

The epistemic apocalypse

"I would plead in favor of a return to the Great Problems,
in order to push back the present trend of fragmentation and incoherence in science"

John L. Casti

In spite of some official assumptions, economic research remains quartered in a methodological space with unclear references. The pretentious small talk among empiricism and historicism still is a source of motivation for the critical positioning. Unfortunately, that which gets reduced to empiricism in economical research proves to be an analysis of statistical data, as historicism still resembles the incrementum - decrementum type of story.

The studies which do not follow these directions are either event oriented, either hagiographical under various forms. A discordant note, in a neutral sense, is made by the never-ending suite of syntheses of what has been said, up to a point in time, in a thematic zone or regarding a fashionable idea, where the scientific goal is replaced by the goal of the profession. The thematic imitations are negatively highlighted, going as far as pretending the founding of disciplines, in accordance with the sensibilities induced in the public agenda by politically motivated intellectual groups.

The most bizarre situation is seen in the area of pretense of inter-, multi- and trans-disciplinary studies.

The most voluminous package of this type relates to the pairing of scientific disciplines in an artificial manner, from the most indigestible and somewhat useless which amalgamate economics with medicine or with who knows which para-quantic theory to those which alchemically combine disciplines in the hope of obtaining the gold of originality.

There is no doubt that, until proved otherwise, any theoretical experiment contains a grain of insertable ore. The problem, essentially, is not of notional *mélangeing*, but that of the method followed by the experimenter – on the one hand, and of the coherent vision in which the meanings of theoretical referentials are established – on the other hand. The substituting of concepts might possibly suggest empty areas in the economic theory, as with the example set by the works of Georgescu-Roegen, but nothing more. The temptation of diversifying the translation of concepts from physics to economics, for instance, has the advantage of fashion, but not that of the invariable epistemic breakthrough.

The physical universe, be it even anthropically re-engineered, remains completely different from the rules contained within economic theory, eminently anthropically centered, being essentially a special theory which rationalizes human behavior. The laws called on by physics are of *natura naturans*, while economics tries to accredit regularities belonging to human nature, a subspecies which introduces a fault line into existence through the quality of being conscious, of emitting rational explanations and of communicating them.

The physical laws constitute the amniotic liquid in which the laws of human behavior are constructed, among them being – in truth, on the frontispiece – the laws of economics. The laws are complementary, interoperable, and not interchangeable. The laws of physics explain existence; the laws of economics, together with all the sciences of man, explain the states of conscience, which means those of the intelligent existence of the anthropic type.

Inter-disciplinarity thus understood is not just lacking in sense, but is also an error in the order of rationality. Inter-disciplinarity should offer the platform for the homogenization of consistencies in order to form a new unity. Unfortunately, until now we've only come across forced redrawings of the senses of some phenomena, from physics to economics, as if these would hold at least compatible consistencies.

The ridiculous can also be found in a different plane: the pretense of engineers of being able to offer solutions to the problems of the economy. That which comes out of this propensity is the paroxysmal expression of the managementization of economical discourse and the engineeringization of quantitative analysis. In reality it is a technological rigor applied to the void in the understanding of what economics is.

The case of multi- and trans-disciplinarity is represented by a mimetic current. And this because it manifests itself in the total absence of the curricular offer of superior education, from where expertise is to be expected. Unidimensionality is built on the fragmentation of specialization, also most often ripped from the contexts of the founding paradigms and of their theoretical referentials. A so-called marketing expert, for instance, who underwent the cycle of licensing of masters and doctorate which we call a "marketing" domain of study, is the sure victim of fragmentation as a solution for specialization and becomes autistic with regard to the power of explaining contexts.

This model, invariably multiplied, makes multi-disciplinarity illusory.

Epistemological inadequacy is obvious. Ignorance is finding a place to call home. Economic research has insured its comfort.

And as if all of this would not suffice, the non-recognition of several levels of reality – even of different realities, together with the refusal of non-classical logic (in fact, a lack of initiation) and with the total breaking-off with the stimulating dilemmas of theoretical visions – discards the area of economic research to the outskirts of scientificity, somewhat even to the derisory.

Facti sumus sicut lapides oculos habentes et non videntes.

Marin Dinu

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Evolution Scenarios at the Romanian Economy Level, Using the R.M. Solow Adjusted Model

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Abstract. *Besides the models of M. Keynes, R.F. Harrod, E. Domar, D. Romer, Ramsey-Cass-Koopmans model etc., the R.M. Solow model is part of the category which characterizes the economic growth.*

The paper proposes the presentation of the R.M. Solow adjusted model with specific simulation characteristics and economic growth scenario.

Considering these aspects, there are presented the values obtained at the economy level, behind the simulations, about the ratio Capital on the output volume, Output volume on employee, equal with the current labour efficiency, as well as the Labour efficiency value.

Key words: *reprezentive consumer; reprezentive firm; macroeconomic model; macroeconomic equilibrium; evolution scenarios; simulation; labour efficiency.*

■

JEL Codes: C15, O11.

REL Codes: 8E, 10B.

1. Presentation of the R.M. Solow adjusted model, with specific simulation characteristics

It is well-known that any economic growth is accompanied by a continuous modification of the life and work conditions and, on the other hand, it releases changes due to which the communities adapt their selves to the changeable exigency of the production, in general.

In consequence, the analysis of the economic growth must explain the social conversion and the progress steps registered by the production technologies.

Besides the hypothesis from the R.M. Solow adjusted model⁽¹⁾, in the next simulations we will use a number of practical ones⁽²⁾, for allowing the running of a consistent model, such as:

- the analysis is made at a given moment (year), with straight mention at 20 past periods, and the forecast will have, also, 20 future periods;
- the model parameters will be:

s - rate of savings (ratio savings volume on each employee);

r_1 - annual growth rhythm of the employment;

r_2 - annual growth rhythm of the technical progress attached to the labour force;

ρ - annual depreciation rate of the capital;

γ_2 - attached power to the production function (output elasticity considering the labour factor);

Observations: 1. The same parameters noted with the sign *prime* will signify the values after the shock;

2. Because the simulations are made on the discrete case, the indicators will have the same characteristic – the time will be index (discrete value) and not one infinitesimal.

- it is assumed that in the year zero take place a shock, demonstrated through the modification of at least one parameter: s , r_1 , r_2 , ρ and/or γ_2 ;

From the econometric analysis were deduced the following values of the R.M. Solow model:

Initial values of the model parameters

Table 1	
$s = 0,275$	$\rho = 0,04$
$r_1 = 0,002$	$\gamma_2 = 0,8$
$r_2 = 0,05$	

- Values obtained at the economy level, at equilibrium:

$\frac{K_t}{Q_t} = \frac{s}{r_1 + r_2 + \rho}$ representing the ratio capital on output volume;

$\frac{Q_t}{L_t} = \left(\frac{s}{r_1 + r_2 + \rho} \right)^{\frac{1-\gamma_2}{\gamma_2}}$ representing the ratio output volume on employee, equal with the current labour efficiency E (labour efficiency or productivity in year zero);

$\left(\frac{60000}{\frac{K_0}{Q_0}} \right)^{\frac{1-\gamma_2}{\gamma_2}}$ representing labour efficiency value, E , in year zero;

Furthermore, the calculation of the economic growth considering the R.M. Solow adjusted model contains the results organization in the table 2.

Economic growth calculated with Solow model

Table 2

Years before and after the shock (t)	Labour efficiency, E	Ratio capital on output volume, K/Q	Ratio output volume on employee, equal with the current labour efficiency, E	Labour productivity (ratio output on employee)
-20 -19 -18 . . . -3 -2 -1	$E_t = \frac{E_0}{(1+r_2)^{-t}}$, $t = \overline{-20,-1}$	$\left(\frac{K}{Q}\right)_{-20} = \frac{s}{r_1+r_2+\rho}$ $\left(\frac{K}{Q}\right)_t = \left(\frac{K}{Q}\right)_{t-1}$ $t = \overline{-19,-1}$	$\left(\frac{Q}{L}\right)_{-20} = \left(\frac{K}{Q}\right)_{-20} = \frac{s}{r_1+r_2+\rho}$ $\left(\frac{Q}{L}\right)_t = \left(\frac{Q}{L}\right)_{t-1}$, $t = \overline{-19,-1}$	$\left(\frac{\tilde{Q}}{L}\right)_t = \left(E_t \left(\frac{K}{Q}\right)_t\right)^{\frac{1-\gamma_2}{\gamma_2}}$ $t = \overline{-20,-1}$
0	$E_0 = \left(\frac{60000}{\frac{K_0}{Q_0}}\right)^{\frac{1-\gamma_2}{\gamma_2}}$	$\left(\frac{K}{Q}\right)_0 = \left(\frac{K}{Q}\right)_{-1}$	$\left(\frac{Q}{L}\right)_0 = \frac{s'}{r'_1+r'_2+\rho'}$	$\left(\frac{\tilde{Q}}{L}\right)_0 = \left(E_0 \left(\frac{K}{Q}\right)_0\right)^{\frac{1-\gamma_2}{\gamma_2}}$
1 2 3 . 18 19 20	$E_t = E_0(1+r'_2)^t$	$\left(\frac{K}{Q}\right)_t = \left(\frac{\frac{K}{L}}{\frac{Q}{L}}\right)_t$, $t = \overline{1,20}$	$\left(\frac{Q}{L}\right)_t = \left(\frac{Q}{L}\right)_{t-1}$ $t = \overline{1,20}$	$\left(\frac{\tilde{Q}}{L}\right)_t = k_t^{1-\gamma_2} E_t^{\gamma_2}$. $t = \overline{1,20}$

Years before and after the shock (t)	Technical endowment of the labour, k	Ratio output volume on employee, considering the current labour efficiency, E	Ratio output on employee, before and after the shock
-20 -19 -18 .. -3 -2 -1	$k_t = \frac{\left(\frac{K}{Q}\right)_t}{\left(\frac{\tilde{Q}}{L}\right)_t}$, $t = \overline{-19,-1}$	$\left(\frac{\tilde{Q}}{L}\right)_t = \left(E_t \left(\frac{Q}{L}\right)_t\right)^{\frac{1-\gamma_2}{\gamma_2}}$ $t = \overline{-20,-1}$	$\left(\frac{\tilde{\tilde{Q}}}{L}\right)_t = \left(\frac{\tilde{Q}}{L}\right)_t$ $t = \overline{-20,-1}$
0	$k_0 = \frac{\left(\frac{K}{Q}\right)_0}{\left(\frac{\tilde{Q}}{L}\right)_0}$	$\left(\frac{\tilde{Q}}{L}\right)_0 = \left(E_0 \left(\frac{Q}{L}\right)_0\right)^{\frac{1-\gamma_2}{\gamma_2}}$	$\left(\frac{\tilde{\tilde{Q}}}{L}\right)_0 = \left(E_0 \left(\frac{K}{Q}\right)_0\right)^{\frac{1-\gamma_2}{\gamma_2}}$
1 2 3 . 18 19 20	$k_t = k_{t-1}(1-r'_1-\rho') + \left(\frac{\tilde{Q}}{L}\right)_{t-1} s'$ $t = \overline{1,20}$	$\left(\frac{\tilde{Q}}{L}\right)_t = \left(E_t \left(\frac{Q}{L}\right)_t\right)^{\frac{1-\gamma_2}{\gamma_2}}$ $t = \overline{1,20}$	$\left(\frac{\tilde{\tilde{Q}}}{L}\right)_t = \frac{\left(\frac{\tilde{\tilde{Q}}}{L}\right)_{t-1}^2}{\left(\frac{\tilde{\tilde{Q}}}{L}\right)_{t-2}}$, $t = \overline{1,20}$

Evolution Scenarios at the Romanian Economy Level, using the R.M. Solow Adjusted Model

2. Characterization of the economic growth scenario

Scenario 1. It has the following characteristics:

Models parameters	Initial values (%)	Shock (%)	After shock values (%)
s, rate of savings	27.50	12.00	39.50
ro, annual rate of the capital depreciation	5.00	0.00	5.00
r1, annual growth rhythm of the employment	2.00	0.00	2.00
r2, annual growth rhythm of the technical progress attached to the labour force	5.00	0.00	5.00
Gama 2: attached power to the production function (output elasticity considering the labour factor)	0.5		No changes in time
Values obtained at the economy level			
Ratio capital on output volume, K/Q:	2.29166667		3.29166667
Ratio output volume on employee, equal with the current labour efficiency, E:	2.29166667		3.29166667
Value of the labour efficiency (E) at the zero moment (year):	26.182		26.182

The results are presented in Appendix 1.

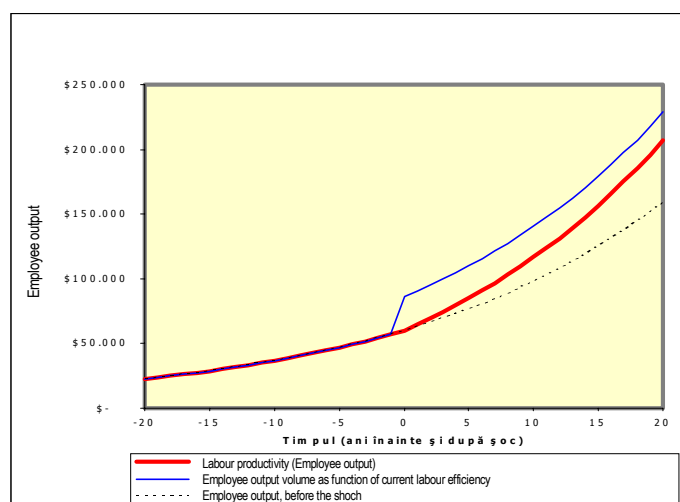


Figure 1. Adjusted increasing Solow model: employee output

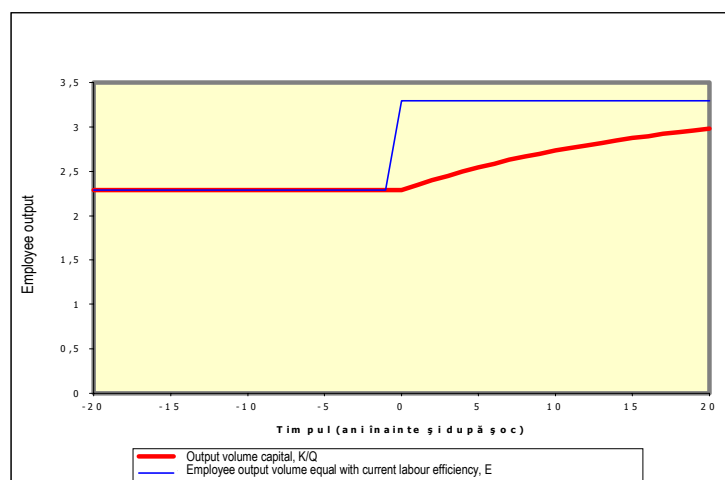


Figure 2. Adjusted increasing Solow model capital-output ratio

Scenario 2. It has the following characteristics:

Models parameters	Initial values (%)	Shock (%)	After shock values (%)
s, rate of savings	20.00	700	27.00
ro, annual rate of the capital depreciation	5.00	0.00	5.00
r1, annual growth rhythm of the employment	2.00	0.00	2.00
r2, annual growth rhythm of the technical progress attached to the labour force	5.00	0.00	5.00
Gama 2: attached power to the production function (output elasticity considering the labour factor)	0.5		No changes in time
Values obtained at the economy level			
Ratio capital on output volume, K/Q:	1.6666667		2.25
Ratio output volume on employee, equal with the current labour efficiency, E:	1.6666667		2.25
Value of the labour efficiency (E) at the zero moment (year):	36.00		36.000

The results are presented in Appendix 2.

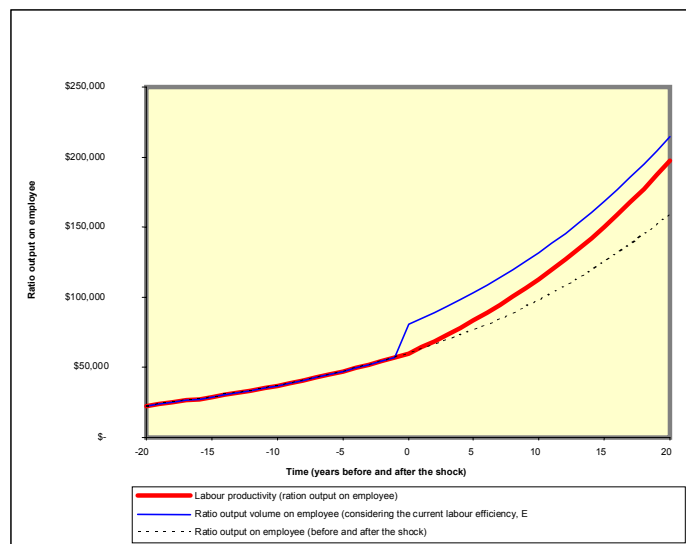


Figure 3. *The R.M. Solow adjusted growth model: output on employee*

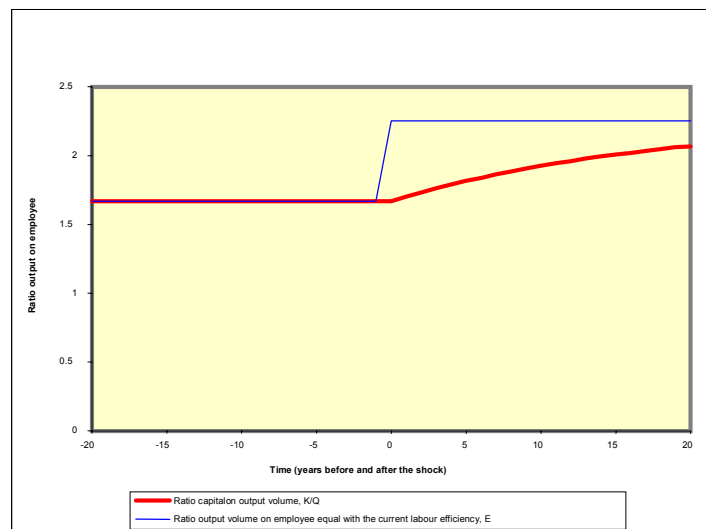


Figure 4. *R.M. Solow adjusted growth model: ratio capital-output*

Notes

- (1) See Roșca Gh. I., Stancu S., Modelul lui R.M. Solow ajustat de creștere economică, *Revista Economie-teorie și practică*, Nr. 5(510), pag. 3, București, 2007
- (2) This simulations considered Brad Delong analysis on the same Solow model.

