99% as compared to the first eleven months of 2012. 96.04% of the GWP for life insurance came from life insurance products, annuities, additional insurance products, life insurance policies and annuities – strongly linked to investment funds, both of them decreasing by 6.07% and, respectively, by 11.52% as compared to 2012.

[1] According to the European Insurance Figures 2009 report, recently published by the European Federation of Insurance and Reinsurance Companies.
[2] According to the 2012 report of the Insurance Control Authority, the current ASF.
[3] According to the annual reports released by the Insurance Control Authority between 1997 and 2012.

Figure 1. GWP dynamics (million lei) during 1997-2012



According to Figure 1, which shows the GWP dynamics on the insurance market, GWP constantly increased during 1997-2008, when a real growth of over 20-30% per year was reported. However, between 2009 and 2011, the decline in GWP is visible. The global economic and financial crisis was not immediately felt on the insurance market, and the first decrease occurred in 2009. Between 2009 and 2011, the Romanian insurance industry experienced an 11.08% decrease. General insurance fell by almost 16%, while life insurance grew by 6.77%. This negative trend was triggered by several factors, such as the industrial and business decline, the uncertainty related to consumers income, and their growing mistrust in financial markets.

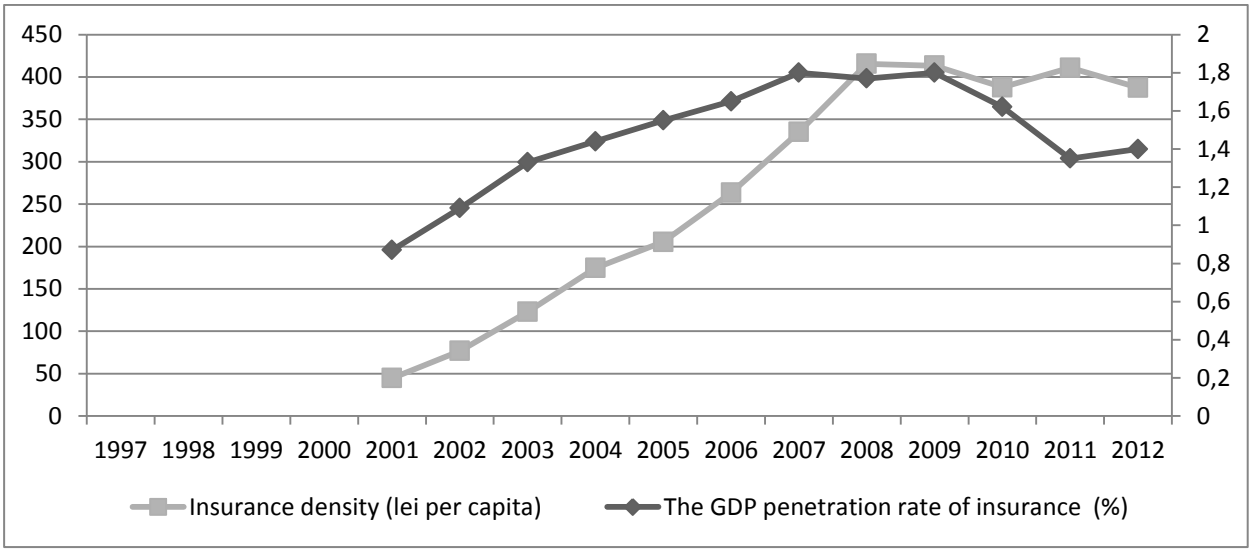
For the first time after 2011, as the previous figure shows, the insurance market experienced a slight increase in 2012, following the general economic trend.

As a share of the economy, the insurance industry has its total contribution to the country's Gross Domestic Product (GDP). The GDP ***penetration rate*** of *insurance*, namely the general and life insurance premium per GDP, was 1.40% in 2012, increasing by 0.05 percentage points on an annual basis. The GDP penetration rate of *general insurance* was 1.10%, increasing by 0.05 percentage points on an annual basis, while that of *life insurance* remained unchanged – 0.30%, as compared to 2011[4]. In the past couple of years, during 2009 – 2011, its contribution to GDP decreased (see Figure 2) as a result of the decline on the insurance market. After experiencing a downward trend three years in a row, in late 2012, the insurance industry reported a slight increase both in GWP and their contribution to GDP.

