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*STATISTICAL ANALYSIS OF ROMANIAN INSURANCE MARKET. A GROSS WRITTEN PREMIUMS PERSPECTIVE**

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Abstract

The paper aims to analyze the Romanian insurance market in 2011 from the perspective of gross written premiums on non-life insurance classes, using principal component analysis technique (PCA) and cluster analysis in order to classify the 30 insurance companies by the most important components obtained by PCA.The empirical results showed that aircraft liability insurance, accident and sickness insurance, liability insurance for ships, insurance of legal expenses and the general liability insurance and surety ship insurance explain best the evolution of the insurance market. Grouping companies after the first two principal components, aircraft liability insurance, accident and sickness insurance, which recovers about 53% of the total variance of the original variables, can highlight three classes of companies: Astra, Allianz-Tiriac and Omniasig. The cluster analysis indicates the existence of four classes of companies: City Insurance, Astra, Groupama Insurances and the rest.

Keywords: insurance market, gross written premiums, principal component analysis, cluster analysis

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1. Introduction

Insurance means guarantee, securing custody, firm pledge, precaution taken by those interested in preserving the value of goods in their property, for protecting individuals from the diminish or loss of work capacity caused by sickness, accident or reaching an age limit, and for the defence of rights that are subject to the eventuality of lost.

In a market economy, the insurance sector is sector of each country's natural economy that contributes to the protection of property and persons against risks taken in insurance. Moreover, they have an increasing role in the gross domestic product's growth, investment placements.

In 2008, the Romanian insurance market has undergone a number of changes due to the entry of new insurance companies on the market and to the takeover of existing companies by internationally known financial groups.

The paper aims to offer a detailed statistical analysis of the insurance market in Romania in 2011 according to the evolution of gross written premiums, having as main objective the classification of the 30 insurance companies based on gross written premiums by classes of general insurance.

In order to fulfil this action we will apply methods of data analysis, principal component analysis and cluster analysis in order to highlight key performance indicators with impact on insurance companies in Romania and the grouping of insurance companies according to these indicators.

1.1 Gross written premiums in 2011

Gross written premiums are benefits received and receivable, including reinsurance benefits received and receivable in respect of all insurance and reinsurance contracts, which become effective in the reference period, before deducting any amount from them.

Gross written premiums are divided into two categories: gross written premiums for life insurance and general insurance gross written premiums.

In 2011, gross written premiums, accrued for the two types of insurance – general and life - totalled 7.8 billion lei, showing a decrease of £ 4.8 billion compared to 2010 and a decrease of 5.81% in nominal terms and 10.98% in real terms. This development is shows the effect of dependence of the insurance market in Romania to the motor insurance segment, which accounted for 65.11% of total gross written premiums on general insurance at the end of 2011.

Subscriptions for Class III - Insurance for land vehicles, and Class X – Motor liability insurance were influenced in 2011 by the contraction of the leasing market and the maintenance of a very low demand for auto loans in banking segment. In class X, Motor liability insurance, another factor influencing the decrease Motor liability insurance in the

volume of gross written premiums was the continuing trend of declining tariffs charged by insurance companies.

Total gross written premiums for general insurance in 2011, was 6 billion lei, registering a 8.37% nominal decrease compared to 2010, which means a reduction in real terms by 13.39%.

At 31.12.2011, the distribution of gross written premiums per insured category was as follows: 40.77% - gross written premiums of individuals with a total of 2,480,467,148 lei, 59.23% - gross written premiums of legal entities with a value of 3,603,475,950 lei.

Tabel 1. Evolution of gross written premiums for non-life insurance between 2007 – 2011

Year	Gross written premiums for non-life insurance(lei)	Increase in nominal terms compared to 2007=100(%)	Increase in nominal terms compared to 2008=100(%)	Inflation rate (%)	Increase in real terms compared to 2007=100(%)	Increase in real terms compared to 2008=100(%)
2007	5.726.752.784	-	-	6.57	-	-
2008	7.068.173.520	23.42	-	6.3	16.11	-
2009	7.241.584.322	26.45	2.45	4.74	19.29	-2.18
2010	6.639.733.598	15.94	-6.06	7.96	9.38	-11.38
2011	6.083.943.098	6.24	-13.92	5.8	0.22	-18.80

Source: The Insurance Supervisory Commission, www.csa.ro

In 2011, gross written premiums for general insurance contracts concluded by individuals decreased by 0.55% in nominal terms compared to 2010. The corresponding value of corporate contracts decreased by 13.08% over the previous year, due to policies to reduce spending on insurance applied by Romanian companies.