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Appendix 1

Years before and after the shock	Labour efficiency, E	Ratio capital on output volume, K/Q	Ratio output volume on employee, equal to the current labour efficiency, E	Technical endowment of the labour, k	Labour productivity (ratio output on employee)	Ratio output volume on employee, considering the current labour efficiency, E	Ratio output on employee before and after the shock
-20	9.868	2,29166667	2,29166667	51.822	22.613	22.613	22.613
-19	10.361	2,29166667	2,29166667	54.413	23.744	23.744	23.744
-18	10.879	2,29166667	2,29166667	57.134	24.931	24.931	24.931
-17	11.423	2,29166667	2,29166667	59.991	26.178	26.178	26.178
-16	11.994	2,29166667	2,29166667	62.990	27.487	27.487	27.487
-15	12.594	2,29166667	2,29166667	66.140	28.861	28.861	28.861
-14	13.224	2,29166667	2,29166667	69.447	30.304	30.304	30.304
-13	13.885	2,29166667	2,29166667	72.919	31.819	31.819	31.819
-12	14.579	2,29166667	2,29166667	76.565	33.410	33.410	33.410
-11	15.308	2,29166667	2,29166667	80.393	35.081	35.081	35.081
-10	16.073	2,29166667	2,29166667	84.413	36.835	36.835	36.835
-9	16.877	2,29166667	2,29166667	88.634	38.677	38.677	38.677
-8	17.721	2,29166667	2,29166667	93.065	40.610	40.610	40.610
-7	18.607	2,29166667	2,29166667	97.719	42.641	42.641	42.641
-6	19.537	2,29166667	2,29166667	102.605	44.773	44.773	44.773
-5	20.514	2,29166667	2,29166667	107.735	47.012	47.012	47.012
-4	21.540	2,29166667	2,29166667	113.122	49.362	49.362	49.362
-3	22.617	2,29166667	2,29166667	118.778	51.830	51.830	51.830
-2	23.748	2,29166667	2,29166667	124.717	54.422	54.422	54.422
-1	24.935	2,29166667	2,29166667	130.952	57.143	57.143	57.143
0	26.182	2,29166667	3,29166667	137.500	60.000	86.182	60.000
1	27.491	2,348	3,29166667	151.575	64.552	90.491	63.000
2	28.865	2,401	3,29166667	166.463	69.318	95.015	66.150
3	30.309	2,452	3,29166667	182.191	74.310	99.766	69.458
4	31.824	2,499	3,29166667	198.790	79.538	104.755	72.930
5	33.415	2,544	3,29166667	216.292	85.015	109.992	76.577
6	35.086	2,587	3,29166667	234.733	90.752	115.492	80.406
7	36.840	2,627	3,29166667	254.148	96.762	121.266	84.426
8	38.682	2,664	3,29166667	274.579	103.060	127.330	88.647
9	40.617	2,700	3,29166667	296.067	109.660	133.696	93.080
10	42.647	2,733	3,29166667	318.658	116.576	140.381	97.734
11	44.780	2,765	3,29166667	342.400	123.825	147.400	102.620
12	47.019	2,795	3,29166667	367.342	131.423	154.770	107.751
13	49.370	2,823	3,29166667	393.541	139.388	162.509	113.139
14	51.838	2,850	3,29166667	421.051	147.738	170.634	118.796
15	54.430	2,875	3,29166667	449.934	156.493	179.166	124.736
16	57.152	2,899	3,29166667	480.253	165.672	188.124	130.972
17	60.009	2,921	3,29166667	512.076	175.298	197.530	137.521
18	63.010	2,942	3,29166667	545.473	185.392	207.407	144.397
19	66.160	2,962	3,29166667	580.520	195.978	217.777	151.617
20	69.468	2,981	3,29166667	617.295	207.080	228.666	159.198

Evolution Scenarios at the Romanian Economy Level, using the R.M. Solow Adjusted Model

Years before and after the shock	Labour efficiency, E	Ratio capital on output volume, K/Q	Ratio output volume on employee, equal to the current labour efficiency, E	Technical endowment of the labour, k	Labour productivity (ratio output on employee)	Ratio output volume on employee, considering the current labour efficiency, E	Ratio output on employee before and after the shock
-20	13,568	1.66666667	1.66666667	37,689	22,613	22,613	22,613
-19	14,246	1.66666667	1.66666667	39,573	23,744	23,744	23,744
-18	14,959	1.66666667	1.66666667	41,552	24,931	24,931	24,931
-17	15,707	1.66666667	1.66666667	43,630	26,178	26,178	26,178
-16	16,492	1.66666667	1.66666667	45,811	27,487	27,487	27,487
-15	17,317	1.66666667	1.66666667	48,102	28,861	28,861	28,861
-14	18,182	1.66666667	1.66666667	50,507	30,304	30,304	30,304
-13	19,092	1.66666667	1.66666667	53,032	31,819	31,819	31,819
-12	20,046	1.66666667	1.66666667	55,684	33,410	33,410	33,410
-11	21,048	1.66666667	1.66666667	58,468	35,081	35,081	35,081
-10	22,101	1.66666667	1.66666667	61,391	36,835	36,835	36,835
-9	23,206	1.66666667	1.66666667	64,461	38,677	38,677	38,677
-8	24,366	1.66666667	1.66666667	67,684	40,610	40,610	40,610
-7	25,585	1.66666667	1.66666667	71,068	42,641	42,641	42,641
-6	26,864	1.66666667	1.66666667	74,622	44,773	44,773	44,773
-5	28,207	1.66666667	1.66666667	78,353	47,012	47,012	47,012
-4	29,617	1.66666667	1.66666667	82,270	49,362	49,362	49,362
-3	31,098	1.66666667	1.66666667	86,384	51,830	51,830	51,830
-2	32,653	1.66666667	1.66666667	90,703	54,422	54,422	54,422
-1	34,286	1.66666667	1.66666667	95,238	57,143	57,143	57,143
0	36,000	1.66666667	2.25	100,000	60,000	81,000	60,000
1	37,800	1.700	2.25	109,200	64,248	85,050	63,000
2	39,690	1.731	2.25	118,903	68,697	89,303	66,150
3	41,675	1.760	2.25	129,128	73,358	93,768	69,458
4	43,758	1.788	2.25	139,895	78,240	98,456	72,930
5	45,946	1.814	2.25	151,228	83,357	103,379	76,577
6	48,243	1.839	2.25	163,148	88,718	108,548	80,406
7	50,656	1.862	2.25	175,681	94,336	113,975	84,426
8	53,188	1.884	2.25	188,854	100,224	119,674	88,647
9	55,848	1.905	2.25	202,695	106,396	125,658	93,080
10	58,640	1.925	2.25	217,233	112,865	131,940	97,734
11	61,572	1.943	2.25	232,501	119,648	138,537	102,620
12	64,651	1.961	2.25	248,530	126,758	145,464	107,751
13	67,883	1.977	2.25	265,358	134,214	152,738	113,139
14	71,278	1.993	2.25	283,021	142,032	160,374	118,796
15	74,841	2.007	2.25	301,558	150,230	168,393	124,736
16	78,583	2.021	2.25	321,011	158,827	176,813	130,972
17	82,513	2.034	2.25	341,424	167,844	185,653	137,521
18	86,638	2.046	2.25	362,842	177,302	194,936	144,397
19	90,970	2.058	2.25	385,315	187,222	204,683	151,617
20	95,519	2.069	2.25	408,893	197,628	214,917	159,198

Application of the Model of Principal Components Analysis on Romanian Insurance Market

■

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Abstract. *Principal components analysis (PCA) is a multivariate data analysis technique whose main purpose is to reduce the dimension of the observations and thus simplify the analysis and interpretation of data, as well as facilitate the construction of predictive models. A rigorous definition of PCA has been given by Bishop (1995) and it states that PCA is a linear dimensionality reduction technique, which identifies orthogonal directions of maximum variance in the original data, and projects the data into a lower-dimensionality space formed of a sub-set of the highest-variance components. PCA is commonly used in economic research, as well as in other fields of activity. When faced with the complexity of economic and financial processes, researchers have to analyze a large number of variables (or indicators), fact which often proves to be troublesome because it is difficult to collect such a large amount of data and perform calculations on it. In addition, there is a good chance that the initial data is powerfully correlated; therefore, the signification of variables is seriously diminished and it is virtually impossible to establish causal relationships between variables. Researchers thus require a simple, yet powerful analytical tool to solve these problems and perform a coherent and conclusive analysis. This tool is PCA. The essence of PCA consists of transforming the space of the initial data into another space of lower dimension while maximising the quantity of information recovered from the initial space⁽¹⁾. Mathematically speaking, PCA is a method of determining a new space (called principal component space or factor space) onto which the original space of variables can be projected. The axes of the new space (called factor axes) are defined by the principal components determined as result of PCA. Principal components (PC) are standardized linear combinations (SLC) of the original variables and are uncorrelated. Theoretically, the number of PCs equals the number of initial variables, but the whole point of PCA is to extract as few factors as possible without compromising the variability of the original space. An important property of the PCs is that the first PC is extracted so as to recover the variance from the initial space to the maximum possible extent. The remaining variance is recovered by the next PCs at a declining rate: the variance of the second PC is greater than the variance of the third PC, the variance of the third PC is greater than the variance of the fourth PC and so on.*

Key words: causal space; principal components; eigen values; variance; insurance; factor matrix; generalized variance.

■

JEL Codes: C21, G22.

REL Codes: 10B, 11C.

As we said earlier, PCA is based on a transformation that links two vector spaces of different dimensions:

$$\Psi : \mathbb{R}^n \rightarrow \mathbb{R}^k, k \ll n \quad (1)$$

Recall that we defined PCs as SLCs of the original variables. Therefore, if w_i is principal component i , $\alpha^{(i)}$ the vector whose elements define SLC i and x_j the original variables, $j = \overline{1, n}$, we have

$$w_i = \sum_{j=1}^n \alpha_j^{(i)} x_j, i=1, \dots, n \quad (2)$$

Let $w = \begin{pmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{pmatrix}$ be the vector of the n PCs,

$$A = \begin{pmatrix} \alpha_1^{(1)} & \alpha_1^{(2)} & \dots & \alpha_1^{(n)} \\ \alpha_2^{(1)} & \alpha_2^{(2)} & \dots & \alpha_2^{(n)} \\ \dots & \dots & \dots & \dots \\ \alpha_n^{(1)} & \alpha_n^{(2)} & \dots & \alpha_n^{(n)} \end{pmatrix}$$

be an $n \times n$ matrix consisting of column vectors and $x = \begin{pmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{pmatrix}$

be the vector of the n original variables. In terms of matrix algebra, equation (2) can be written as

$$w = A^t \times x \quad (3)$$

Let w and α be two generic notations for a PC and a vector whose elements define a SLC, respectively. In order to determine the PCs, we must maximize $\text{VAR}(w)$. This is done by solving the following system:

$$\begin{cases} w = \alpha^t \times x \\ \max \text{VAR}(w) \end{cases} \quad (4)$$

Taking into account that α is a SLC, system (4) can be equivalently written as:

$$\begin{cases} \max \alpha^t \sum \alpha \\ \alpha^t \times \alpha = 1 \end{cases} \quad (5)$$

where Σ is the covariance matrix of the original variables.

It can be easily proven that the normated eigenvectors of matrix Σ satisfy system (5). The variance of each PC, given by the bilinear form $\alpha^t \sum \alpha$, will equal the corresponding eigenvalue of matrix Σ . It is obvious that Σ has n eigenvalues; rearranging them so as $\lambda_1 \geq \lambda_2 \geq \dots \geq \lambda_n$, the following inequality holds:

$$\text{VAR}(w_1) \geq \text{VAR}(w_2) \geq \dots \geq \text{VAR}(w_n) \quad (6)$$

Consequently, increasing the number of PCs retained will result in a greater share of variance recovered from the original variable space. It is worth mentioning that the PC transformation preserves the *total variance* (V_T) from the initial space:

$$V_T = \sum_{i=1}^n \text{VAR}(x_i) = \sum_{i=1}^n \lambda_i \Leftrightarrow \text{tr}(\Sigma) = \text{tr}(\Lambda) \quad (7)$$

where Λ is the covariance matrix of the PCs. is a diagonal matrix⁽²⁾:

$$\begin{pmatrix} \lambda_1 & \dots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \dots & \lambda_n \end{pmatrix}$$

PCA also results in the preservation of generalized variance (V_G):

$$V_G = |\Sigma| = |\Lambda| \quad (8)$$

In this paper, we will use the PCA technique to determine the financial strength of the insurance companies that operated on the Romanian market in 2006. We have selected a number of eighth (8) relevant variables⁽³⁾: gross written premium, net mathematical reserves, gross claims paid, net premium reserves, net claim reserves, net income, share capital and gross written premium ceded in reinsurance.

The mean and standard deviation for each variable

Table 1

	Mean	Std.Dev.
GR_WRI_PRE	143.232.114	228.320.22
NET_M_RES	43.188.939	151.739.60
GR_CL_PAID	65.569.646	125.986.40
ET_PRE_RES	41.186.950	65.331.44
NET_CL_RES	14.726.188	24.805.66
NET_INCOME	-1.711.048	22.982.14
SHARE_CAP	33.006.176	38.670.76
GR_WRI_PR_CED	37.477.746	93.629.54

As we can see, standard deviations are high for each variable in the model, which means that there is a large quantity of information in the original space. The high levels of standard deviations can be explained taking into account the powerful correlations between the original variables.

The correlation matrix of original variables

Table 2

	GR_WRI_PRE	NET_M_RES	GR_CL_PAID	NET_PRE_RES	NET_CL_RES	NET_INCOME	SHARE_CAP	GR_WRI_PR_CED
GR_WRI_PRE	1.00	0.32	0.95	0.94	0.84	0.22	0.47	0.82
NET_M_RES	0.32	1.00	0.06	0.21	0.01	0.30	0.10	0.01
GR_CL_PAID	0.95	0.06	1.00	0.94	0.89	0.14	0.44	0.81
NET_PRE_RES	0.94	0.21	0.94	1.00	0.88	0.19	0.50	0.68
NET_CL_RES	0.84	0.01	0.89	0.88	1.00	-0.23	0.55	0.63
NET_INCOME	0.22	0.30	0.14	0.19	-0.23	1.00	-0.15	0.21
SHARE_CAP	0.47	0.10	0.44	0.50	0.55	-0.15	1.00	0.14
GR_WRI_PR_CED	0.82	0.01	0.81	0.68	0.63	0.21	0.14	1.00

We now face the problem of information redundancy due to powerful correlations between the variables (e.g. between gross written premium and gross claims paid, between gross written premium and net premium reserves, between gross claims paid and net claim reserves etc.). Recall that we defined the PCs as uncorrelated SLCs⁽⁴⁾ of original variables. Therefore, a primary purpose of PCA is to eliminate information

redundancy, along with dimensionality reduction.

Assuming the standardization of the initial data⁽⁵⁾, we shall now perform PCA via the correlation matrix. It is worth mentioning that only eigenvalues greater than one are of interest⁽⁶⁾ because only the PCs with higher variance than the standardized original variables should be extracted.

The eigenvalues greater than one of the correlation matrix

Table 3

	Eigenvalue	Total variance (%)	Cumulative Eigenvalue	Cumulative (%)
1	4.648900	58.11126	4.648900	58.11126
2	1.454291	18.17864	6.103192	76.28990
3	1.014728	12.68410	7.117920	88.97400

The plot of eigenvalues below shows that the other five eigenvalues are negligible:

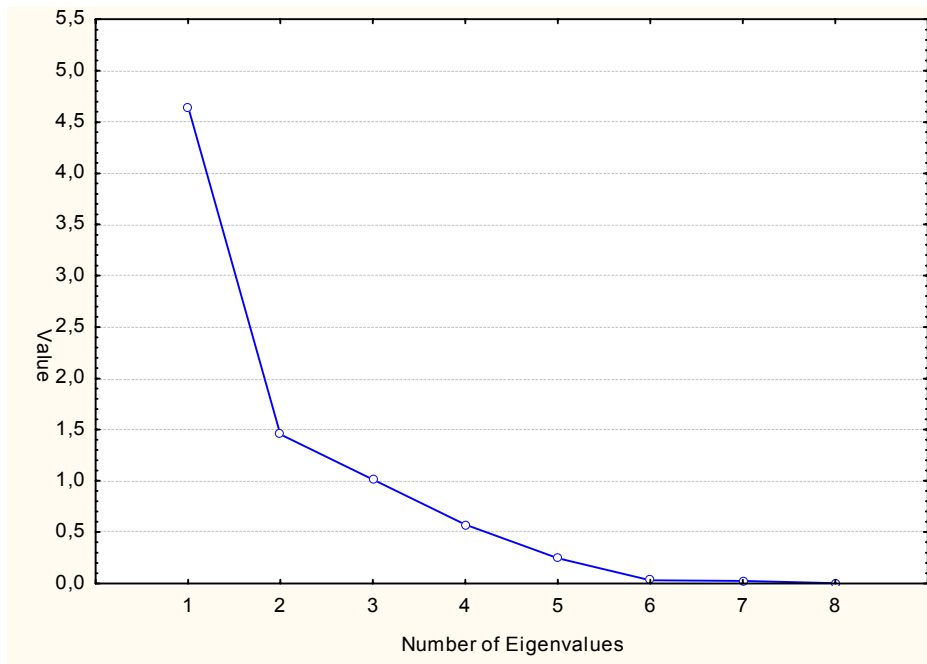


Figure 1. Variation of correlation matrix eigenvalues

The correlation matrix has three eigenvalues greater than one. As a result, three PCs have been retained in our analysis. They account for approximately 89% of the variability of the original space, which means that the PCA technique enabled us to transform an 8-dimensional space into a 3-dimensional space losing only 11% of the information contained in the former. It is also worth mentioning that the first PC alone explains over 58% of the variability of the original space, which means that it can be used to perform a pertinent classification of the insurance companies.