Another indicator that measures average insurance spending per capita is presented below. ***Insurance density*** is calculated as the ratio of total insurance premiums to total population. In 2012, it stood at 387.35 lei per capita, decreasing by 23.42 lei per capita, as compared to the previous year (410.77 lei per capita). Between 2009 and 2012, it declined sharply. The decrease experienced in 2012 – in comparison with 2011 – was triggered by the population growth, according to the 2012 census – 21,316,420 inhabitants. Previously, National Statistical Office released its 2011 report -19,042,936 inhabitants[5].

[4] According to the 2012 annual report of the Insurance Control Authority, the current ASF.
[5] According to the 2012 annual report of the Insurance Supervisory Commission, the current ASF.

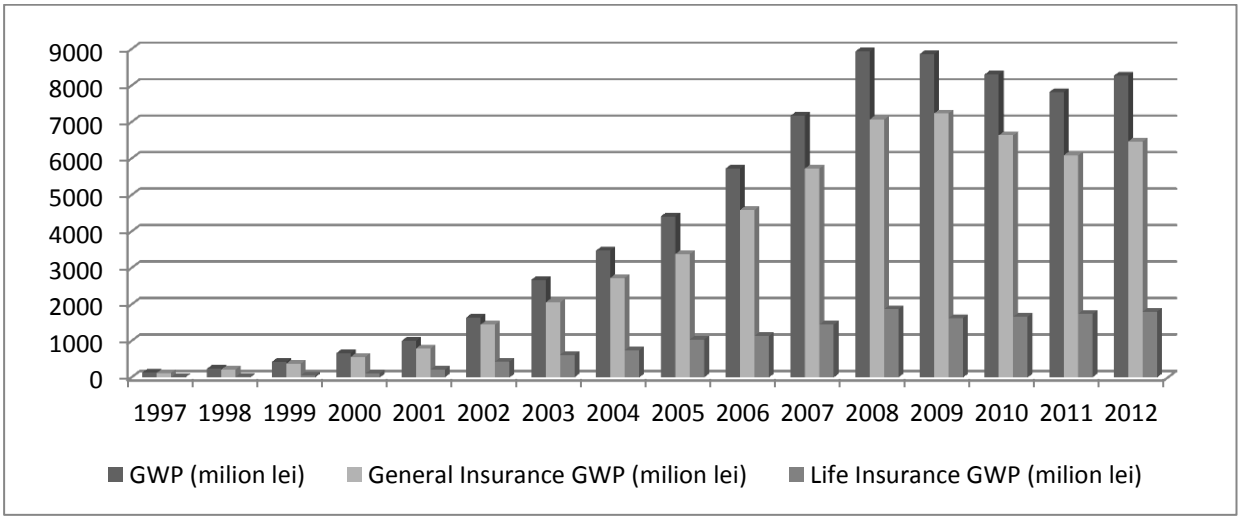
Figure 2. Insurance penetration rate versus insurance density, between 1997 and 2013.



Despite the large number of news reports and analyses of the insurance market potential, in the past 16 years this "obstinate" industry remained at low levels of only a few percentage points, from the point of view of the insurance penetration rate, namely the contribution of GWP to the country's GDP.

However, the Romanian insurance market attracted major European and international players in the field, such as the famous companies ING, AVIVA, AXA, Allianz, Generali or Metlife, which opened branches in our country. Local companies had also emerged, some of them gaining top positions, such as ASTRA or being absorbed by international giants, such as OMNIASIG, ARDAF, ASIROM or BCR Insurance and BCR Life Insurance.

Figure 3. GWP dynamics – total amount and share premium amount (million lei), during 1997 – 2012.



Before talking about the maturity of the Romanian insurance market, one should analyze the maturity of the consumers' financial behavior, which lacked sophistication even before the global financial and economic crisis. For e.g., the Romanian consumers reluctance towards life insurance products is probably cause by their unfortunate experience with general insurance companies. Moreover, the lack of adequate reinsurance programs to incorporate the risks assumed casts serious doubt on the Romanian insurance companies' ability to pay for the losses suffered by their clients.

As for local insurance industry predictions, estimates show a growth of a few percentage points in 2013, mainly due to compulsory insurance policies, followed, most likely, by stagnation in 2014.