The reported data analysis by the 31 insurance companies that have subscribed for general insurance benefits shows that 10 companies have accumulated an amount of 5.29 billion lei, representing 87.09% of this segment.

As regards the structure of gross written premiums in 2011 by non-life insurance classes, class III Insurance for land vehicles (other than railway rolling stock)(32.72%), class X-Motor liability insurance(32.9%) and class VIII Insurance against fire and other natural forces accounted for the highest weights in the market(19.36%).

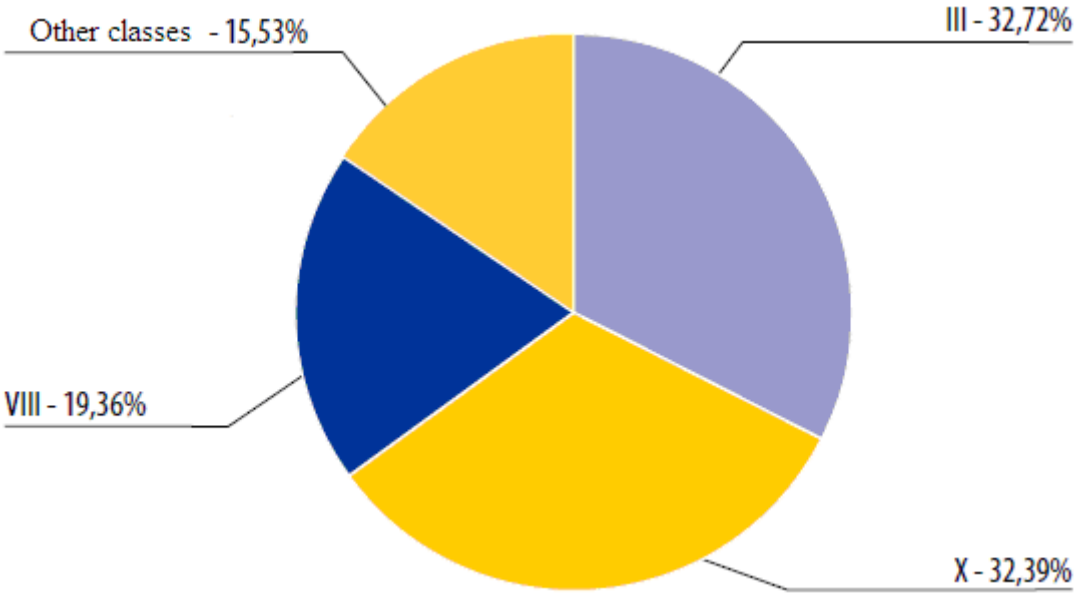
The evolution of gross premiums written for the above mentioned 3 insurance classes in 2011 shows as follows:

a) ***class III – Insurance for land vehicles (other than railway rolling stock):*** gross written premiums amounted to 1990961515 lei, 18.84% down in nominal terms and 23.28% down in real terms, compared with 2010. Premiums written for this insurance class have started on a downward trend ever since 2008, at the onset of the economic crisis, particularly as a result of

reduced business volumes generated by leasing companies, reduced lending volumes in the banking sector and, last but not least, diminished domestic purchasing power.

b) ***class VIII – Insurance against fire and other natural forces:*** gross written premiums amounted to 1.178.020.775 lei, a nominal increase by 21.77% compared with 2010. This positive evolution was sustained by the voluntary household insurance (increase by 3.49% in 2010 compared with the previous year).

c) ***class X – Motor liability insurance:*** gross written premiums amounted to 1.970.529.648 lei, a decrease by 21.01% in nominal terms compared with 2010. This negative evolution of premiums was caused principally, by the premium decrease of motor compulsory insurance (RCA).



Source: The Insurance Supervisory Commission, www.csa.ro

Fig.1. Structure of gross written premiums for non-life insurance by insurance classes in 2011

2. The statistical analysis of insurance companies in Romania

The paper aims to apply the principal component analysis as exploratory method for studing the insurance classes by gross written premius in the year 2011 in order to extract relevant indicators, on which we can achieve a more eloquent classification of insurance companies.