Having determined the number of principal components retained, we are now concerned with the interpretation of the PCs.

Hence we computed the factor matrix (also known as factor loadings matrix), whose elements (factor loadings) represent the correlation coefficients between the original variables and the PCs. The elements of the factor matrix are computed using the formula

$$\omega_{ij} = \frac{\sqrt{\lambda_j}}{\sqrt{\text{VAR}(x_i)}} \times \alpha_i^{(j)}, \quad i = 1, 2, \dots, n$$

$$j = 1, 2, \dots, k \quad (9)$$

where k is the number of retained PCs.

One common problem in PCA is that the unrotated factor matrix often provides unconvincing interpretations. To solve this problem, we determined the rotated factor matrix⁽⁷⁾:

The rotated factor matrix

Table 4

	Factor 1	Factor 2	Factor 3
GR_WRI_PRE	0,957868	0,267247	0,032382
NET_M_RES	0,053602	0,923184	-0,044009
GR_CL_PAID	0,985009	0,014747	0,053012
NET_PRE_RES	0,936205	0,202520	0,114957
NET_CL_RES	0,877731	-0,066607	0,416310
NET_INCOME	0,165885	0,464570	-0,747579
SHARE_CAP	0,408991	0,289363	0,712994
GR_WRI_PR_CED	0,875686	-0,123486	-0,273978
Expl.Var	4,499135	1,284163	1,334622
Prp.Totl	0,562392	0,160520	0,166828

The first PC is powerfully correlated with five of the original variables (gross written premium, gross claims paid, net premium reserves, net claim reserves and gross written premium ceded in reinsurance) and recovers 56.24% of the variability from the original space (as opposed to 58% in the unrotated situation). The second and third PCs are powerfully correlated with net mathematical reserves and net income and share capital, respectively. The plot below is a graphical representation of the correlations between the PCs and the original variables.

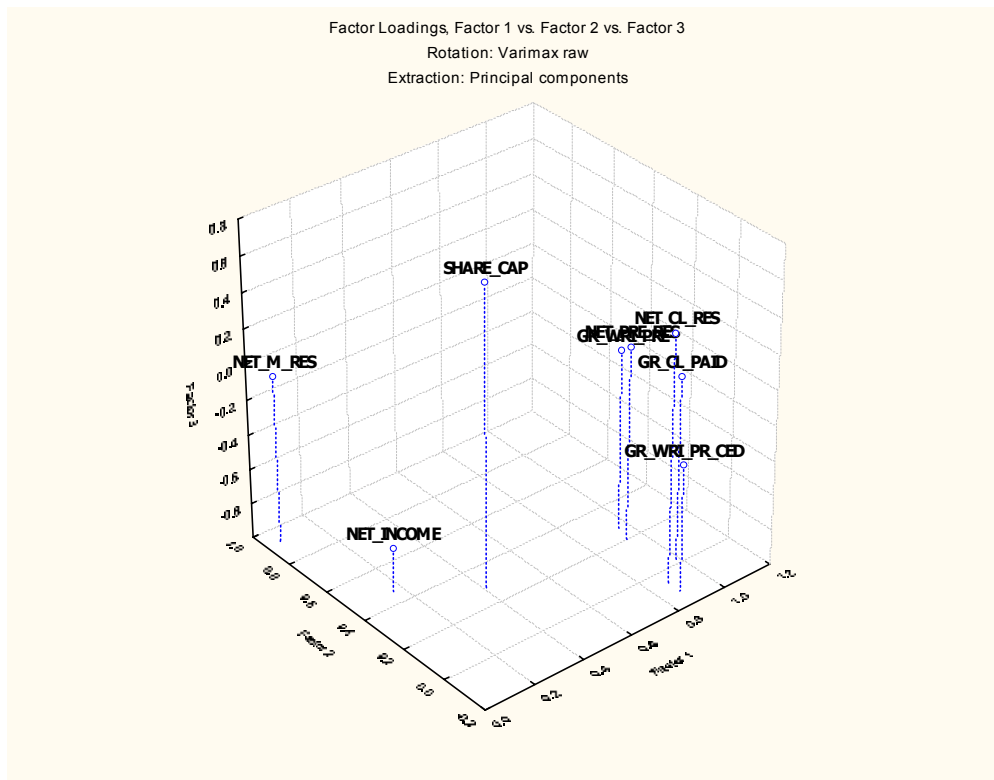


Figure 2. Correlation between PCs and original variables

Besides reducing dimensionality and eliminating information redundancy, PCA emphasizes the influence of common, latent (unobserved) factors on the original variables. According to Simar (2003), it is natural to believe that *most of the relevant information carried by a multivariate variable can be summarized by a limited*

number of latent factors. In terms of factor analysis, the behaviour of each original variable (also known as indicator or test variable) is guided by three types of factors: *common factors* (which influence all the variables in a model), *individual factors* and *residual factors*. The last two categories influence each variable in an individual

manner, thus exerting a specific influence. Equation (10) illustrates the decomposition of the values of indicators (original variables):

$$x_i = \sum_{j=1}^k a_{ij} \times f_j + a_i \times u_i + \varepsilon_i, i = 1, 2, \dots, 8 \quad (10)$$

common factors' influence
individual factor's influence
residual factor's influence

where x_i are the indicators and a_{ij} are the factor loadings (computed as elements of the factor matrix). Therefore, the variance of the original variables can be written as

$$\text{VAR}(x_i) = \text{Communality} + \text{Individuality} + \text{Residuality} \quad (11)$$

total variance of original variable i
variance explained by common (latent) factors
variance explained by the individual factor
variance explained by the residual factor

It should, however, be pointed out that it is difficult to distinguish between the individual and the residual factors. Equation (11) can hence be written as

$$\text{VAR}(x_i) = \text{Communality} + \text{Specificity} \quad (12)$$

total variance of original variable i
variance explained by common (latent) factors
variance explained by specific factors (individual and residual factors)

We can now determine the communalities for each original variable as the sum of squares of the elements on the corresponding line of the factor matrix (that is, the factor loadings). The specificities have been computed as $1 - \text{Communality}$:

The specificities of the factor matrix

Table 5

Indicator	Communality	Specificity
GR_WRI_PRE	0.989980	0.010020
NET_M_RES	0.857079	0.142921
GR_CL_PAID	0.973271	0.026729
NET_PRE_RES	0.930709	0.069291
NET_CL_RES	0.948162	0.051838
NET_INCOME	0.802217	0.197783
SHARE_CAP	0.759365	0.240635
GR_WRI_PR_CED	0.857138	0.142862

The table shows that the common factors exert a significant influence on the original variables (although this influence cannot be measured directly). In all but two of the cases the communality is above 0.85, the exceptions being net income and share capital. The specific factors account for 20% or more of the variance of these indicators because the respective variables have a somewhat subjective determination, as they can be heavily influenced by management decisions and stockholders' options. The highest communalities pertain to the indicators gross written premium, gross claims paid and net claim reserves. This happens because the behaviour of such variables is much more likely to be determined by general factors (like economic development and the general need for insurance within the economy) than by specific factors.

Recall that we defined the PCs as linear combinations of the original variables. As we saw earlier, the coefficients of the SLCs are given by the normated eigenvectors of the covariance (or correlation) matrix⁽⁸⁾:

The normed eigenvectors of the correlation matrix

Table 6

	Factor 1	Factor 2	Factor 3
GR_WRI_PRE	0.202495	-0.036051	0.119201
NET_M_RES	-0.088258	0.080710	0.764878
GR_CL_PAID	0.236082	-0.055489	-0.093669
NET_PRE_RES	0.196206	0.023689	0.078077
NET_CL_RES	0.182116	0.235296	-0.102060
NET_INCOME	0.063400	-0.553745	0.273611
SHARE_CAP	-0.004514	0.566914	0.290264
GR_WRI_PR_CED	0.258101	-0.324141	-0.240419

The factor scores

Table 7

	Factor 1	Factor 2	Factor 3
ABC ASIGURĂRI	-0.528918	-0.33091	-0.28589
AGRAS	-0.467755	-0.37092	-0.29948
AIG LIFE	-0.248735	-0.55629	1.05069
AIG ROMÂNIA	-0.251086	-0.67712	-0.43519
ALLIANZ-ȚIRIAC	4.453070	-2.14199	-0.54004
ARDAF	0.260885	3.98877	-1.57900
ASIBAN	1.471385	0.89075	0.34927
ASIMED	-0.547944	-0.49811	-0.34818
ASIROM	1.782933	0.36140	0.99269
ASIROM CONCORDIA	-0.548484	-0.40579	-0.30114
ASITO KAPITAL	-0.417567	-0.48417	-0.34874
ASITRANS	-0.274011	-0.35407	-0.36907
ASTRA	0.374542	2.42955	1.07949
ATE INSURANCE	-0.556508	-0.19879	-0.22494
AVIVA	-0.542741	1.23577	0.60924
BCR ASIGURĂRI	1.565687	-0.89718	-0.51044
BCR ASIGURĂRI DE VIAȚĂ	-0.424433	-0.31347	0.08715
BT ASIGURĂRI TRANSILVANIA	0.326596	0.73905	0.00527
CARPATICA ASIG	-0.078883	-0.26261	-0.35684
CERTASIG	-0.550829	-0.41410	-0.33531
CITY INSURANCE	-0.547583	-0.38413	-0.31154
CLAL ROMÂNIA	-0.570951	-0.18724	-0.35681
DELTA	-0.495821	-0.64218	-0.00517
DELTA ADDENDUM	-0.537575	-0.37856	-0.31518
EUROASIG	-0.541163	-0.37547	-0.31967
FATA ASIGURĂRI AGRICOLE	-0.536367	-0.39092	-0.31551
GARANTA	-0.087410	-0.70769	-0.22368
GENERALI	0.624774	0.68381	-0.54874
GERROMA	-0.544834	-0.45527	-0.32081
GRAWE	-0.415959	-0.17728	0.22579
ING ASIGURĂRI DE VIAȚĂ	-0.351754	-0.22964	5.42741
INTERAMERICAN	-0.391006	0.44912	-0.04643
IRASIG	-0.553515	-0.40953	-0.34051
KD LIFE ASIGURĂRI	-0.559469	-0.15693	-0.28189
NBG INSURANCE	-0.496560	-0.34410	-0.31078
OMNIASIG	1.912550	0.87197	0.38104
OMNIASIG VIAȚĂ	-0.378050	-0.07020	0.01006
OTP GARANCIA ASIGURĂRI	-0.525552	-0.07187	-0.22618
RAI	-0.467720	-0.45225	-0.31294
UNITA	0.666760	1.68859	-0.04802

As mentioned previously, we can perform a classification of the insurance companies based on the values (scores) of the first PC. This variable captures 56.24%

of the variance of the original space and is powerfully correlated with the following indicators⁽⁹⁾: gross written premium, gross claims paid, net premium reserves, net claim reserves and gross written premium ceded in reinsurance.

The graph shows that ALLIANZ-ȚIRIAC is the leader in the insurance market, followed by OMNIASIG, ASIROM, BCR ASIGURĂRI, ASIBAN, UNITA, GENERALI, ASTRA, BT ASIGURĂRI TRANSILVANIA and ARDAF, while companies like CERTASIG, IRASIG, ATE INSURANCE, KD LIFE ASIGURĂRI, CLAL ROMANIA and others lag behind. This classification gives us a clear picture of the insurance market, as opposed to the classification provided by CSA, which is almost exclusively based on market share. Why does this happen? Because the first PC takes into account crucial indicators, such as technical reserves and reinsurance policy of insurance companies. The latter is particularly important because an adequate reinsurance policy can greatly improve the financial stability of insurance companies. For instance, according to the classification provided by CSA, ING ASIGURĂRI DE VIAȚĂ is one of the market leaders. However, the score of the first PC does not distinguish this company from others, because ING's gross written premium ceded in reinsurance is negligible (compared to its gross written premium) and this is a threat to the company.

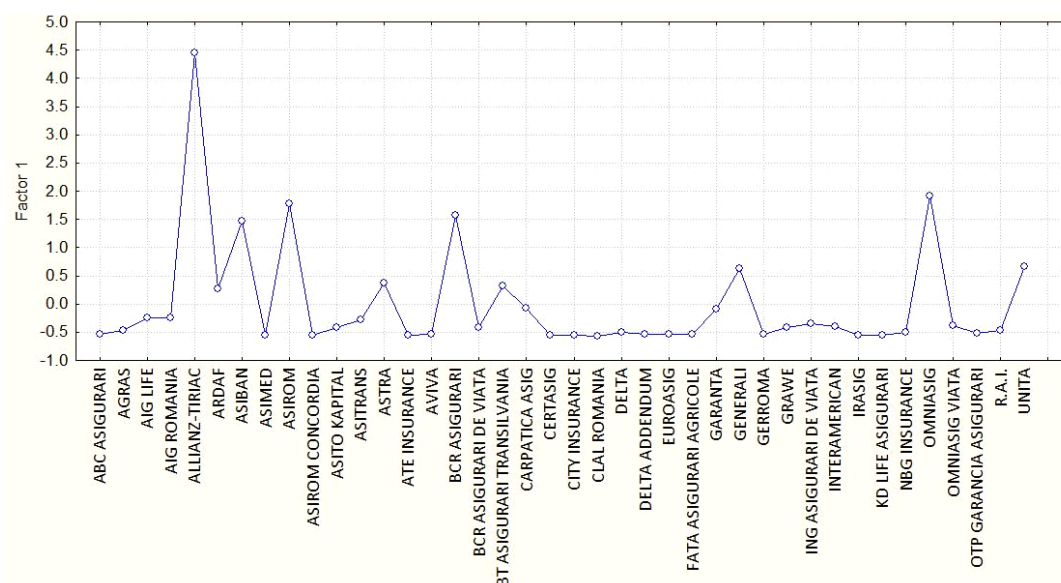


Figure 3. Plot of observations against factor 1

Similarly, we can perform a classification of the insurance companies based on the first two PCs:

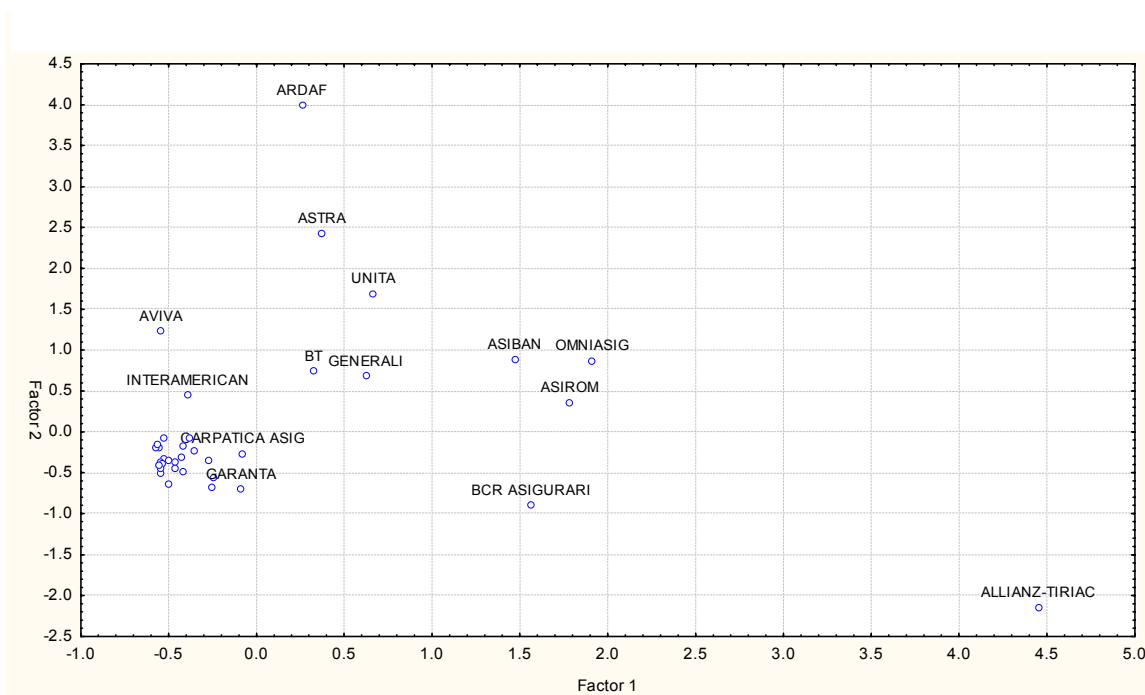


Figure 4. Scatterplot of observations

Recall that the second PC occurs in powerful correlation with net income and share capital (positive correlation with the former and negative correlation with the latter). Therefore, observations with negative values of the second PC make profits and have important return on equity. This is the case of ALLIANZ-TIRIAC, BCR ASIGURARI and GARANTA. Other companies (observations with positive scores of the second PC) make negligible profits or even run on losses: ASIROM, INTERAMERICAN, GENERALI, BT ASIGURARI TRANSILVANIA, OMNIASIG, ASIBAN, AVIVA, UNITA, ASTRA and ARDAF. Some of these companies (such as ARDAF, GENERALI

and AVIVA) encounter serious financial problems.