The main causes of this decline in GWP are considered to be the low income of population, freezing of loans, decreasing consumption, and the gradual fall of the life insurance market.

On the other hand, the health insurance segment is expected to show robust growth, due to the announced implementation of the long-delayed reforms on the respective market. Other positive developments that could encourage growth could be the potential increase in demand for facultative home insurance and a tighter tax policy to cover the significant loss of earnings.

Since economic recovery is quite unlikely, 2014 will probably be a difficult year for the insurance industry. Moreover, the expected tax increase will have an indirect negative impact on this market, since it will affect all consumers.

The growth of insurance industry depends on the improvement of living standards, wage increases, and, of course, efficient campaigns to inform consumers about the benefits of insurance to society. Therefore, the insurance companies could intervene only by improving the quality of their services, in order to gain consumers trust and excite their interest in facultative insurance.

2.2. Statistical Methods for Romanian Insurance Market Surveys

Since any decrease or increase in economy affects the insurance industry as well, we took into consideration several factors that could influence the total amount of GWP. Theoretically speaking, these factors could be: *wage levels* (WL), the country's *GDP*, and the number of *economically active people* (EAP). The *GWP* variable is a dependent variable. The independent variables are the above-mentioned factors.

The statistical analysis of the relationship between these variable employs two tools: regression and correlation. The first model enables us to describe the average variance of the dependent variable, while the latter measures the strength of their relationship[6].

To find the independent variables, we resorted to scientific tools, such as the correlation matrix. The chart for the four variables is also presented below. We employed STATISTICA v.8.0. The correlation coefficient is the most important tool in measuring the strength of the linear relationships.

The correlation coefficient (see Table 2) for GWP and WL is 0.983, and for GWP and GDP – 0.989, revealing a very strong relationship, as compared to the GDP per EAP relation, whose correlation coefficient is 0.51.

Table 2. Correlations (GWP). Marked correlations are significant at p < ,05000 N=16 (Case wise deletion of missing data)

	Means	Std.Dev.	GWP	WL	GDP	EAP
GWP	908,17	714,538	1,000000	0,983520	0,989057	-0,517417
WL	960,35	672,688	0,983520	1,000000	0,997096	-0,575233
GDP	13577,32	9722,175	0,989057	0,997096	1,000000	-0,559054
EAP	4623,26	384,723	-0,517417	-0,575233	-0,559054	1,000000

[6] See reference [2.]

Figure 4. GWP and WL evolution during 1997 – 2012.