The problem formulated in this way leads us to the idea of using principal component analysis tehcnique, doubled by an cluster analysis. Principal components analysis is a

multivariate statistical technique that aims at extracting a small number of latent factors responsible for the correlations between the original variables to recover as much of the total information contained in the original data. If these correlations are significant, we can assume that would be caused by the existence of one or more hidden factors common to all variables.

For data reduction, the principal components method of extraction begins by finding a linear combination of variables (a component) that accounts for as much variation in the original variables as possible. It then finds another component that accounts for as much of the remaining variation as possible and is uncorrelated with the previous component, continuing in this way until there are as many components as original variables. Usually, a few components will account for most of the variation, and these components can be used to replace the original variables.

The classification methods or cluster analysis aims to group individuals identified through a series of attributes-numeric variables-in a more limited number of homogenous classes. What characterizes them is that makes a pooled analysis of individuals that are studied by a large number of variables and the required assumptions are minimal. It wants to make classes (groups) so that individuals belonging to the same class to be more alike each other by their variable values (that are similar) while classes to be as different.

The variables of the study are the gross written premiums on general insurance classes for the year 2011:

I. Accident and sickness insurance (including labour accidents and professional sickness)
II. Health insurance
III. Insurance for land vehicles (other than railway rolling stock)
IV. Insurance for railway rolling stock
V. Aircraft insurance
VI. Insurance for ships (sea, lake, river and canal vessels)
VII. Insurance of goods in transit
VIII. Insurance against fire and other natural forces
IX. Other insurance against damage to property
X. Motor liability insurance
XI. Aircraft liability insurance
XII. Liability insurance for ships (sea, lake, river and canal vessels)
XIII. General liability insurance
XIV. Credit insurance
XV. Surety ship insurance
XVI. Insurance against financial loss
XVII. Insurance of legal expenses
XVIII. Touring and travel assistance insurance

It is important to point ut the fact that the initial data matrix elements required a standardization, as the standard deviations of the eighteen indicators are quite different.

Table 1. Descriptive statistics for the insurance classes

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
I	30	0	7900310	1574920.57	2088255.632
II	30	0	10697185	933184.97	2710159.019
III	30	0	430961176	66365383.83	1.167E8
IV	30	0	1540468	133838.40	379923.945
V	30	0	9897624	576622.47	1962691.645
VI	30	0	8345495	735858.13	1839780.126
VII	30	0	11576057	1367357.17	2594231.201
VIII	30	.000	2.996E8	3.92674E7	6.427527E7
IX	30	-1634	27180467	5348175.90	8005001.963
X	30	0	445560373	65684321.60	1.142E8
XI	30	0	15220447	741163.90	2931526.443
XII	30	0	5297505	487940.57	1366032.119
XIII	30	0	111566466	8960525.00	2.076E7
XIV	30	-850098	73923279	4211313.37	1.567E7
XV	30	-316357	72199230	3799957.03	1.318E7
XVI	30	0	4707027	572122.00	1227957.455
XVII	30	0	7089	345.23	1406.367
XVIII	30	0	9738236	2037713.97	2974418.643
Valid N (listwise)	30				

We proposed to identify important syntheic indicatos of the Romanian insurance market using the principal component analysis technique. Information on quality adjustment is expressed using eigenvalues of matrix correlations.

The table shows the variance explained by the initial solution, the extracted components and rotated components. Thus, we analyze the quality of the point cloud adjustment (in our case the insurance companies) using the eigenvalues. Because we have requested that eigenvalue greater than 1 is extracted, so the first five principal components form the extracted solution, explaining nearly 81.37% of the variability in the original ten variables.

Adjusting the points cloud by a single factorial axis (accepting only a single synthetic indicator), it explain 36.45% of total variance; then, adjusting the points cloud by two factorial axes (accepting two synthetic indicators) we recover 16.09% of total variance, a total of 52.55% of this variance. If we require three factorial axes (three synthetic indicators) we explain 63.61% of total variance, while for the five synthetic indicators we recover about 81.37% of total variance.