It is also worth mentioning that the second PC provides a good image of the capital adequacy of insurance companies. Companies like ALLIANZ-TIRIAC, BCR ASIGURARI and GARANTA have an optimally dimensioned capital and very good levels of return on capital, while INTERAMERICAN, AVIVA, UNITA and ASTRA have too high capital-to-activity ratios. As for the other observations (companies with small market share and relatively low levels of profitability), the graph shows that they tend to form clusters (GARANTA, AIG ROMANIA, DELTA, AIG LIFE, BCR ASIGURARI DE VIATA and CARPATICA ASIG).

Notes

- ⁽¹⁾ This is measured by the generalized variance or the total variance.
- ⁽²⁾ As a matter of fact, PCA basically consists of diagonalizing a symmetrical matrix (in our case Σ). Matrix Λ is computed as $\Lambda' \Sigma \Lambda$.
- ⁽³⁾ These are the original variables.
- ⁽⁴⁾ Geometrically, the PCs form an orthonormal vector system.

- ⁽⁵⁾ If the initial data are standardized, the covariance matrix will be nothing else but the correlation matrix.
- ⁽⁶⁾ According to the Kaiser-Guttman criterion.
- ⁽⁷⁾ Using the Varimax Raw rotation method.
- ⁽⁸⁾ Here we provide the rotated solution.
- ⁽⁹⁾ With correlation coefficients greater than 0.875.

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Analysis Regarding the Perception and the Evolution of the Ethical Values of the Economist Students of the Faculty of Economic Studies of University of Oradea

■

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***Abstract.** The present work of research analyzes the evolution of ethical values among economist students during the university year. The ethical values studied have been: trust, morality, relationships, social behaviors, the immigrants as labor force, attitude towards the work place, the accepted means of social protest, environment protection, voluntary activities. Surprisingly is that certain values, attitudes didn't change at all during the analyzed period, for example the answer at the ethical dilemma, while other attitudes such as church trust, have known significant variances.*

Key words: ethics in business; ethical values of business; moral values; the culture and the ethics of business.

■

JEL Codes: A13.

REL Codes: 4B, 4D, 14C.

The present work is the result of a field research⁽¹⁾ whose general objective is to take stock, to study in evolution, having as subjects – students of the Faculty of Economic Sciences of University of Oradea – during two years, ethical values, the perception of ethics in business, the evolution of defining concepts and the evolution of ethic behavior in business of the future economists who will be part of the Romanian and global business environment. The specific objectives are: the identification and definition of the ethical behavior dimensions, organizational values, religious values and family values; the observation of evolution and the transformation of perceptions and ethical behavior through the process of instruction from the first to the second year of study, the identification and definition of the principal directions and ways of forming and valuing of an ethical behavior into a more and more competitive market. The final purpose of the research is the investigation of the fundament of an ethic culture of business in Romania and the in building of some educational strategies of the Economic Sciences students in the direction of forming and respecting a minimal set of ethical values in business.

The field research took place in two phases: in the first phase there were questioned the first year students, and in the second phase the questionnaire was applied to the same students now being in their second year of study. We specify that some of those students chose the optional course of Ethics in business, but questioning those students wasn't our aim. In order to analyze the questions from this research, we considered as relevant the differences towards the first phase of the survey.

In the first phase of the survey the total number of validated questionnaires applied at the University of Oradea, Faculty of Economic Sciences, was 277, the distribution of the subjects questioned has been: 33.6% men and 66.4% women, respectively 74.6% from the urban area and 25% from the rural area. In the second phase of the research the total number of filled in questionnaires was 151, the representative consisting of 80.8% women, and 19.2% men, 65.6% from the urban area towards 34.4% from the rural area, 88.1% of them living in Bihor county.

In the present work we try to capture the perception and evolution in time of the moral and ethical values of the students from University of Oradea in order to fundament an educational strategy proposal in the spirit of forming and consolidation an ethical system of business values for our students and in order to create an Ethics of business course specific for them to capture their interest, to motivate them, and to value their ethic potential. In order to complete this we selected items referring to:

I. Moral values religiosity (considered to be the base of moral values in this work), morality or the way of solving a moral dilemma, values that should be sustained in the family, the fundamentals of building the relationships, the tolerance towards certain behaviors, evaluation ethic – non-ethic of school behaviors, importance given to the diverse dimensions of life.

II. Ethical values: the ethic – no ethic evaluation of school behavior.

III. The institutional trust, the attitude towards different forms of bribery, corruption, civism, attitude towards work, attitude towards immigrants as labor force, the relationships of man with the nature and environment.

I. Moral values

Religiosity

While 98.9% of the subjects declare that they have faith in God, most of them (31.39%) say that they go to church at the important holidays, followed by those who go weekly (24.82%), those who go once a month (18.25%), and those who go daily (13.14%). 11.31% say they go very rarely, and 1.09% don't go to church at all. After one year, the participation of the students at the religious services remains predominant due to the

traditional holidays which are also the religious ones. Nevertheless, as you can observe from the bellow graphic, a big percentage is represented by the students who participate more than once a week, fact that indicates a relative polarization between those who practice religion only as a costum or those who go often to church. Making a comparison with the dates obtained last year this polarity is more obvious, because on this sample those who go once a month or even rarely represent a smaller percentage.

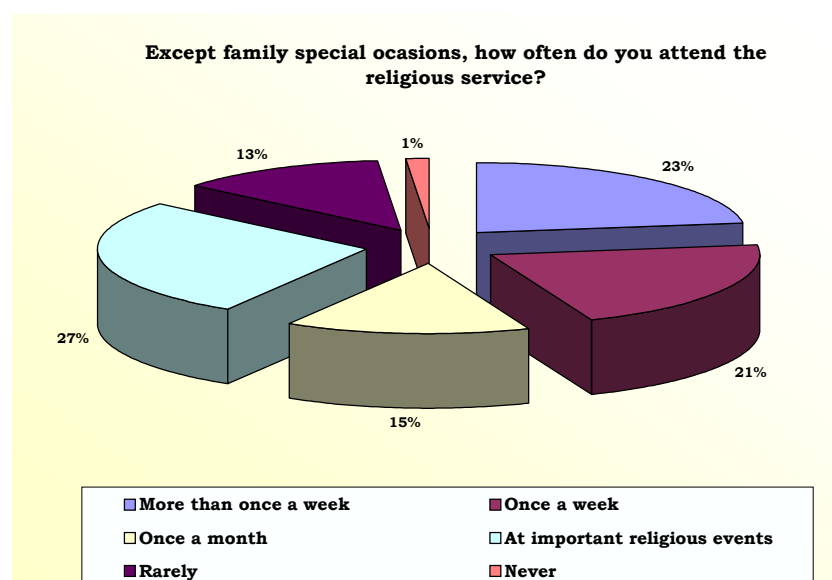


Figure 1. The participation at church services of economist students

Morality or the way of solving a moral dilemma

The morality of the questioned students and the solution in the case of an ethical dilemma was observed through the answers to the question “You are in a bus station at 10 p.m. The bag of a woman standing in the same bus station with you is being stolen. The thief runs, and the woman cries for help. What do you do?” . At this question, the answers are being distributed in the first

phase of the research like this: 29% declare that they would run after the thief, trying to catch him, 58% only think about doing this and 13% declare that they would think that it is a problem that doesn't concern them. The values of this characteristic didn't change in a significant way, so, after one year, the balance of those who take attitude didn't change, but there is a slight increase of 2.3%, from 13% to 15.3%, we consider that unwelcome, at the total passiveness.

**Your are in a bus station, at 10 p.m.
A women's bag got stolen, in the
same station as you. The thief run away.
What do you do?**

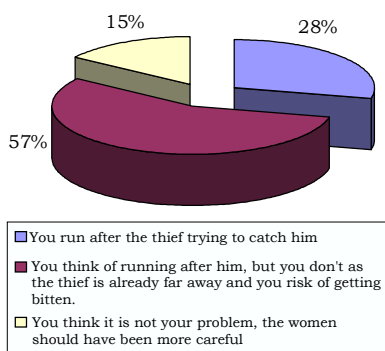


Figure 2. *The solution of the economist students for the ethic dilemma*

One observes like this that there are very little changes in the solutions chosen by the students for the ethic dilemma. The difference of 2 per cent of those who declare that the problems of other persons does not regard them and they wouldn't do anything for catching the thief, per cent higher in the second phase than in the first one it is to be noticed. This fact can indicate a decrease of the morality or of the civic attitude of the students, but the relative small number of cases doesn't allow doing generalizations.

Values promoted in the family

According to the opinion of the economist students, the most important three characteristics that should be encouraged by the parents are: the assumption of responsibilities (with 77.2% options), diligence (50.4%), and religious faith (49,3%).

Also, after one year, the most important three values promoted by the family considered by the people questioned are: the assumption of responsibilities (76,8%), followed by religious faith (52,7%) and then by tolerance – the respect towards others (48%). This percentages correspond to the data obtained the year before, the significant difference being the decrease of the importance given to diligence – 50,4% towards 41,2 % this year

being situated on the forth place from the second place last year. The most unimportant are the respect for hierarchic structures, the altruism and the creativity.

Values promoted in the family

Table 1

	No (%)	Yes (%)
Independence	66.4	33.6
Diligence	58.8	41.2
The assumption of responsibilities	23.2	76.8
Imagination/Creativity	83.2	16.8
Tolerance/ respect towards others	52.0	48.0
Intendance/Economical attitude	71.5	28.5
Perseverance	74.0	26.0
Religious faith	47.3	52.7
Altruism	90.7	9.3
Respect for hierarchic structures	94.0	6.0

The fundamentals of building human relationships

Concerning the possibility of building human relationships, 51.1% of the people questioned state that the most important thing it is to understand the preferences of the others, and 48.9% consider that the most important thing is to state your preferences very clear.

As you can see from the graphic bellow, the understanding of the preferences of the others it is considered to be more important than the clear statement of your own opinions after a year of faculty, showing besides a big polarization of the answers compared to the year before.

**Here are two sentences regarding the bases of human relationship.
Which one is closer to your opinion?**

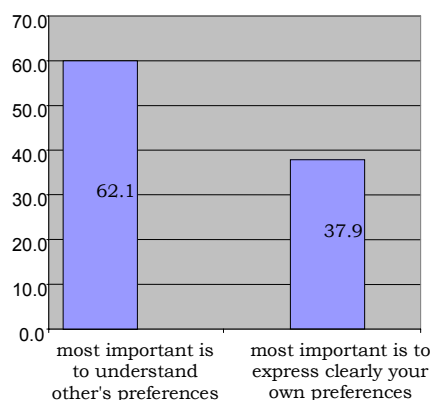


Figure 3. *Relationships*

Tolerance towards certain behaviors

Student's attitude toward some social behaviors is mostly negative, intolerant in both years in which we applied the questionnaires. In the table below we present in a comparative way the means of the responses for each behavior noted on a scale 1 to 10 (where 1 means never justified and 10 always justified).

Attitude toward social behaviors

Table 2

	Mean score year 1	Mean score year 2
Homosexuality	2.64	2.81
Prostitution	2.25	2.36
Abortion	2.68	3.21
Divorce	4.6	4.88
Euthanasia	3.32	3.35
Suicide	1.52	1.53

This table shows the intolerant attitude of students toward all behaviors from the

study, the smallest tolerance being shown towards suicide, followed by prostitution and homosexuality. The most significant difference between the 2 years appears regarding the attitude towards abortion, even if it is on the fourth level in both stages, and which becomes more tolerant in the second year. The most accepted behavior by the students from Oradea is divorce, which in the second year is approaching the middle level (it's between approve and disapprove)

The importance given to the diverse dimensions of life

In order to gradate these aspect students had to put on a scale of importance the following aspects of life: family, spare time, friends, work place, politics, religion, serving of others.

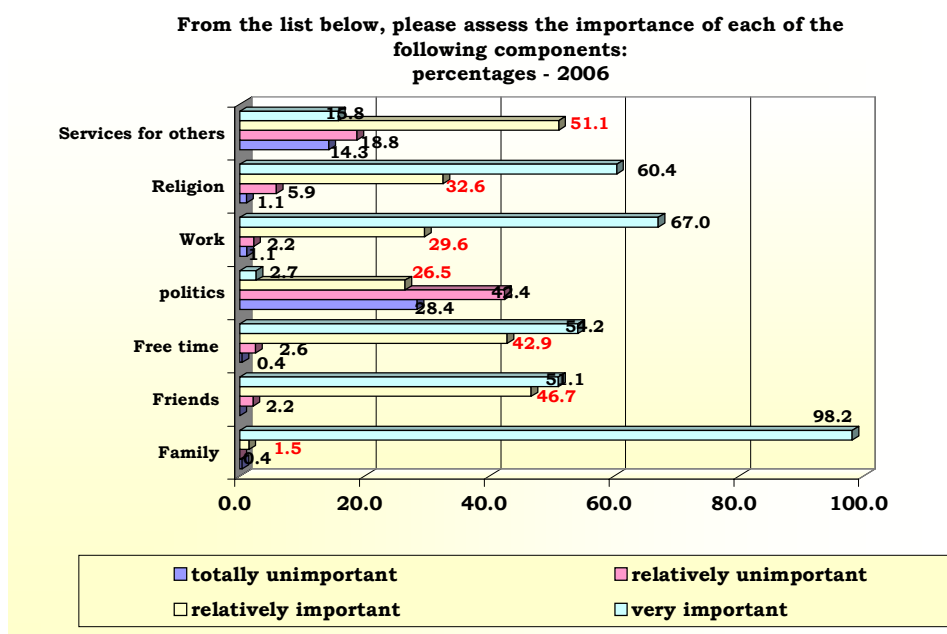


Figure 4. Importance given to the different dimensions of life (2006)

In the first study year, the most important is declared the family, followed

by the work place, on the last place being situated politics.

From the list below, please assess the importance of each of the following components:
percentages - 2007

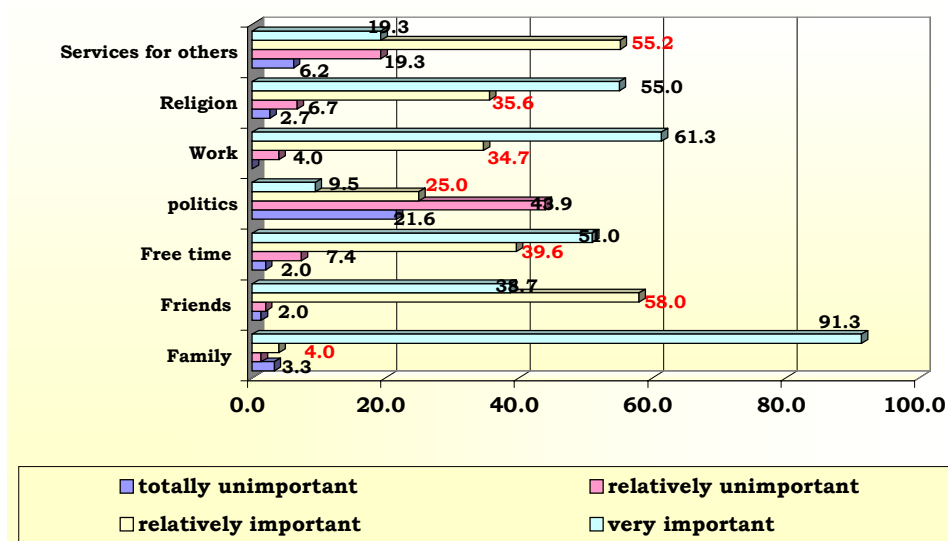


Figure 5. Importance given to the different dimensions of life (2007)

In the second year of study, family is still the most important, with a percentage even higher of those who consider it very important, followed by the work place. With a smaller percentage than last year, politics is again on the last place, being considered totally or relatively unimportant by most of the students.

II. Ethical values

The evaluation ethic – non-ethic behaviors from school

The most unethical behaviors for teachers, referred to by our students (in the first phase of the research) were: teaching under the influence of alcohol (48%), acceptance of bribe for passing exams (47%), and teaching under the influence of drugs (44.4%). As presented in table 3, in the

second year the most unethical behaviour became the acceptance of bribe (with a slightly higher percentage than the previous year – 48%), followed by a problem that was not highlighted in the first year: insulting students (43.7%). Only on the third place we find teaching under the influence of alcohol which was considered worst in the previous analysis.

Respondent rates are significantly higher for accepted behaviours, out of which the highest rates of acceptance are for: comments with political propaganda content (92%), ignoring copying during exams (90.5%), plagiarism (88.7%). In the second year these choices are repeated yet in different order: plagiarism gets on the second place, showing the rise of tolerance regarding it.

Attitudes towards unethical behavior on behalf of teachers

Table 3

From the following list of behaviors of your teachers. please select the most unethical two:	First year		Second year	
	No (%)	Yes (%)	No (%)	Yes (%)
Comments of gestures with sexual meaning	69.9	30.1	64.7	35.3
Teaching under the influence of alcohol	51.3	48.7	59.7	40.3
Teaching under the influence of drugs	55.6	44.4	63.1	36.9
Acceptance of bribe for passing exams	52.4	47.6	52.0	48.0
Comments or gestures with racist meaning	84.0	16.0	82.8	17.2
Comments with political propaganda content	92.0	8.0	92.1	7.9
Including subjects in exams which were not taught during class	69.5	30.5	70.9	29.1
Insulting students	58.2	41.8	56.3	43.7
Public presentation of personal information regarding students	81.8	18.2	84.1	15.9
Ignoring copying during exams	90.5	9.5	87.4	12.6
Plagiarism	88.7	11.3	91.4	8.6

Regarding the unethical behaviors of colleagues, in both research phases, the most unaccepted behaviours were: insulting colleagues, coming to class under the influence of alcohol and bribery for passing exams. Comments with political propaganda content are the most accepted behaviour, along with plagiarism and comments of gestures with sexual meaning. One can note a significant difference between the two phases of the research the gravity regarding

comments of gestures with sexual meaning and copying to pass exams which are seen worst in the second phase. Less important are in the second year compared to the first “coming to class under the influence of drugs” and plagiarism. Most of these changes are probably also the effect of experience of students within the school, from the presence of problematic situations both regarding comments with sexual meaning and, which graver, copying at exams.