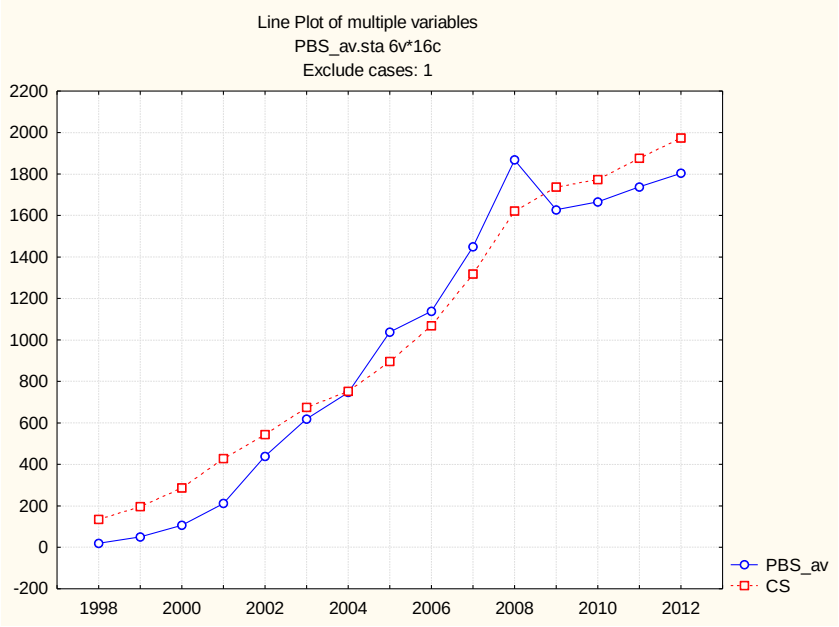
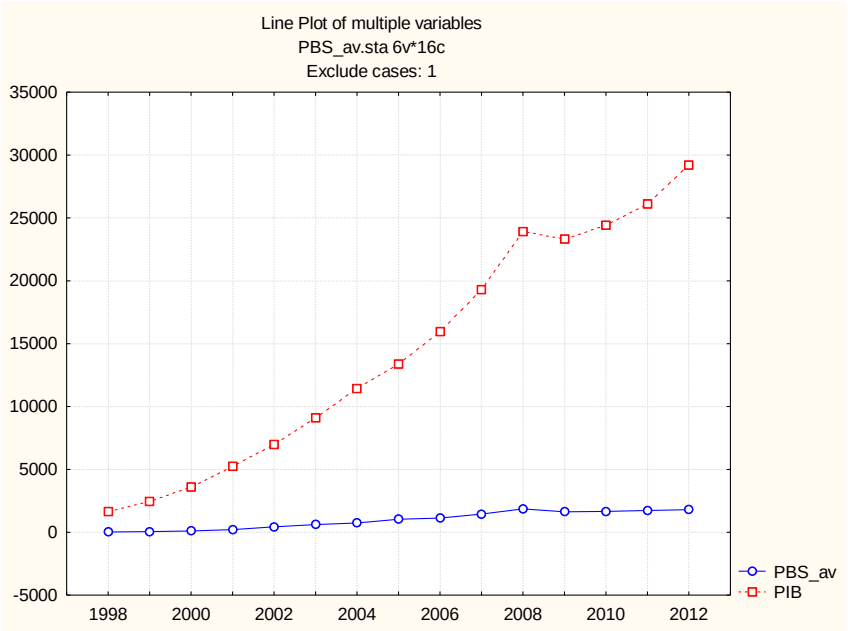


Figure 5. GWP and GDP evolution during 1997 – 2012.



Although the GWP – WL variables appear to be strongly related, the GWP – GDP variables are more strongly related than the GWP – WL ones. Therefore, GDP is the independent variable in the regression.

To provide short-term GWP values, we choose the following model:

$$GWP_{(t)} = b_0 + b_1 * GWP_{(t-1)} + b_2 * GDP(t) + \varepsilon(t)$$

which represents a fist-order correlation plus a simple linear regression model – ARIMA (1.0) without seasonal effects. To provide medium-term GWP values, one can use ARIMA models (autoregressive integrated moving average) to forecast non-stationary processes, which enable estimation of trends.

The multivariate regression performed with STATISTICA v.8.0 provided the following results:

Summary Statistics; DV: GWP (GWP.sta) Exclude cases: 1	
	Value
Multiple R	0,9879
Multiple R2	0,9759
Adjusted R2	0,9719
F(2,12)	242,7827
p	0,0000
Std.Err. of Estimate	116,8548

	B	**Std.Err. - of B**	**t(12)**	**p-level**
Intercept	-57,6374	74,56772	-0,772954	0,454506
GDP	0,0645	0,01837	3,513379	0,004275
GWP_t-1	0,1130	0,24929	0,453285	0,658431

The correlation ratio or the Pearson's correlation coefficient, also known as R, is a measure of the strength and direction of the linear relationship between two or more variables, regardless of their form. The square of the correlation ratio, typically denoted R^2, and called the coefficient of determination, estimates the proportion of the variation in a variable that is accounted for by the best-fit line[7]. R^2 is a statistic that will give some information about the goodness of fit of a model. In regression, the R^2 coefficient of determination is a statistical measure of how well the regression line approximates the real data points. An R^2 of 1 indicates that the regression line perfectly fits the data.

According to STATISTICA results, the value of the correlation ratio is 0.9879, which shows that the two variables – GWP and GDP – are strongly related. The coefficient of determination R2 is 0.9759, which shows the variation of the resulting variable (GWP) is determined by the variation of GDP influence, in this case 97%.

Comparing the model's results with the observations (the predicted values, based on regression, versus empirical values), we find that the regression coefficient is 0.97588, and the correlation coefficient is 0.98787, which means that the two variables are strongly related (see Figure 6). The two-dimensional scatter plots visualize a relation (correlation) between the two variables GWP and GDP_pred. Individual data points are represented in two-dimensional space, where axes represent the variables. The two coordinates that determine the location of each point correspond to its specific values on the two variables.