Table 2.The component eigenvalues

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.562	36.458	36.458	6.562	36.458	36.458	4.008	22.266	22.266
2	2.898	16.098	52.557	2.898	16.098	52.557	3.965	22.028	44.294
3	1.990	11.057	63.614	1.990	11.057	63.614	2.650	14.720	59.014
4	1.764	9.800	73.413	1.764	9.800	73.413	2.055	11.417	70.432
5	1.433	7.962	81.375	1.433	7.962	81.375	1.970	10.944	81.375
6	.714	3.968	85.343						
7	.672	3.734	89.077						
8	.550	3.054	92.131						
9	.404	2.245	94.376						
10	.311	1.727	96.103						
11	.241	1.339	97.442						
12	.209	1.163	98.605						
13	.126	.699	99.304						
14	.078	.432	99.736						
15	.032	.178	99.914						
16	.010	.054	99.967						
17	.005	.030	99.998						
18	.000	.002	100.000						

Extraction Method: Principal Component Analysis.

The Information concerning the interpretation of the principal components are obtained by analyzing the correlation coefficients calculated between the five main components and original indicators. The interpretation of principal components is relatively simple. Namely, a principal component can be "explained" by the initial variable for which the correlation coefficient is maxim but at the same time, the initial variable has small correlation coefficients with the other principal components. Therefore, for a more relevant and a more realistic interpretation, it is recommended the usage of an rotation axes option that have like purpose obtaining correlation coefficients as low as possible on one or two principal components. One of most used rotation technique is “Varimax”.

The first component is interpreted in the terms of XI^{th} indicator- Aircraft liability insurance. The second component is interpreted in the terms of I^{th} indicator- Accident and sickness insurance (including labor accidents and professional sickness). The third component is interpreted in the terms of XII^{th} indicator- Liability insurance for ships (sea, lake, river and canal vessels). The fourth component is defined by the $XVII^{th}$ indicator- Insurance of legal expenses. The fifth component is defined in terms of $XIII^{th}$ and XV^{th} indicators-general liability insurance and surety ship insurance.

Realizing graphical representation after the first two principal components notice a fairly compact group of insurance companies that seem to have similar behavior against the new indicators, but also two groups that detach from group companies (Society 7 (Astra) and companies 2 and 26 (Allianz-Tiriac and Omniasig)). The results are similar to those obtained for the study in 2008 on gross written premiums on general insurance classes in which after the first two principal components that insurance companies were detached from the platoon Astra and Allianz-Tiriac, who have kept the form of leaders of the insurance market in 2011.

Table 3. Rotated component matrix

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
Zscore(I)	.090	.849	.109	-.042	-.077
Zscore(II)	.794	-.079	-.076	-.065	-.056
Zscore(III)	.311	.818	.146	.261	.034
Zscore(IV)	.074	.494	.703	-.044	.046
Zscore(V)	.880	.096	.368	-.052	.014
Zscore(VI)	.187	.039	.840	.121	-.023
Zscore(VII)	.092	.723	.563	-.099	.044
Zscore(VIII)	.825	.481	.147	.121	.019
Zscore(IX)	.075	.607	.141	.476	-.014
Zscore(X)	.731	.392	.207	-.047	-.021
Zscore(XI)	.914	.046	.289	-.036	.014
Zscore(XII)	.298	-.018	.877	-.055	.024
Zscore(XIII)	.006	.195	.062	-.057	.971
Zscore(XIV)	-.058	.153	-.039	.881	-.055
Zscore(XV)	-.015	-.182	-.032	-.007	.973
Zscore(XVI)	.023	.752	-.107	.224	-.005
Zscore(XVII)	-.039	.106	.020	.928	.001
Zscore(XVIII)	.548	.606	.054	.110	.243

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

Therefore we classify the 30 insurance companies in the plane of synthetic indicators aircraft liability insurance and accident and sickness insurance (including labor accidents and professional sickness):

Class 1: Includes insurance company Astra which has better score on the first component ("aircraft liability insurance") and a low score on the second component ("accident and sickness insurance").

Class 2: Includes insurance companies Allianz-Tiriac and Omnisiag with a good score on the second component ("accident and sickness insurance") and a low score on the first component ("aircraft liability insurance").

Class 3: Includes the remaining insurance companies that have poor scores on both components.

The results presented reveal that on the general insurance market in Romania stand the performing companies Allianz Tiriac and Astra from the perspective of accident insurance and Astra Company in terms of liability insurance. It followed the insurance companies with low scores in terms of the main components that summarize information. So it can be inferred that companies can be divided into homogeneous groups (Class 1, 2 and 3). Besides the three insurance companies (Astra, Allianz Tiriac and Omniasig) general insurance market is relatively homogeneous in terms of the two principal components analysis.