Attitudes towards unethical behavior on behalf of colleagues

Table 4

Out of your fellow behaviors choose the most non-ethical ones:	First year	Second year
	Yes	Yes
Comments of gestures with sexual meaning	16.7	21.2
Coming to class under the influence of alcohol	38.0	35.3
Coming to class under the influence of drugs	46.2	36.0
Bribery for passing exams	39.6	36.4
Comments or gestures with racist meaning	19.9	24.5
Comments with political propaganda content	5.1	6.0
Insulting colleagues	50.5	41.1
Public presentation of personal information regarding students	25.5	25.2
Passing exams by copying	17.8	23.8
Plagiarism	9.8	8.2

We consider as interesting two of the behaviors, both on behalf of teachers and of colleagues, which were more tolerated in the

second year then in the first: the influence of drugs and the attitude towards plagiarism, aspects that need further investigations.

The institutional trust

The initial research revealed the fact that the highest levels of trust are in church (with a very big percentage of the subjects who declared total trust: 60.4%), followed at big distance by ONU (with 18.5% total trust), and by the army with (17.1% total trust). On the last positions as trust given by students of Oradea University we find political parties (49.6% of the subjects declare total disbelief), followed by the government (39.2% total disbelief) and parliament (32.9% total disbelief).

After one year, compared to those dates and significantly as change is the decrease of the trust in church, which the year before was among the most trusted institutions, and now has been appreciated on the forth position, after the international institutions who register the higher trust

level: EU, on the first place with 13.7% ONU, on the second place with 13.4%, on the third place with 12.1% the ecologist institutions and organizations. The highest levels of disbelief are declared towards the political parties (52.9%), followed by the parliament (36.8%) and by the government (35.9%).

Attitude towards different forms of bribery, corruption, civism

In order to analyze the attitude towards different forms of bribery, corruption, civism, the students stated their opinion towards the several behavior: Recourse to public funds unwarrantable, free riding in public transportation, non-payment of taxes and contributions, accepting bribe in order to obtain different benefits.

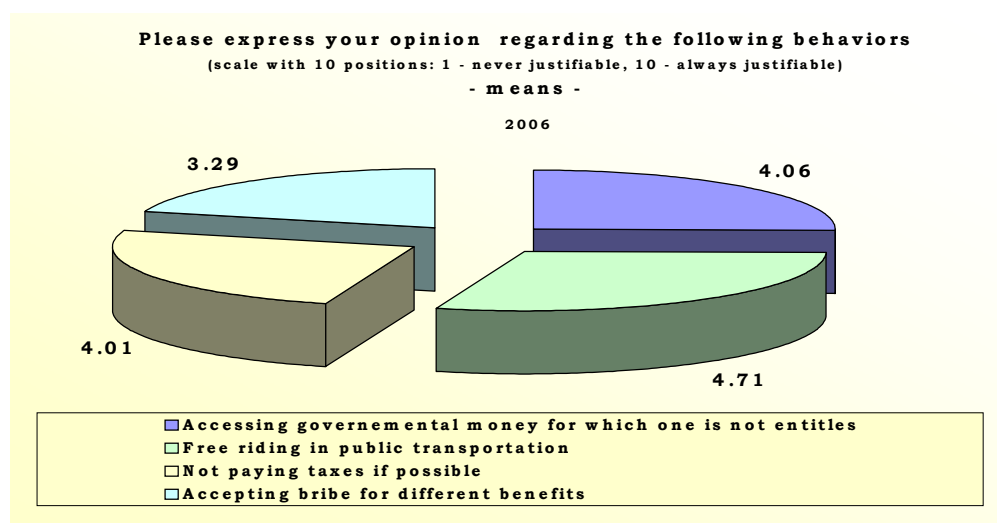


Figure 6. Attitude towards different forms of bribery, corruption and civism (2006)

In the first year of study, the general opinion is that those attitudes are seen as *rather unjustified*. The activity which is considered the least justified is the acceptance of bribery, and the one that is accepted as being sometimes justified is

traveling by public means of transport without a ticket. Therefore, the answers of the students can be considered desirable being situated in the negative attitude towards bribery generally speaking, or especially at the questions referring to the

ethic behavior of teachers and students (the bribery being declared in this group of

questions among the behavior towards which there is the biggest rejection).

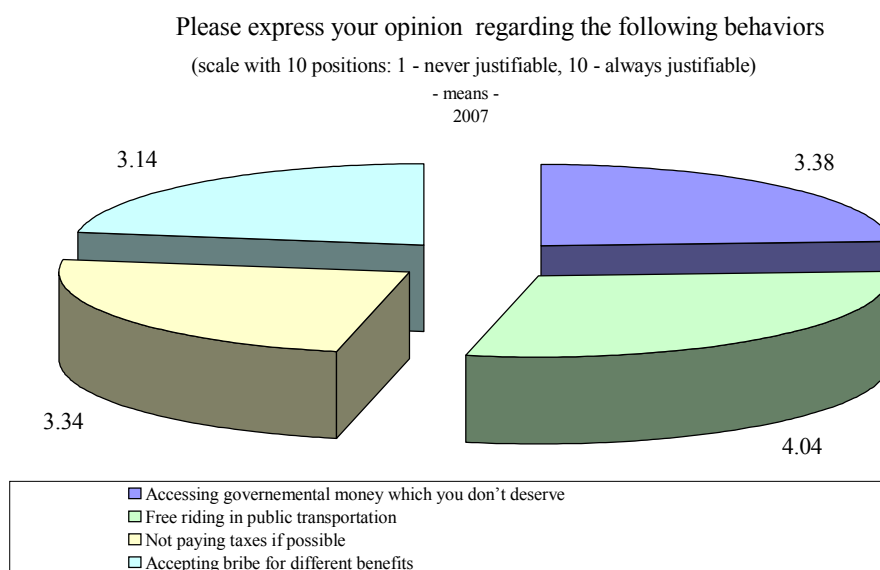


Figure 7. Attitude towards different forms of bribery, corruption and civism (2007)

Making a comparison, it can be observed that in the second year the attitude towards aspects did not change in a significant way, the medium scores being much closed. Nevertheless, we can notice that in 2007, all the medium scores get closer to 1 – *Never justified*, thing that let us hope that these results are indeed the behavior that the University wants to infuse to its students.

Attitude towards work

The considered characteristics of the work place have been: the certainty of the work place, the chance to build a career, the social importance of the work place, the gross wage, low stress, flexible program, the opportunity of being inventive, creative, many holidays and a lot of off days, interesting content of activity, the use of a special talent that you have. The most important characteristics of the work place for the economist students from Oradea have

been the same in the both years, the first three position stay unchanged – the importance of the gross wage 88.3% (2006) and 82.1% (2007), second position – the chance to make career with 59.8% (2006) and 63.6% (2007), followed by the certainty of the work place with 59.4% (2006) and 55.0% (2007). To be noticed is that the least appreciated characteristics of the work place are: the social importance of the work place, many holidays and a lot of off days, on the last place being situated the use of a special talent – even with a decreasing evolution from 8.5% in 2006 to 4.8% in 2007.

Also, it has been followed up attitude towards work, through the statement of the accord or disaccord regarding certain statements regarding the work: work is the most important, even if by this the time spent with the family is shortened, people do not have to work if they do not feel like working, all the people with total power of work who

do not do it are lazy, it is unfair to receive money without working in change, in order to fully use your talents and abilities it is necessary to have a work place.

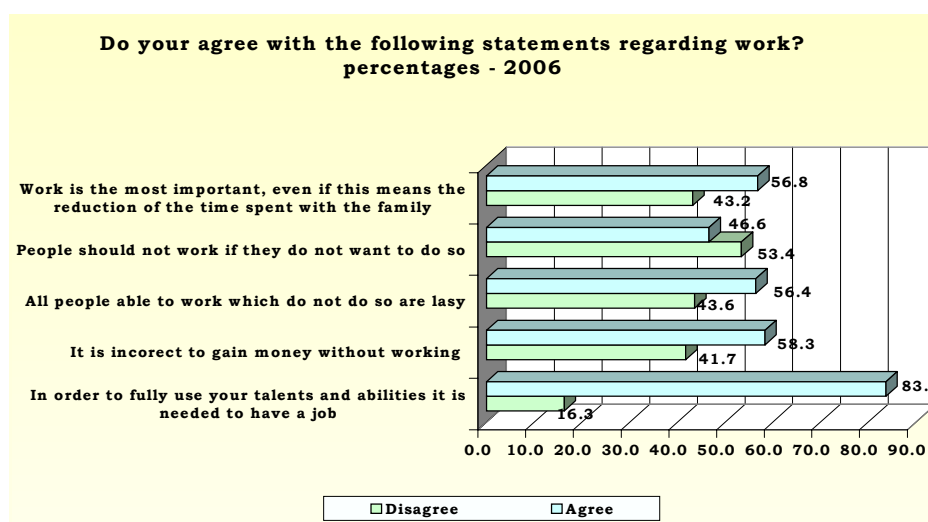


Figure 8. Attitude towards work (2006)

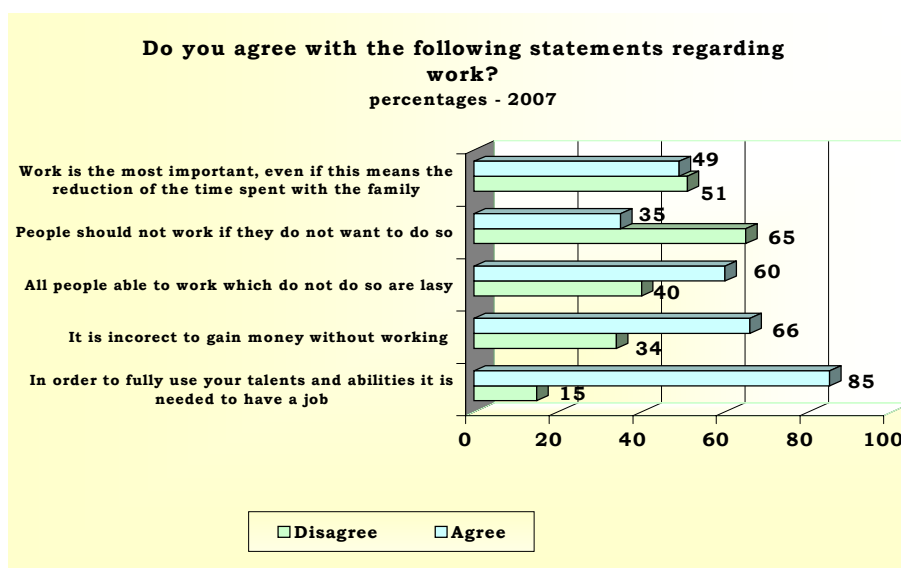


Figure 9. Attitude towards work (2007)

From the graphics 8 and 9 there can be noticed the results obtained in the two years of study, results which did not register significant changes, with the exception of the first statement referring to the importance of work towards family – where it is registered a slight change of attitude. If in 2006 a percentage of 56.8% of the students disagreed with this

statement, after a year of study the accent is on work, registering a percentage of 51% in favor of work importance.

Attitude towards immigrants as labor force

Regarding the attitude towards immigrants in Romania as labor force it is

registered a tolerance quite high: 37.6 % of the students consider that every foreigner should be allowed to work in Romania, 49.6 % consider the same thing, in the measure of available work places, 11.6% declare that it is necessary the strict limitation of the number of immigrants from Romania, and only 0.8% consider that it should be forbidden the immigration of labor force in Romania. Compared to those dates, in the second year the tolerance is slightly lower: only 29.8% declare that every stranger has to be able to work in Romania, a higher percentage (56.3%) considering that this has to be possible in the limit of available work places. Only 0.7% consider, in this year, that the immigration of labor force should be forbidden.

The relationships of man with the environment and the nature

In order to analyze the relationships between man and environment students had to choose between two statements: *the environment protection is the higher priority and the economic growth and new working places are priorities*. On the first place, closer to the point of view of students, it was situated in the both years – the environment protection with the percentage of 53.7% in 2006 growing to 64.8% in 2007. Also, the option of students between the statements – man has to dominate the nature and man has to coexist with the nature it has been a substantial percentage for the first statement with 89.8% in 2006 growing to 91.4% in 2007. We consider these results as desirable considering that these students will probably work in the business environment of Bihor County, in which, for example, we register

only a percentage of 10% of companies (Pop Cohuț, 2004: pp 280-281) which state the desirable attitude towards the environment protection in their conduit codes.

Synthesizing, our research reveals that the main ethical behavioral patterns, the values promoted in the family, the frequency of participation at religious activities, characteristics promoted through the family, attitudes towards unknown people did not change in two years in which we collected our data, despite the changes in the school environment, entourage, access to information. The explication can be driven from the fact that the majority of students did not change their residence, over 60% stay during their studies with their families.

Regarding the behavior promoted within the communities in the establishment of ethical values, one can notice the Romanians behavior in the general patterns of attitudes regarding several social behaviors (homosexuality, prostitution, abortion, etc.). Some data show that Romanians are less tolerant than other European citizens and it seems that our students have the same negative attitude. Worrisome is also the high rate of acceptance of ethical behaviors in school, mainly regarding plagiarism and the positive attitude of copying at exams.

Also, it is worrying the percentage regarding the acceptable behaviors in school, the easy acceptance of plagiary essays and also a very big percentage has registered the easily acceptance towards the attitude of ignorance of teachers towards the evident copying tentative. This behavior is surprising because in our faculty took place in 2006 an anti-copying campaign initiated by the student's representatives.

The research results we presented will form in the next laps of the research in the project called “The perception and the evolution of ethical values of business at the Economic Sciences students (The forming

of an ethic culture of business)”, the leaving point for promoting an education strategy of students from the Faculties of Economic Sciences aiming to form a minimal set of ethical values of business.

Note

- ⁽¹⁾ Research realized in the project: “The Perception and the evolution of the ethical business values at students studying at business faculties (The Formation of a ethic culture of businesses)”, CNCSIS Grant, contract nr. 5662/2 June 2006, Theme nr. 5, cod 543, Length: 2006-2008,

Manager: Professor Gheorghe Ionescu, West University of Timișoara, Faculty of Economic Sciences, as member of the research team. The aimed group is formed of students who study in the field of business and management from Universities of Timișoara, Cluj-Napoca, Arad, Oradea

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The Market Power Measurement of Firms within the European Union

■

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Abstract. *Market power is important because it may lead to an inefficient and bias appropriation, meanwhile worsening productive efficiency. I have used the most important indicators for measuring market power and market concentration in this paper – the Lerner index, price dispersal and the Herfindahl-Hirschman index (HHI). With the help of the indexes and of the available statistics I have managed to analyze the market power held by European firms and the activity sectors that have the highest economical concentration. Moreover, by using data from other countries (USA and Japan), I was able to make a comparison between the level of current prices, and reach the conclusion that, although the enforcement of the single market has had a strong and immediate effect on price dispersal, there is still room left for future reductions, along with market integration growth and the growth of the competitive pressure.*

Key words: market power; market concentration; dispersal.

■

JEL Codes: C10, L13.

REL Codes: 17C, 10B, 2B, 7E.

Introduction

A market power is a “position of economical force, which a concern is in, that allows it to hinder maintaining an actual competition on the relevant market, granting it the power to act, to a certain extent, independently towards the participants, clients and its consumers. Such a position does not exclude competitiveness, which would stand to happen if there would be a monopoly or quasi-monopoly, but it offers the concern the possibility of having a significant influence on the terms based on which that competitiveness will develop and the possibility to act without taking it into consideration, as long as this behavior is not in its detriment” (Case 85/76, pp. 38-39).

Here we may draw the conclusion that an enterprise that is in a market power does not always have to be criticized; but the enterprise is due not to allow its behavior to affect market competitiveness. Ronald Coase talks about a risk: “if an economist finds a business strategy of a certain type that he does not understand, he will look for an explanation connected to monopoly. Seeing as how we are highly ignorant when it comes to this sector, the number of unaccountable strategies, tends to go through the roof and cases that are based on monopoly related justifications are very frequent” (Coase, 1972, p. 116).

The backbone of the European legislation concerning market power abuse is art. 82 of the EC Treaty, text of which is presented below. Also regulating market power abuse is art.81 of the EC Treaty and art 65 of the CECO Treaty. Art. 82 – The improper exploitation of a market power, exerted by one or more than one enterprise, on the

corporate market, or any significant part of it, is incompatible with the corporate market and forbidden, to the extent in which the trade between member states may be affected.

Such abusive strategies may be:

- a) the direct or circuitous exaction of sale or purchase prices or of certain unfair trade;
- b) the limitation of the production line, of the commodity markets or of the technical development, to the consumers’ detriment;
- c) applying unequal stipulations for labor conscriptions that are fair towards the trade partners, thus creating a competitive disadmarket power;
- d) closing deeds is conditioned by the partners’ agreement on certain additional labor conscriptions, which according to their commercial use have no direct connection to the aim of these deeds.

The criteria used to demonstrate the existence of market powers are:

■ *The structure criteria.* The high market share is an important factor in establishing a market power. For example, in the Hoffman-La Roche case, CEJ stated that: “ the existence of a market power may be derived from a number of factors, which, separately, are not particularly conclusive, but amongst which one is highly important, and that is the existence of a very high market share” (Case 85/76, p. 461).

In this case, the firm’s market share during a period of three years has been of 75-87%.