[7] See reference [2].

Figure 6. Predicted values versus independent variable and regression

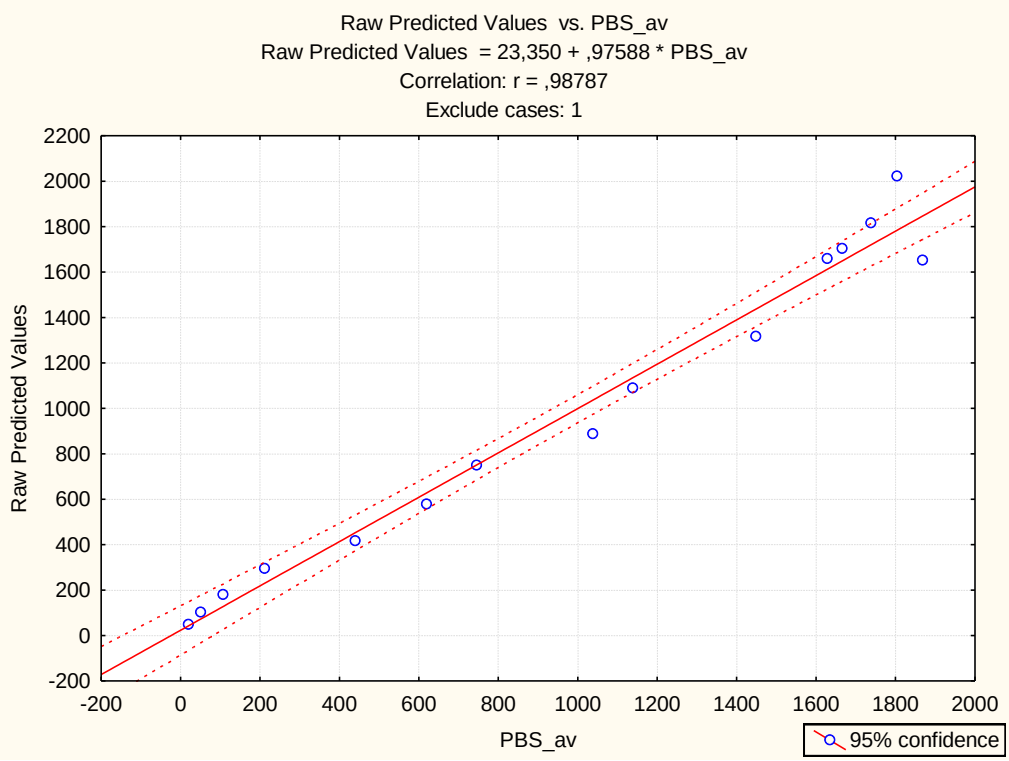
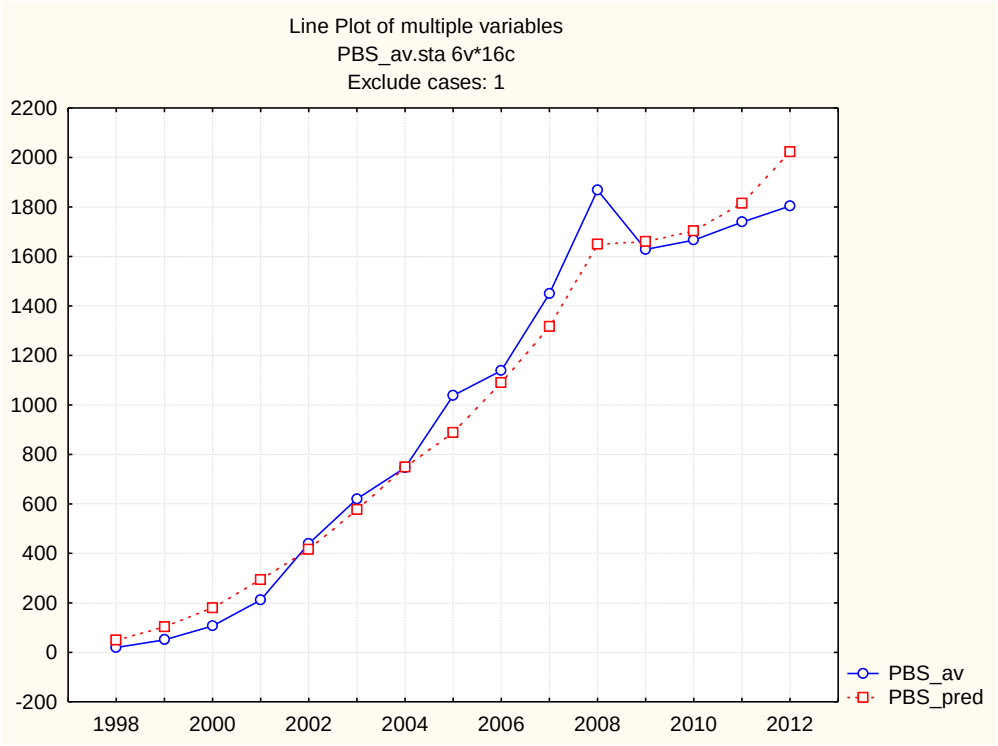