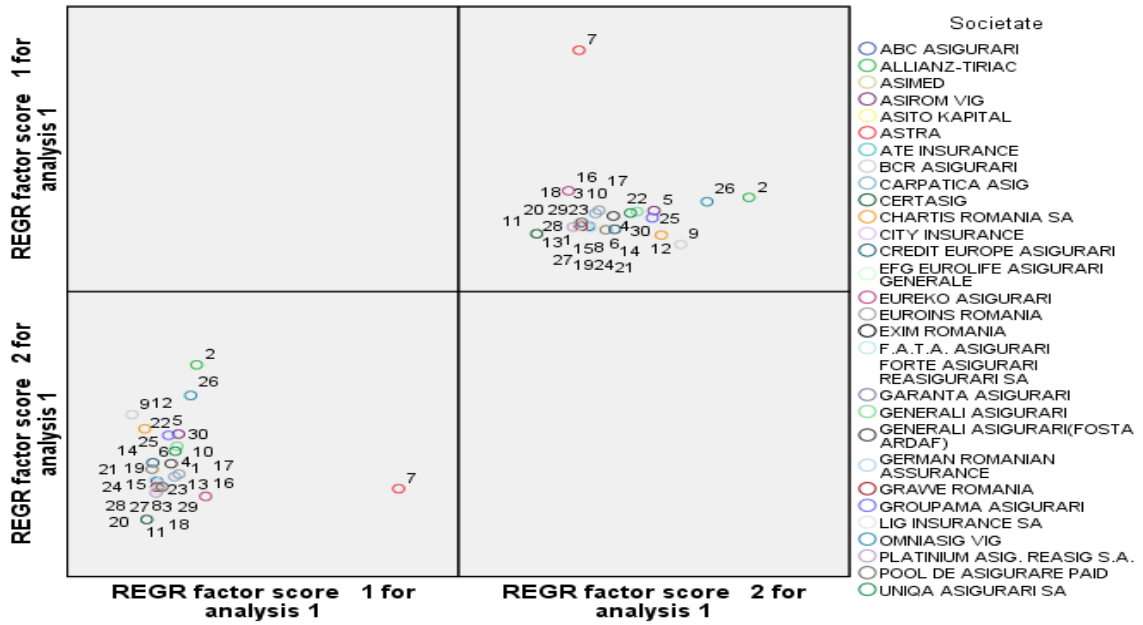


Fig. 1.Company component scores

The first two principal components (counted above) correspond to the first two eigenvalues with values of 6.56 and 2.89 with a recovery of 52.55% of the information. The analysis can be completed by taking into account the rest of the main components, basically following to see if there are significant differences between classes formed by the first two principal components and those produced by the simultaneous action of the 5 main components.

In order to realize this approach, we apply the cluster analysis, which involves identifying and grouping the insurance companies in a small number of homogeneous classes.

The analysis begins by separating each company in a class. In each stage are grouped the most similar two classes, ultimately resulting in a cluster containing all variables. The basic criterion is the distance analysis. The other side objects should belong to the same cluster, while companies at large distances should be divided into different clusters.

In the cluster analysis we used hierarchical ascending classification based on nearest neighbor method and in order to evaluate the distance between individuals we have used square Euclidean distance.

Analyzing the dendogram of insurance companies, we point out the existence of four classes of companies: Class 1: City Insurance, Class 2: Astra, Class 3: Groupama Insurance, Class 4: the remaining insurance companies). It is found empirically that when we take into account all the five main components, the only reliable insurance company that maintains from the previous classification, after the first two principal components and which is highlighted into a separate class is Astra Insurance.