Another structural criteria used to analyze market power is the existence of barriers that make it hard for new competitors to enter the market. These can be regulatory measures, market characteristics (market complexity or the consumers’ preference towards a certain brand), the behavior of

firms that function on the market or high investments. The degree of vertical integration of the firm or firms that have a strong market position may create a market power through the control it exerts on production and the distribution chain.

- *The behavioral criteria.* In a memorandum on December 1995, the Committee stated that market power cannot only be defined by means of market shares or other structural quantitative elements, but it can appear following a firm's significant influence over the market. In reality, the Committee and CEJ use behavioral elements as additional analysis for market power.

- *Economic dependency.* If companies have no other alternative in obtaining goods and services outside of one company, this may be considered to hold a market power. In the case of Aeroports de Paris, in the analysis, the Committee showed that the handling services suppliers were depending on the authority that was responsible for the exploitation of airports (Aeroports de Paris), which was supposed to grant a license in order for them to carry on their activity. Hoffmann-La Roche, a multinational company from Switzerland, which was accused of having a market power exerted by: "closing deals that contain conditions regarding consumers or granting loyalty discounts, which offer them a stimulus to buy all or most of their needs exclusively or preferably from the company" (Case 85/76, p. 625). Its activity's aggrandizement was achieved by making deals with 22 companies employed in the production or sale of vitamins on the single market, for using them either in the pharmaceutical industry (25%), either in the foods industry (15%), or as an additive in animal goods (60%).

Methodological framework and the analysis of results

Market power represents a profitable firm or firms' ability to maintain prices above the level correspondent to perfect competitiveness, over a significant period of time. According to the definition given by Samuelson, "market power represents the degree of control that a company or a group or companies exerts over the price and production levels of a certain activity branch" (Samuelson, Nordhaus, 2000, p. 208). The economical definition of market power tells us that this is not more of a rule, than an exception. On a short term, any firm that is not a price receiver will hold a certain degree of the market power (because of the slightly decreasing value of the demand). Singularly, any merchandiser of a discriminated product most definitely holds a certain share of the market power.

Economically, market power is conditioned by the consumers' preferences and the availability of the substitute products. It exists as a result of consumers' preferences for a company's product to the detriment of those products belonging to the competition. A slight decrease of the firm's demand stands to show that consumers will opt for the change to the nearest substitute or the reassignment of their expenditures toward other goods. The consumers' ability to shift towards certain other suppliers is synthetically expressed with by means of the demand's elasticity. It is preferable, as often as possible, that the analysis of the demand's elasticity be considered and used as a means of determining market power.

Pending on the price, the demand's elasticity measures the reaction to the demand, as a result of the change of price. At a given moment in time and for a certain market

structure, the „*Lerner index*” supplies with an exact estimate of the market power, based on the demand elasticity concept:

$$p - c/p = 1/\varepsilon$$

in which p represents the price c represents the marginal cost and ε is the demand elasticity towards the price.

The Lerner index is a means of measuring the market power because it reflects the extent to which a firm is capable of raising the price above the level of the marginal cost. If there is a circumstance of perfect competition, the price is equal to the marginal cost so that the value of the index is null. When the price tops the cost, the Lerner index becomes positive and its value is situated between zero and one. The closer the index is to the value one, the higher the firm's monopoly power.

A series of issues surface, when we use the difference between the price level and that of the marginal cost, as a means of measuring the intensity of the market's competitiveness. First off, marginal costs are very difficult, if not impossible, to establish, because there are more and more products and common inputs that cannot be clearly identified as being either marginal or immutable. As a consequence, it is more convenient to use the difference between the price and the average cost. Another issue would be that the structural changes of the production process might lead, in time, to structural modifications of the difference between the price and cost, modifications that are independent from the intensity of the market competitiveness. The level of this difference depends on the inflation rate and the level of demand.

A way of assessing market power is concentration on the *difference between the level*

of the price and that of the average cost or, in other words, on the firms' profit. A decrease indicates the fact that there is a net benefit for consumers and a net loss for firms, meaning a growth of the degree of competitiveness.

A similar study undertaken by J.B. Sauner-Leroy suggests that after the single market is established, the difference between the price and average cost dropped in the manufacturing industry (Sauner-Leroy, 2003). Later on, the difference grew due to the expenses realized in the research-development sector. The biggest difference was recorded in Finland as compared to other European states. The decline of the indicator recorded after 1999, the date of the euro release, is very interesting. The modifications are shown in table 1 below.

**The change in percent of the difference between the price and the average cost
December 1998 – March 2003**

Table 1

Country	Change in percentage
Austria	3.25
Belgium	-2.25
France	-2.25
Finland	-5.25
Germany	0.00
Italy	-1.00
Holland	-1.75
Spain	-0.25
Euro 8 Zone	-0.75

The price differences that exist between European countries are still rather high. Some studies analyzed their convergence in their community space, showing how it evolved during the course of the last decade (table 2). Price dispersion dropped throughout the course of time, seeing as how the changes were bigger at the beginning of the 90s.

Estimates regarding price dispersion in Europe

Table 2

Authors	Period	Purpose	Results
European Committee	1980-1993	Price indexes for detailed products and services categories within the EU	Accelerated convergence as a result of launching the Domestic Market program
Dresdner Kleinwort Benson (European investment bank)	1980-1993	Price analysis for 56 products from the USA and Europe	Price dispersion is higher in the EU than in the US for nearly all of the products (except four of them)
J. Haskel and H. Wolf	1998	Price analysis for 25 countries, including 11 European countries	Differences between prices are due to the existent competitiveness
Financial Times	2000	Cost of living index in 155 cities	In the EE price dispersion is currently at 7.5% and in the US it reaches 5.8%
European Committee	2000	Price analysis for fresh products and electronics within the EU	Brands and consumer preferences explain up to 40% of the current price dispersion

The reduction of price dispersion varies based on the products and services taken into account. The establishment of the single market has had a strong and immediate effect on price dispersion at the beginning of the 90s, but it maintained a high level beyond the community frontiers, which suggests that there is, still, room for future deductions, along with market integration and competitive pressure.

According to the horizontal mergers Guide, of 1992, the authorities in power will use the Herfindahl-Hirschman index (HHI) to measure the market concentration.

A growth of more than 100 percents on an average focused market, or a growth of 50 on a focused market, will convince authorities that serious issues exist (Matthes, 2007, p.7).

Table 3 shows the focus level of the European Union, compared to those of Japan and the USA, for different sectors of the industry. The table's analysis suggests that there is a high market focus in Finland, Belgium and Sweden, which creates certain issues concerning competitiveness. A high market focus is also present in Italy, in the service sector (energy, postal services and telecommunications).

Herfindahl-Hirschman industry concentration index

Table 3

Manufactured products	Aus	Bel	Fin	Ita	UE	Swe	GB	Japan	USA
Groceries	26	31	150	31	59	131	27	2	3
Textiles	88	54	443	7	148	125	19	3	7
Leather goods	553	2566	263	22	851	360	134	46	65
Wood	58	87	167	4	79	76	16	5	4
Paper	160	185	352	75	193	218	79	23	14
Printing/publishing	49	40	99	43	58	39	14	18	3
Beverages	226	595	2064	69	738	1428	-	40	192
Glassware	440	430	1154	153	544	675	-	105	-
Raw metals	170	299	739	94	326	352	112	46	29
Non-ferrous metals	-	1059	2372	280	1237	517	-	65	-
Constructions Ship repairs	1707	242	1422	646	1004	249	-	178	-
Machinery equipment	43	96	98	12	62	70	17	8	8
Medical gear	-	76	269	31	125	321	43	48	-
Oil products	-	1083	-	1127	1105	917	-	220	76
Chemical products	207	75	284	44	153	375	44	15	14
Pharmaceutical products	490	551	2175	137	839	2042	-	51	-
Office equipment	792	387	-	2208	1129	367	285	84	18
Motorized vehicles	476	363	429	238	377	446	90	49	24
Services									
Electricity, gas	181	889	154	976	550	156	-	-	-
Postal services	230	608	559	1957	839	653	106	-	-
Telecommunications									

Source: OCDE, (2002), "Product Market Competition and Economic Performance: A Framework for EDRC Reviews", *Working Party no. 1 on Macroeconomic and Structural Policy Analysis*, Paris.

Conclusion

In all these cases, the existence of a market power can only be proven and established after the relevant market has been defined. This implies taking into consideration the product and the territory. The geographical or territorial position of the relevant market is important for two reasons. First of all, according to art. 82, the market power must be abused “*inside the single market or a significant part of it*”. Second, the market’s geographical establishment determines how many other competitors must be taken into consideration, and this affects the evaluation that must be made on that company’s economical power. Generally, the less extended the market is, the more diluted the

company’s economical power is and the less probable it is that the company will be regarded as holding a market power. Basically, the geographical or territorial market is that area in which the contender’s objective conditions that are applicable to the product(s) under discussion are the same for everyone. The objective conditions of the competition may vary from one region to another for different reasons: the state’s action, consumer preferences, transport costs or the product’s characteristics. For example, a perishable product can only be transported over a limited distance or a short period of time. This is what determines the relevant geographical market for that product. Still, market power abuse must go into effect on the single market or a significant part of it.

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Aspects Concerning the Optimization of Authentication Process for Distributed Applications

■

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Abstract. *There will be presented the types of distributed applications. The quality characteristics for distributed applications will be analyzed. There will be established the ways to assign access rights. The authentication category will be analyzed. We will propose an algorithm for the optimization of authentication process.*

For the application “Evaluation of TIC projects” the algorithm proposed will be applied.

Key words: optimization; security; authentication; distributed application.

■

JEL Codes: C10, O31.

REL Codes: 10B.

1. Types of distributed applications

In the dedicated literature there are described types of user's authentication for distributed applications, the characteristics of biometric, mutual, multifactor, using tokens, username and password, using certificate, CHAP and Kerberos authentication being specify.

Authentication using username and password, called one way authentication, consists in filling fields with the credentials associated with the client and validating those data entered in the form with:

- the username and password which are found clearly in the source code;
- the username and password found on the server, information being sent by means of methods called GET/POST to the server where the validating process will authenticate or not the credentials introduced by the user comparing them with the information stored in databases;
- information stored in databases, using cryptography algorithms for a high level of security as well as the information sent via network.

This method of authentication with username and password it's one of the first methods that validates the identity of a user and one of the most unsecure as well if this process isn't administered well enough.

Biometric authentication is the method of authentication which implements hardware devices and processes that can determine the physiological characteristics of a person called user. Some of the most

used methods of authentication by means of measuring biometric data are:

- fingerprint methods;
- iris scanning methods;
- hand geometry;
- face geometry;
- voice recognition;
- keystrokes.

Beside the ones presented above, it is worth to mention: facial thermogram, AND, walk style and many others who can identify uniquely a person. They are much harder to implement and to expensive.

Mutual authentication is presented as using methods through which the both parts, the user and the authenticator, will be validated. The process has the fallowing principle: the server will try to validate the identity of any user that request a connection and after that the user will validate the server identity based on a digital certificate.

Multifactor authentication is the method in which the authentication, the process of validating the identity of the requestor, is very complex. This is due to the fact that there will be used multiple authentication methods, for that the multifactor authentication it is known as strong authentication. Usually the methods used in this type of authentication are complementary, meaning that one of the methods is used just in case the other fails, avoiding to not letting wrong users to get access to the system.

CHAP authentication defined in RFC 1994 standard is based on an authentication protocol used for validating the identity of

users who are connected from distance to the servers using secret information that is not passed through a network channel. The authentication is based on a process with three steps:

- after the physical connection was set between the hardware components and the CHAP authentication method was chosen, the one who make the authentication will transmit a message to client;
- the client will respond with a value calculated through a one way function, MD5;
- the response is validated by the one who made the authentication.

At that the CHAP algorithm is just a one way authentication, when this process is used by two parties the CHAP authentication becomes a mutual process for verify the user's identity.

Authentication using tokens. By the authentication process point of view, will have the following types of tokens:

- session ones;
- access tokens;
- tokens used for authentication process.

Session tokens are a value generated, usually through a hash function, without any interest, transmitted by the server to client for easily controlling his session of work. The client will save this value and any time he tries to access any of the server services will send it through browser cookies or by GET/POST means.

Access tokens are objects that include information about the user who accessed services and has passed an authentication

process. This kind of tokens together with the service accessed by the user form his set of rights.

Token as a hardware is a component used in an authentication process who stores enciphered keys like digital signature or biometric data like fingerprints.

Kerberos authentication is a method that can be used as a one way authentication but also as a mutual process of validating the identity of users. The way that systems based on Kerberos make run the authentication process is based on using session keys and securing information changed between client and server with a cryptography method. Kerberos authentication process has the following steps:

- for using a service which resides on a server which has a Kerberos authentication system, client first must obtain a ticket which grant him access for it; for that he must send a request to the server, specifying the service which will be accessed, his identity as a public key and the timestamp from the moment of sending his request;
- the authentication system will respond to the previous request with a response enciphered in which client can find the ticket which will grant him access to the service; more, the response will include a timestamp for security reasons and a temporarily session key;
- the ticket is then used by the user for connecting to the services offered by a server in a secure way thanks to the various factors which converge to the same result, meaning a secure connection between two parties.

Every method of authentication is used for a certain level of security, disaccords are followed by important negative aspects for the user if for simple applications will be solicited a high level of security and if for systems where financial transactions are made, the level of security will be relatively low.

On the development phase of a distributed application the target group is analyzed because the quality characteristics of systems developed are correlated with the target group who access the resources made available by the application and who through the level of satisfaction of users will determine the next phase in development of distributed applications.

It is defined a collectivity C having $c_1, c_2, \dots, c_N$ as elements and a distributed application A formed by $M_1, M_2, \dots, M_K$ modules.

From problem to problem, from the user's requests and from owner's financial resources there are defined:

- the period of development the application;
- level of complexity;
- quality level;
- the variety of used resources;
- the degree of solving the problem;
- the communication with other applications.

If there are severe restrictions regarding the nature of the problem, solution structure and especially user behavior it is preferred to define a linear distributed application structure (figure 1).

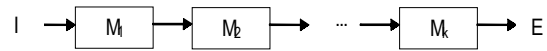


Figure 1. Linear application structure

The input data i is only made from compulsory fields and the ultimate output is structure enforced. When launching in execution, inline processing is made with modules $M_1, M_2, \dots, M_k$ and they will be stopped only if all the modules are correctly executed. The intermediate result R_i , output of module M_i is intermediate input data D_{i+1} for M_{i+1} module (figure 2).

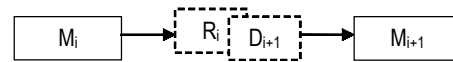


Figure 2. Data transfer between the linear structure's modules

The linear structure is used when the distributed informatics application makes one processing, has a very large coverage area, the number of entities in the data bases is also very large so there is a need for a guaranteed security level such that every final result fundamentals a decision in terms of YES/NO or accepted/rejected, GOOD/BAD, accompanied by actions with immediate effects. Linearity is in regard with the connections between modules. Within a module all the control structures are used, without enforcing linearity inside the module as well.

When a problem P decomposes in sub-problems $SP_1, SP_2, \dots, SP_H$, and during the process one of the sub-problem's corresponding processing is activated they are associated with a two level tree structure (figure 3).

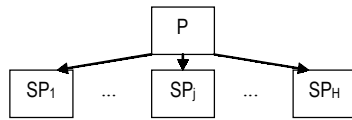


Figure 3. *The decomposition of problem P in sub-problems*

This approach has corresponding module access options belonging to user, which in turn correspond to a sub-problem and in the frame of the sub-problem to the modules required to solve particular problems. For the distributed application a tree structure is defined in which module M_0 is the main program and the other modules are placed on 1, 2, ..., r levels (figure 4).

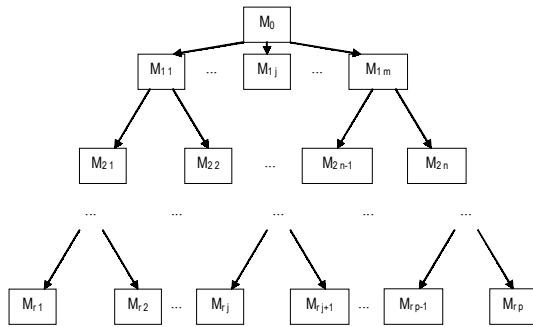


Figure 4. *Tree structure associated to the distributed application*

The modules on the last level, r , are terminal modules which close the successful processing and which are finalized with result display and saving the data.

Starting from the main module and finishing with one of the last modules systematically, a set of modules is referred, by user decision based selection. If the number of terminal modules is S , it results that the users have at their disposal an application with the help of which they select resources to solve S personal problems. The

tree structure assumes the existence at each branch level of the calling module until one of the terminal distinct modules for the same processing and the distinct modules for printing the same results. This means that a very high level of redundancy is obtained because of code duplication.

The initial versions of un-optimized distributed applications have tree structures. This structure permits simultaneously the development of modules corresponding to sub-trees, partial testing of the application at sub-tree level. The foundation of the whole application is made by assembling sub-trees from level g , by calls from modules at level $g-1$. The existence of the tree structure creates favorable premises to define the problem which is to be solved with the data from each user, gradually.

If the tree structure is overtaking an optimization process which assumes that the modules with similar functions be referred at the level of a single module and the referring of modules on level g of modules on superior levels $g-1$, $g-2$, ..., 1, a network type structure will be obtained (figure 5).

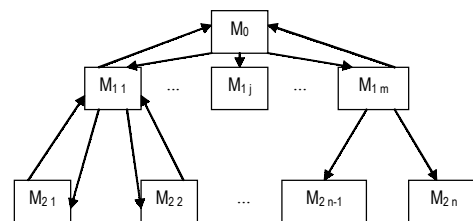


Figure 5. *Network structure for a distributed application*

The definition of a new network structure allows comebacks to modules placed in upper levels to make data

completions, for making new selections to facilitate the user to obtain favorable versions.