Figure 7. GWP values versus predicted GWP values.



The regression line expresses the best prediction of the dependent variable, given the independent variables. However, nature is rarely (if ever) perfectly predictable, and usually there is a substantial variation of the observed points around the fitted regression line. The deviation of a particular point from the regresison line (its predicted value) is called the residual value.

We also used STATISTICA to display a normal probability plot of the residuals. If the residuals (plotted on the x-axis) are normally distributed, then all points should fall into a straight line in the plolt. If the residuals are nor normally distributed, they will deviate from the line. Outliers may also become evident in this plot[8]. Residual value is the observed value minus the predicted value.

One can see the normal distribution of residuals after examining the residuals of the model (see Figure 8).

Figure 8. Residual analysis. Distribution of residuals.

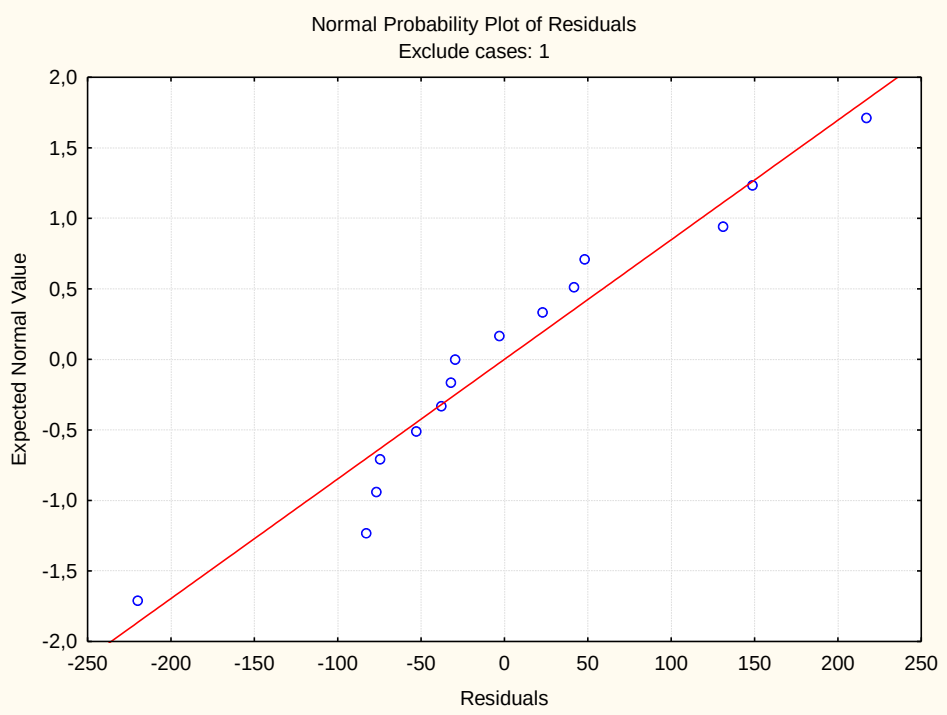
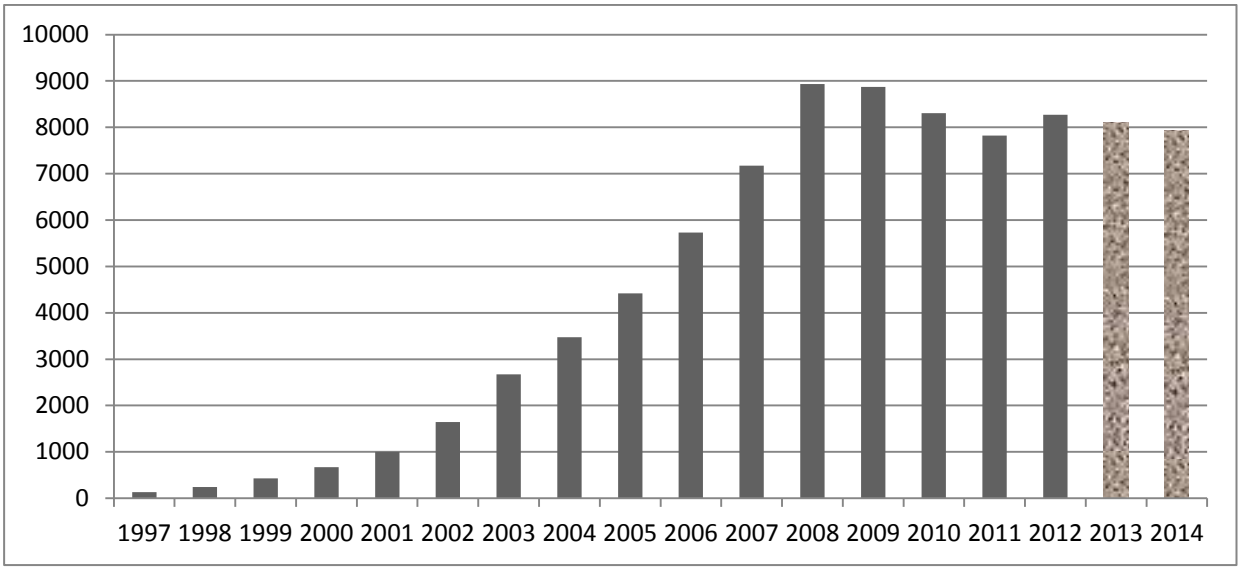