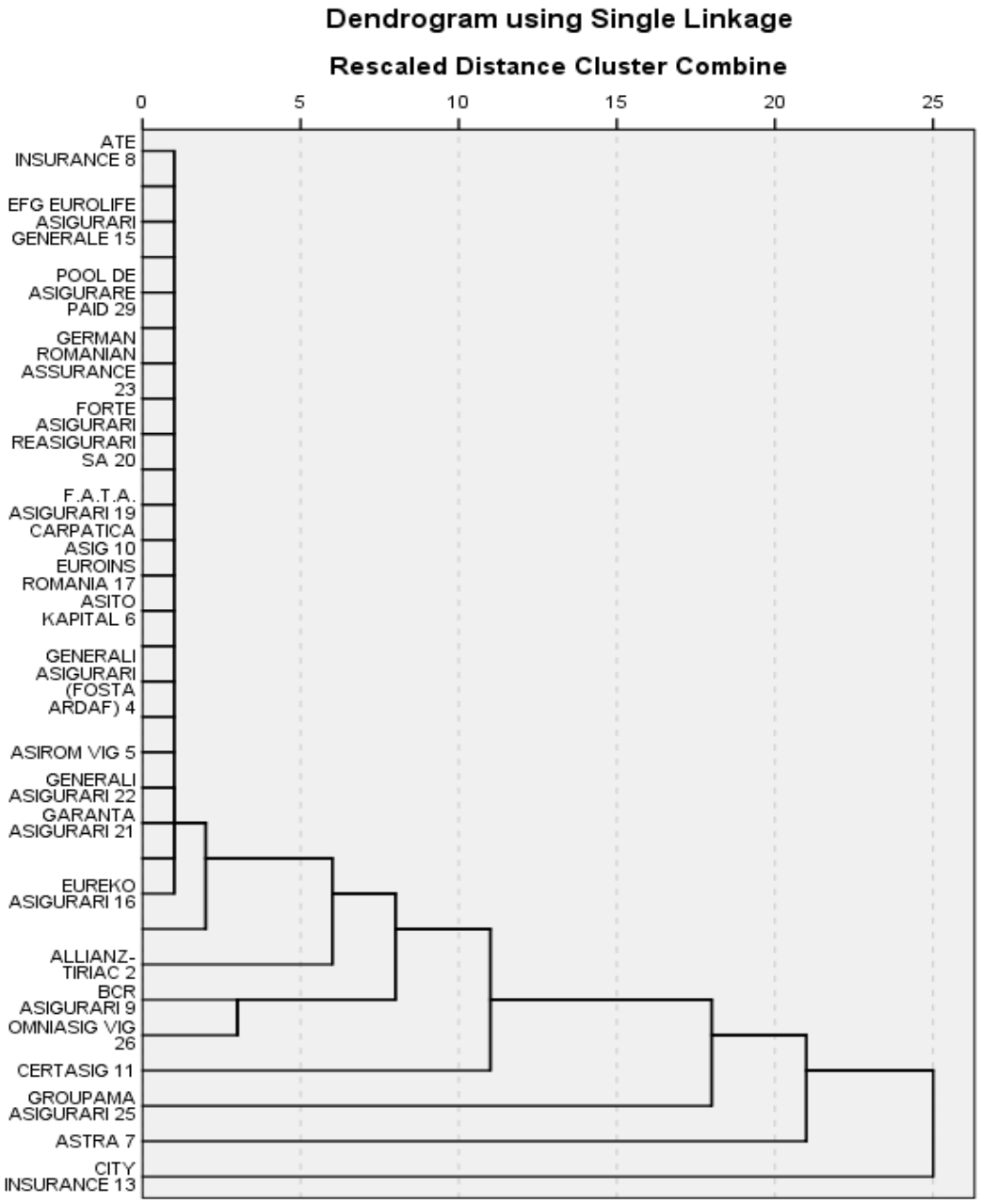


Fig.2. Dendogram of insurance companies

Conclusions

The paper aims towards a laborious analysis of the insurance market in Romania expressed in the context of the year 2011, having as main objective a classification of the 30 insurance companies by gross written premiums on non-life insurance classes.

For this, methods of multidimensional data analysis were applied - principal components analysis and cluster analysis - in order to identify the main latent variables with significant

impact on the performances of insurance companies in Romania and to classify the companies by these latent variables.

The empirical results showed that aircraft liability insurance, accident and sickness insurance (including labour accidents and professional sickness), liability insurance for ships (sea, lake, river and canal vessels), insurance of legal expenses and the general liability insurance and surety ship insurance explain best the evolution of the insurance market in Romania.

Grouping companies after the first two principal components, aircraft liability insurance, accident and sickness insurance, which recovers about 53% of the total variance of the original variables, can highlight three classes of companies: Astra is first class, with special performances on aircraft liability insurance. In the second class is Allianz-Tiriac and Omniasig, both strong companies on the accident (including industrial injury and occupational diseases) insurance market. In the third class, we can find the remaining insurance companies.

The cluster analysis that took into account the simultaneous action of all principal components indicate that there are four classes of companies: City Insurance, Astra, Groupama Insurances and the rest of insurance companies, the only insurance company that remains from the old classification being the class formed by the insurance company Astra SA.

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