The network type structure is compatible with the use of library type components provided that the referred modules from a set of locations that are taken from libraries have a high level of generality and the parameter list will be easy to manage.

If in a tree structure three terminal modules exist out of which one displays an elementary variable, the second one, elements of a vector, and the third one the elements of a matrix, when referring a single module to display in a network type structure, the module will have a high degree of generality and will be realized in one of the forms:

- the three modules are reunited and the selection is made in the framework of an alternative multiple structure for each of the three situations;
- the matrix display module is used if the number of columns and lines is 1, the elementary variable is displayed; if the number of columns is 1 and the number of lines is random or the number of columns is random and the number of lines is 1 an array is displayed, if both the number of columns and lines is random then a matrix is displayed.

The comebacks from inferior levels towards upper ones are used when the data validation processes require only complete and correct data. The limitation of the number of comebacks is obtained by parameterization, such that the enforced number of admitted operating errors is not exceeded.

The network type structure must be regarded as the result of the optimization process and not in a different fashion.

2. Access right attributes

For the online informatics application there are NT types of users. In each TU_i user type of type i a collectivity is formed having NU_i elements.

The total number of users NTU of the application is given by:

$$NTU = \sum_{i=1}^{NT} NU_i$$

When the specifications are elaborated, it is important to correctly define the user types, such that their job descriptions are orthogonal, meaning that there will not be two users that have interrelating jobs. In this context for each user type strict access is associated with a certain group of application resources. No other user of type TU_i will have access to the resources belonging to a user of type TU_j , $i \neq j$, $i, j = 1, 2, 3, \dots, NT$.

In this type of conception, the access rights matrix is a square matrix in which:

- alongside the lines there are NT users;
- the columns hold NT processing functions.

It is concluded that the user of type TU_i has access to the processing functions grouped under FP_i .

The MDA access matrix is:

TU/ FP	FP ₁	FP ₂	FP ₃	...	FP _i	...	FP _{NT}
TU ₁	*			...		...	
TU ₂		*		...		...	
TU ₃			*	...		...	
...	...	...	...	...		...	...
TU _i				...	*	...	
...				...		...	
TU _{NT}				...		...	*

An online informatics application enforces the existence of administrating component which has the role of supervising the way processing unfolds, which needs the user TU_{NT+1} , with special access rights regarding the access to all processing functions for operative interventions when needed, when a operating error was signaled. The modified access rights matrix is:

TU/ FP	FP ₁	FP ₂	FP ₃	...	FP _i	...	FP _{NT}
TU ₁	*			...		...	
TU ₂		*		...		...	
TU ₃			*	...		...	
...	...	...	...	...	...	...	...
TU _i				...	*	...	
...	...	...	...	...	...	...	...
TU _{NT}				...			*
TU _{NT+1}	*	*	*	...	*	...	*

The resource access functions of the online application must be treated distinctly for the users that have maintenance roles. This group includes the users that bring the data base up to date, execute operations in conformity with the transactions made by the end users of the application.

In an e-commerce application, the client represents the one that:

- gets informed, this meaning no authentication because the access rights to the application's resources imply only consulting a list of components stored in a data base, obtained by applying a selection request;
- order products with payment upon delivery;
- order products with online payment;
- become regulars by repeated purchasing;
- enter comments regarding purchased goods and rate them.

For the current processing there is staff which accesses the application for:

- procurement of supplies;
- delivery to clients;
- bringing data bases up to date;
- defining new processing functions for development and implementation;
- creating access rights for clients;
- processing the requests in the queue;
- strictly financial information validation.

In organizational tree structures, adopted in conformity with the management schema, the processing functions access orthogonality restriction is retrenched.

The individuals on level $h+1$ from the tree structure have access rights to certain resources, and the individual on level h , figure 6, which coordinates them, besides his specific rights, has rights to check the aggregated results of all the individuals that report to him.

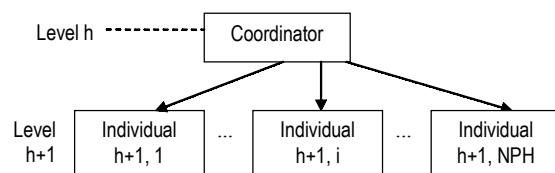


Figure 6. The coordination report from level h towards level $h+1$

Adjacently, the access rights matrix will include levels from the tree structure associated to the organization and processing functions, resulting double access for coordinators from level NIV_h for their specific functions but also their access to the functions of individuals in their suborder from level $h+1$.

The access matrix is:

NIV/ FP	FP ₁	FP ₂	FP ₃	...	FP _{i-1}	FP _i	FP _{i+1}	...	FP _{NT-1}	FP _{NT}
NIV ₁	*			...				...		
NIV ₂	#	*		...				...		
NIV ₃		#	*	...				...		
NIV ₄			#	...				...		
...	...	...	...	...				...		...
NIV _{i-1}					*					
NIV _i				...	#	*		...		
NIV _{i+1}						#	*			
...				...				...		
NIV _{NRNIV-1}									*	
NIV _{NRNIV}				...				...	#	*

The „*” symbol represents the personal access rights of individuals on level h , and the „#” symbol represents the right to check the way in which the subordinates from level $h+1$ are working.

If when defining the problem for which the informatics application is developed the definition of user classes, the definition of processing functions and the access types have another approach the following need to be clearly defined:

- the interferences generated by multiple access;
- the effects of multiple access;
- the risks implied by resource multiple access;
- the responsibility distribution for multiple access;
- the inclusion of supplementary information for the individualization of operations which take place when using resource multiple access.

For systems with a generalized character against a criteria, like the subsidiary system of a bank, the criteria being the territory dispersion or an educational structure, based on a level organization, with components dispersed in the territory, the access matrices are clearly defined, enforcing in the job description enough restrictions in order to:

- reduce the interferences generated by multiple access;
- minimize the effects of multiple access;
- manage the risks implied by resource multiple access;
- identify precisely who made a modification, from what office was the modification made, at what time, such that the distribution of responsibilities when dealing with multiple access is managed at the highest level.

The access matrix is a dynamical construction in two ways:

- if the access is very clear for a user a resource, but the evolution of processing proves that it is a very restrictive decision making typology, from the matrix in figure 6 it shall be moved on to another matrix in which some resources become multiple access, with the condition that this is reflected in the management schema, and in the data base structure identification fields must appear of the ones that accessed the resource;
- if the initial application includes a lot of resource multiple access elements along with risks and ambiguities, the following step is to refine the access,

eliminating rights, such that in a matrix column a lot less „*” or „#” operators will be found.

The access matrix construction process is iterative.

The refinement of the access matrix depends on experience and must lead to a balanced construction.

For online informatics applications belonging to the same class, the access matrix must not differ significantly.

3. User authentication

Authentication is a process necessary for selecting users in order to hand in access rights to the resources of the distributed application.

Any other distributed application, against to user access, disposes of components that are accessed without restrictions by them, ensuring transparency in the organization – individual relation, of components for which authentication is necessary and rights belonging to specialists needed to operate on the application modules.

Authentication assumes:

- creating a data base for authentication, DBA, which contains user identification elements, a string of characters representing user names, a string of characters representing the access passwords;
- the procedure of taking the input from the users;
- a mechanism of checking the existence of user defining coordinates in the DBA data base;
- the implementing of access rights by traversing the MDA matrix.

Authentication has implemented versions such as:

- procedures in which the application administrator defines access rights and creates a record in the database DBA for each user; users use the character strings announced by the administrator to gain access to application resources; there are situations in which the procedures allow each user to generate own character strings for user name and password, respecting rules enforced regarding uniqueness, length and structure of the character strings;
- procedures in which the user directly defines the necessary character strings for the authentication process and inputs identification data which are used to execute transactions; a distributed application built in this manner must include user classes, and the user belonging selection automatically creates initializations in the access rights matrix;
- authentication procedures which use peripheral equipment through which vocal, digital and ocular prints are taken from the user; there are cases in which the users receive cards and authentication is realized by running the card through a device; in this case the card is also a support for storing information, which allows independent transfers of data towards autonomous applications.

There are standard procedures for implementing specific authentication functions and it is extremely important to add new software elements to these procedures in order to reduce risks like:

- the risk of user access in an area given to another user because of reduced accepted orthogonality level through the structure of the distributed application structure regarding the content of the data base, DBA, to user name fields and password fields;
- the risk of triggering irreversible operations on files and in the personal data bases of each user which is authenticated, by hiding destructive operations, making content copies which are used to restore files and data bases affected by destructive processes, if the user realized in a reasonable time interval of the produced accidents; a balance is made between logical erasing and physical ones based upon the users statistical behavior;
- the risk of deploying processing characterized by operations which suppose irreversible modifications of files and databases, processing made for the first time by the user; procedures are meant to assist processing, either putting the user in a situation to decide, either archiving previous information before running the destructive operations; the user must know that indifferently which processing he makes there are complete archives with values of operands from the last *NKA* sessions reported to the current session of the informatics application.

Informatics applications record user behavior related to the following:

- time required for authentication;
- number authentication errors;
- types of authentication errors;
- number of opened sessions by authentication in a time interval;
- the moments of modifying the strings that define the user name and password;
- the structure of the strings that define the user name and password in report to the users' personal data;
- the moments and operations in which the user proceeds to making irreversible modifications to the content of the data bases;
- the available resources in the application reported to the access time established in the contracts, subscriptions and direct payments;
- warning messages sent to the users.

All this information is stored awaiting processing to contribute to perfecting internal management of the distributed application.

If the user makes modifications on the distributed informatics application is necessary, the authentications through biometrical elements or character strings is enough.

If the interaction between several distributed applications is necessary, each of which posses its own authentication system, to ensure continuity to the processing stream, it is required that the user is authenticated each time. On each authentication, the user must respect the rules set for the application which resources he desires to access from the base application. In the case of on-line shopping, there is an access to the virtual shop's resources and one to the e-banking application from the bank where the user has an account. The first authentication respects the rules set for the virtual shop and the second

one enforces the rules set by the electronic bank payments. There are situations in which the statistical studies on informatics applications A_i and A_j regarding:

- the orthogonality of strings associated with user names, SNU_i ;
- the orthogonality of strings associated with passwords, SPU_i ;
- the orthogonality between SNU_i and SNU_j ;
- the orthogonality between SPU_i and SPU_j ;
- the orthogonality between SNU_i and SPU_i ;
- the orthogonality between $(SNU_i \cup SNU_j) \cap (SPU_i \cup SPU_j)$

determines the elaboration of procedures which restructure character strings such that by increasing the level of orthogonality inside the application and inter-application will reduce the risks when the interaction user – application is unfolding.

4. Optimization algorithms

Currently to optimize means to have:

- a set of restrictions in which a process evolves;
- an objective function which must be maximized;
- a list of variables which influences the evolution of a process;
- a field for defining the evolution of each variable.

Currently to optimize means:

- finding a set of values for which the objective function has the highest value;
- obtaining the set of values by a finite number of steps of an algorithm;

- to demonstrate that the unique set of values also called solution is unique;
- to highlight that the optimum solution maximizes the objective function with no consideration to other values of variables in their definition domain.

Correspondingly, the minimizing objective function is defined.

In software production several versions of informatics applications are developed. The informatics application A_i is designed in the $A_i^0, A_i^1, A_i^2, \dots, A_i^S$ versions. For each version the level of the objective function is computed $f_{ob}()$, of maximum. A string with $S+1$ values results, $\{f_{ob}(A_i^0), f_{ob}(A_i^1), f_{ob}(A_i^2), \dots, f_{ob}(A_i^S)\}$.

To optimize the development process of the informatics application A_i means:

- to choose from the string of $S+1$ values $\{f_{ob}(), f_{ob}(), f_{ob}(), \dots, f_{ob}()\}$, the element with the maximum value, this results in the A_i^{optim} application which will be developed;
- to cross the development cycle for the in the A_i^{optim} application;
- to implement the finished product.

It is observed that in the general optimization problem case the optimum solution regards any of the values in the defining the domain of the variables, in the area of software optimization, the optimum solution endorses a finite number of choices. In the current case there are $S+1$ choices and to optimize means selecting that choice from the $S+1$ set which maximizes the objective function.

The choices have a dynamical character. It means, that at a given time, the software development team imagines the A_i^{S+1} application version. To the initial array of versions this one is added as well, the array

becomes $\{A_i^0, A_i^1, A_i^2, \dots, A_i^S, A_i^{S+1}\}$. The $S+2$ values array is computed $\{f_{ob}(), f_{ob}(), f_{ob}(), \dots, f_{ob}(), f_{ob}()\}$ from which the maximum value element will be selected, element which indicates the informatics application version for which the stages of the development cycle will be traversed.

According to the development cycle of a software application the stages which have to be covered in order to obtain a final form in the development process are:

- analysis;
- design;
- implementation;
- testing.

In order to optimize an application one needs to optimize each stage of the

development cycle of the product. Multiple different readings are created for each stage,

$$VERS_{i,j}, i = \overline{1,4}, j = \overline{1,r},$$

where:

i – stage i in the development process of the application;

j – different reading created for a stage in the development process.

The optimization of each stage leads to a final result, a distributed informatics application, which because of this iterative process (figure 7), unfolded in the frame of analysis, design, and implementation and testing according to dynamical programming represents an optimized informatics application.

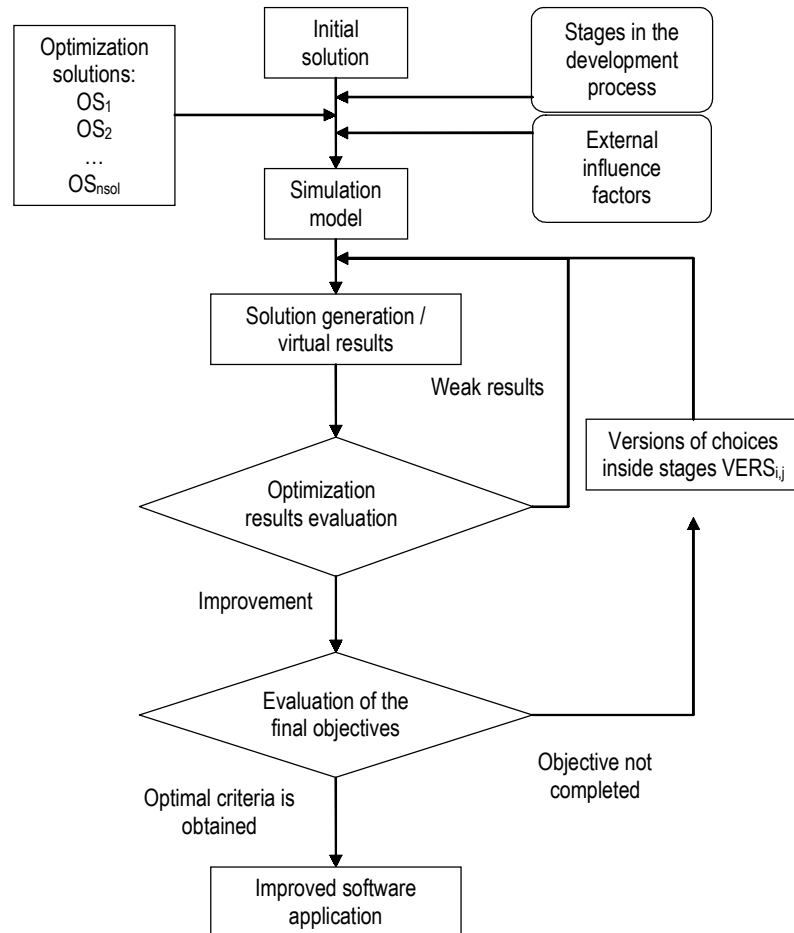


Figure 7. The optimization stage based process

Informatics security is a requirement for all distributed informatics applications because:

- user access is controlled;
- the software and hardware components are protected;
- the data bases are protected;
- the risks regarding data base deterioration and software modules are controlled.

To optimize the security components in a distributed application means:

- to define the optimal state criteria: maximizing the generality degree, minimizing the duration of a transaction, minimizing the accommodation duration of individuals with new applications, maximizing the level of flexibility, maximizing the diversity of solved problems in a work session, minimizing the volume of user input data as an effect of reusing data that already exists in the personal data base and in accessed data bases, coming from applications belonging to other owners;
- choosing one of the criteria in order to reach it according to the way in which the security components are designed;
- to build restriction sets for security models: a list of operations is made in the application and users are put in correspondence with elements from the list; when no resource is accessed for a defined interval of time, the user resource access session automatically ends;
- to find practical modalities which maximize/minimize the closed criteria;
- to test the software sub-system developed for the distributed application security;

- to implement the informatics application that incorporates the security sub-system.

For authentication, optimization does not include:

- the building manner of SNU and SPU arrays;
- the implementing of procedures which ensure a adequate level of orthogonality inside each array and between arrays;
- establishing the moment in time to restructure SNU and SPU;
- the way private information is accessed if authentication credentials are lost.

Optimization in authentication process assumes:

- recording user behavior;
- setting costs for access and negative effects that come from wrong decisions;
- building an optimization model;
- choosing the most convenient alternative of authentication procedure from very small set of different procedures existing in specialized literature.

An optimization problem is considered: maximizing the degree of client satisfaction.

The relation gives the indicator used to compute the degree of satisfaction GSC:

$$GSC(x, u, v, w) = \frac{ax + bu + cv + dw}{x + u + v + w},$$

where:

x - individuals that log in order to solve n problems;

u - individuals that log in to solve all problems;

v - individuals that log in and solve k problems from m suggested ones;

w – individuals that log in and are satisfied with the presented information;

a – importance coefficient associated to the individuals which log in to solve n problems;

b – importance coefficient associated to the individuals which log in to solve all the problems;

c – importance coefficient associated to the individuals who log in and solve k problems out of m suggested ones;

d – importance coefficient associated to the individuals which declare that are satisfied with the information found.