Figure 8 shows that the program does not detect outliers (compared to the model) in observations. Outliers are atypical (by definition), infrequent observations; data points which do not appear to follow the characteristic distribution of the rest of the data. Because of the way in which the regression line is determined (especially the fact that it is based on minimizing not the sum of simple distances but the sum of squares of distances of data point from the line), outliers have a profound influence on the slope of the regression line and consequently on the value of the correlation coefficient.

For the years 2013 and 2014, the value of GWP is consistent with the regresison results and has a downward trend (See Figure 9).

[8] See reference [12].

Figure 9. GWP evolution in 2013 and 2014.



The model of regression and self-regression used is not suitable for prediction, and a simple self-regression model with time-integrated relationships (based on nonstationary time series, according to Figure 1), namely ARIMA (1,1,0) could be obtained, meaning that:

$$GWP(t) = b_1 GWP(t-1) + \varepsilon(t)$$

The choise of this model respects Ochkam's razor (based on the following principle: „do not use more parameters there are needed") and the ARIMA method, based on the shape of the autocorrelogram (ACF) and partial autocorrelogram (PACF), according to which „one autoregressive parameter (p): ACF – exponential decay, PACF – spike at lag.1, no correlation for other lags". This test will be the subject for future research.

3. Conclusions

Analyzing the correlation matrix of several determinant factors that influence the total value of GWP and calculating the correlation ratio, one can see that GWP is strongly influenced by GDP. For these variables, we applied a model representing a first-order correlation plus a simple linear regression model – ARIMA (1, 0) without seasonal effects. For the years 2013 and 2014, the value of GWP is consistent with the regression results and has a downward trend.

According to forecasts, we should witness a slight increase by a few percentage points in 2013, mainly due to compulsory insurance policies, this trend being expected to continue into 2014. As for the determinant factors, we already mentioned that the insurance industry, as a share of the economy, follows the general economic trend, therefore it depends on future developments. To conclude, if no major events with a negative impact on the insurance market occur this year, there will be no dramatic changes in 2014, as compared to the previous year.

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