First it is proceeded to obtain the importance coefficients a, b, c, d using one of the existing methods, out of which a method is proposed through which:

- the direct distributed informatics applications users set is built, formed out of NRS specialists $S_1, S_2, \dots, S_{NRS}$;
- rules are established based on which the qualifiers or points are given for each of the categories of individuals which access the application; the marks will be between 0 and 10, without grading two characteristics;
- a table is obtained, it contains NRS lines and a number of columns equal to the number of variables, 4; the specialist S_i gives a mark x_i for the *individuals that log in order to solve n problems* variable; the specialist S_i gives the mark u_i for the *individuals that log in to solve all problems* variable; the specialist S_i gives the mark v_i for the *individuals that log in and solve k problems from m*

suggested ones variable; the specialist S_i gives the mark w_i for the *individuals that log in and are satisfied with the presented information* variable;

- the sums $S_x, S_u, S_v, S_w, S_{TOTAL}$ are computed as:

$$S_x = \sum_{i=1}^{NRS} x_i S_u = \sum_{i=1}^{NRS} u_i S_v = \sum_{i=1}^{NRS} v_i S_w = \sum_{i=1}^{NRS} w_i$$

$$S_{TOTAL} = S_x + S_u + S_v + S_w$$

- the importance coefficients for the four individuals categories are computed like this:

$$a = \frac{S_x}{S_{TOTAL}}, b = \frac{S_u}{S_{TOTAL}}, c = \frac{S_v}{S_{TOTAL}}, d = \frac{S_w}{S_{TOTAL}}$$

- the $VA_1, VA_2, VA_3, \dots, VA_{NV}$ application alternatives are elaborated based on NV different types of authentication; each of the alternatives contain in their modules counters to keep track of resources accessed by users; after the users which form the set of NPRS individuals test the $VA_1, VA_2, VA_3, \dots, VA_{NV}$ applications, these counters are stored in a data base with NV records, each record containing X_j, U_j, V_j, W_j , where:

X_j - number of individuals that log in order to solve n problems in VA_j application;

U_j - number of individuals that log in order to solve all problems in VA_j application;

V_j - number of individuals that log in order to solve k problems out of m suggested ones in VA_j application;

W_j - number of individuals that log in and are satisfied with the information presented by the VA_j application.

- Information is extracted from the data base and the indicators are computed

$$GSC(X_j, U_j, V_j, W_j) = \frac{aX_j + bU_j + cV_j + dW_j}{X_j + U_j + V_j + W_j}, j=1, 2, \dots, NV$$

and the array is constructed $\{GSC_1, GSC_2, GSC_3, \dots, GSC_{NV}\}$.

■ The expression is evaluated:

$$GSC_{max} = \max(GSC_1, GSC_2, GSC_3, \dots, GSC_{NV})$$

If $GSC_{max} = GSC(X_h, U_h, V_h, W_h)$, it means that alternative VA_h is the best because it has the highest level of satisfaction of individuals which interact with it.

If a series of modifications are made for an application VA_s in order to improve its characteristics, another version of the application will be obtained, which is added to the existing ones, becoming VA_{NV+1} . For this application the measuring process is rerun using the same set and the indicator is computed:

$$GSC(X_{NV+1}, U_{NV+1}, V_{NV+1}, W_{NV+1}) = \frac{aX_{NV+1} + bU_{NV+1} + cV_{NV+1} + dW_{NV+1}}{X_{NV+1} + U_{NV+1} + V_{NV+1} + W_{NV+1}},$$

The expression is evaluated:

$$GSC'_{max} = \max(GSC_1, GSC_2, GSC_3, \dots, GSC_{NV}, GSC_{NV+1})$$

The high effort needed to ensure a correct base for continuing the optimization process to maintain the stability of the set and keeping the database up to date and the computing of the aggregated indicator, which measures the degree of satisfaction for new application versions, is noticed.

Before launching the versions in use by the members of the set, it is necessary to proceed with application version testing using the same sets of test data. The test data must activate all the modules of the application, and the counter variables

included in the modules must supply sufficient information such that the testing process is very efficient.

The versions are justified when the user number is very high and a favorable difference of 1% in the GSC_i indicator, compared to the GSC_j indicator determines important resource saving.

The situations in which the test data sets are irrelevant and the user set is unrepresentative must be avoided. If this kind of situation occurs, the versions that will be selected as the best prove during effective exploitation that it generates a waste of resources and leads to a low degree of individual satisfaction.

5. Experimental verification process unfolding

For no matter which distributed informatics application or type of implemented authentication system, it is needed to verify experimentally:

- application behavior;
- user behavior;
- establishing the authentication process;
- the types of errors that appear;
- the effects generated by blocking resource access;
- the efficiency level regarding resource use allocated to each user;

The distributed application ADV and a model MA implemented for authentication are considered.

For checking, a representative sample of users with a NUE dimension is constructed, which ensures statistical error.

The ADV application is launched in execution.

The user behavior gathered in the user sample is registered automatically using functions built and activated from the application as follows:

- the moment when the user UE_i referred the application;
- the moment when user UE_i exited the application;
- the string inputted by user UE_i for its associated user name;
- the string inputted for UE_i 's associated password;
- the number of re-input attempts $NRUE_i$ in case of unsuccessful inputs;
- the increment of the variables associated to the processing procedures activated by the user in order to solve the problem for which the application was accessed;
- the number of estimations of type j given by the user to the application, according to the obtained solution, NQ_j .

All this information is stored in the database of the application behavior, ADV.

Simultaneously with the elaboration of the ADV application a software product is developed destined to process the rows in the application behavior database.

The processing allows the obtaining of indicators like:

- average duration of resource accessing from individuals that make up the representative sample;
- the orthogonality level between the character strings defined as user names in the application and the character strings inputted in the process of accessing the application;

- the level of orthogonality between the character strings defined as passwords of the application users and the password strings inputted by the users in the application accessing process;
- the user degree of satisfaction from solving problems using the ADV application;
- the average number of unsuccessful application accessing attempts;
- the average length of the path, defined as the number of activated procedures, traveled by the users in order to solve the problems;
- the list of procedures which generated unsuccessful processing, ordered by decreasing number of failures.

All these elements and others that are completed systematically when a more complete defining of the user environment is needed, but for the application behavior as well, must be used constructively to perfect the application. Even more, the indicators that relate to the authentication components must be analyzed in detail to modify the authentication procedure structure such that the following are reduced on the server:

- the number of successful access attempts to the application resources from valid users;
- the number of successful application access attempts from invalid users;
- number of access to unallocated resources.

The unfolding of the verification process is a permanent activity that is undertaken at regular time intervals. The results of the processing related to user behavior between two moments of processing fundamental decisions relating to:

- authentication procedures;
- processing streams;
- the vocabularies in the interfaces;
- the final results structures.

Only in case in which the application in improved dynamically a growth in the user satisfaction degree is obtained, the only criteria which has to be the base of optimizing processes in distributed applications, because these are developed in order to solve problems of individuals and only after to optimize the informatics streams in organizations.

6. Conclusions

Informatics security, by definition represents all the procedures and methods through which an informatics system is protected by deliberate or non-deliberate attacks which originate from the exterior of the application. This definition is applied at a smaller scale, so that to talk about the security of memory zones in an application.

Authentication represents only a component through which access to application resources is defined, managed, and protected.

It is important to move systematically in order to include all the components of the securing process for the informatics distributed application, by iterating through the following steps:

- ensuring the *availability* of applications at any given time, by

implementing securing methods of informatics systems: protection in secure chambers, restricted access to these chambers;

- protecting the distributed application systems by adding intermediate password security levels to ensure the application's integrity;
- preventing unauthorized access to distributed applications to avoid any prejudice because of braking the *confidentiality* of the information in the application;
- implementing encryption systems to sign the information in the distributed application such that the *non-repudiation* principle is not broken.

For the above steps one proceeds to the fields definition in the application such that when events linked to them are produced a variable increment takes place and the data base application behavior related content is altered.

Indicators are constructed to evaluate the security level reported to the added components, to see the measure in which they are efficient or not. Even in such case the permanent character of analysis and modification of procedures is considered, so that the level of security is improved all the time. Parallel with these activities the effects lack of security causes is measured, such that efficiency computations are made to establish the cost of obtaining a maximum level of security reported to the hypothetical defined system.

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Annex 1

Variable and operator list

C	The collectivity that makes up the target group
c_i	The i^{th} element in the collectivity
N	The number of elements that make up the C collectivity
M_j	The j^{th} module in the structure of the A distributed application
K	The number of modules which make up the distributed application
I	Input data
E	Results obtained after processing finished
P	The initial problem for solving
SP_h	Sub-problem h
NT	Number of user types
TU_i	The type of user i
NU_i	The number of users of type i
NTU	The total number of users in the application
FP_i	Processing functions of on-line distributed informatics applications
NIV_h	Level h of the tree structure associated to an organization
NRNIV	Then number of levels of the tree structure
NKA	Number of accesses
SNU_i	The string of user names in application A_i
A_i	Distributed application i
SPU_i	The string of passwords in application A_i
$reuniune$	The reunion operator on sets
$intersecție$	The intersection operator on sets
S	The number of versions in which application A_i is elaborated
$f_{ob}()$	Objective function
A_{optim}	The optimal application version reported to the maximum criteria $f_{ob}()$
MA	Authentication model
ADV	Distributed application undergoing the checking process
NUE	Number of users in the representative sample
UE_i	User i in the representative sample
NRUE _i	The number of re-inputs of the user name and password in case an error occurs
NQ _j	The number of j type appreciations; ; NQ ₀ – the number of unsatisfied users, NQ ₁ – the number of users that give the application a satisfactory qualification; NQ ₂ – number of users who are satisfied and give the well qualification; NQ ₃ – the number of users that appreciate the application as very good;
R	Number of choices in each development stage
$VERS_{ij}$	The solution version j realized in the i development process
Nsol	The number of application optimization solutions inside the proccess

Planning the Marketing Activity in the Health Care Services

■

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Abstract. *The integration of marketing in the field of health care, starting with the 50's, was accompanied by a series of controversies generated by the ethical and moral aspects that this type of services imply, as well as by the difficulty in determining exactly the demand, the unequal access to information of participants, the regulated mechanism for the establishment of prices and of rates and the intervention of the third party payer, the significant role of the state in ensuring the fair access of population to basic services, etc.*

The formulation of the marketing strategies, in the marketing planning process, starts from the generic strategy chosen by the organization according to its mission and objectives. As it has to adapt to the environment where it acts, to cope with the changes that appear, the organization must benefit from a perspective vision, all its actions must be subordinated to this vision in a whole marketing policy.

Key words: health care services; the health care services consumer; the physician-patient relation; third party payer; health insurance; the financing of the health care services; strategic planning; marketing strategies.

■

JEL Codes: M21, M31.

REL Codes: 14G, 14K.

1. The marketing of health care services at the macro and microeconomic level

In health care domain, the marketing is an interdisciplinary domain because, both at the conceptual and operational levels, it uses a series of concepts, methods and techniques of marketing appropriate to the marketing of services and to the social marketing, too, having in view, on the one hand, selling of a service by a service supplier to a beneficiary and, on the other hand, raising of an adhesion to an idea, cause, social behaviour of a person or of a community.

Moreover, the need that the health care service satisfies places this field on the limit between economic and social, between the orientation for profit and non profit one, a fact with profound implications over the marketing measures at the macro and microeconomic level.

The marketing at the macroeconomic level or the macromarketing implies the application of the marketing at the level of the national economy as a social process which manages an economic flow of goods and services, from producers to consumers, in a manner which combines, in an efficient way, the offer and the demand and which fulfils the society's objectives.

Therefore, the macromarketing has in view the application of the marketing by the society, at the level of the entire national economy, through its specific forms of organization, orientation of the economic activity, and the micromarketing deals with the distinct activity of each organization within its confrontation with the market, with the economic-social environment.

In the health care services domain the role of the marketing is more important due to the influence of the state over the availability, accessibility and the cost of health care services.

Mainly, applying the marketing concept at the macroeconomic level implies the redefinition of the place and of the role of the Ministry of Health, as it is the specialized organism through which the intervention of the state in the economy is accomplished, the realities from the domain of the health care services are analysed, the decisions which manage this domain are grounded and the service supplied, taking into consideration the individual needs or the community's needs, is projected.

The marketing measures, at the macroeconomic level, aim, through the accepted policies, strategies and tactics, the surveillance of the public health, the promotion of the public health, prevention of the diseases, as well as the projection and the proportioning of the offer depending on the characteristics and on the way in which the demand is revealed.

The regulation of this domain, which is strong enough, influences the manner in which the marketing policy is grounded. Therefore, the marketing policy, which is applied in the health care services, is generally grounded at the level of the Ministry of Health which accomplishes the study of the economic-social environment and also the manners in which the health system is adapted to the population's needs and in accordance to the requests imposed in/by the adherence at the European Union.

Therefore, through its macroeconomic dimension, the marketing follows the description and the analysis of the social, economic and institutional phenomena and processes which take place on the market. Any marketing approach of an organisation starts from a macroeconomic analysis, at the level of the market or at the level of the sector of activity.

The organisations must know their environment- the framework in which they develop their activity, the market on which they

work, as well as the main laws, norms, rules which defines this market, institutions which give decisions and have activities playing a decisive role in their development.

The micromarketing aims the marketing applied by the organisations for their functioning within the economy, directly referring to the “accomplishment of the activities which aim to fulfil the objectives of an organization through the anticipation of the needs of the buyers or clients and managing the flow of goods and services for satisfying the needs from producer to buyer or client” (Balaure, 2002, p. 69). The microeconomic dimension of the marketing is a managerial one. It refers to the decisions and actions of the organization referring to what it does and what it has to do in order to guide its current activity for touching some pre-established targets.

At the level of the organizations from the health care domain, the marketing aims the prevention, the diagnosis, the treatment, the healing and the recovery of the consumers' health, considered in an individual manner.

From the attempt of clarifying the place of the marketing in the health care domain in one of the two specializations – social marketing and services marketing –, comes one conclusion: through the concepts, methods and techniques that it uses, adapted to the contain and the characteristics of the services of public health care or which are linked by the person's medicine, this is a specialized domain, self-contained, with a strong social and economic orientation; the decisions are taken at the central level of the Ministry of Health and they are operated, at the microeconomic level, by the organizations which supply services of health care to the population.

1.2. Particularities of the marketing enforcement in the health care domain

From the conceptual point of view, the acceptance of the marketing in the health care domain has followed an insecure path as there are more elements which hamper its implementation, as a managerial function inside the organizations from the health care domain.

The application of the marketing in the health care services domain is different from other departments due to its particularities established by the characteristics of the market, of the organizations, products, staff and of consumers.

- *The market* - the existence of a real market, from the economic point of view, in the health care domain, is questionable as the manner in which the law of the demand and of the offer functions is different in comparison with other markets; even if the offer of health care services raises, in most of the cases, this does not impose a diminution of the price and even if the level of the demand increases, does not mean that the price will increase; with other words, the modification of the demand and of the offer, in most of the cases, does not influence the modification of the price.

The offer depends on the government's politics and on different restrictions, and the level of the demand is determined by the level of the insurances, by the availability of resources and by the activity of the family doctors, and less by the illness level of the population. Moreover, the existence of a real market would suppose that the reasons and the activities of the suppliers of health care services and of third parties are strictly economical, a fact which is not a characteristic of the organizations' behaviour from the health care domain.

On a real market, the suppliers of health care services enter in relationships of competition for the consumers' resources, and this competition determines the price of the goods and of the services, a situation which is not specific to the health care services. Moreover, many organizations have the monopoly for a specific service. Therefore, a particular market will occur. Oligopoly is very present and sometimes the consumers do not have many options in choosing the medical staff or the services which are supplied.

Although, in case of the health care services supplied to consumers who do not have insurance, the payment will be made directly, still there are certain ethical grounds for which the patients with serious problems must be nursed even if they do not have insurance and they cannot pay. On other markets, the products and the services are paid directly by the consumer, while very little health care services are paid directly, the majority being paid through third party payer.

- *The organizations* – the health care sectors is different from the other activity sectors even when we refer to the organization's objectives. While in other branches of activity the majority of the organizations establish their objectives taking into consideration the profit, many organizations from the health care domain must accept clients which are not able to pay or are considered to be "undesirable". If some providers have the liberty of accepting or rejecting the patients with normal problems of health, the departments of emergency must accept a patient with serious problems.

Moreover, unlike the traditional pyramidal hierarchy of power met in the majority of the organizations which relies on profit (where a great number of persons are reported to a

smaller number of superiors, which then leads to the consolidation of the power in one person from the executive), most of the organizations from the health care service have a double hierarchy of the power; on the one hand, the specialists in medicine (surgeons, physicians, dentists, therapists, psychiatrists), and, on the other hand, the managers (the management), each of them having different objectives.

Like in some other domains, these organizations, especially the hospitals, maintain a monopoly or oligopoly control on the markets where they develop their activity having therefore a secure number of the patients. Nowadays, in the European countries and in USA, few of them still have this loyalty from the part of the patients.

The non-profit organizations have had an important role in the health care domain and they still have it. Although a number big enough of physicians were employed in the medical centres and cabinets relying on profit, there are a great number of non-profit organizations. This non-profit orientation creates a different environment in comparison to other activity domains.

Another aspect which makes the difference between these organizations and the others, from other domains, is connected with the relational system on the basis of which it functions, relationships which appear between physicians from the primary assistance and those from hospitals. Therefore, the hospitals accept patients on the basis of a medical note, except the emergency hospitals. The importance of this kind of relationship is reflected by the fact that, in most of the cases, the decision of referring to an organization or another does not represent the willing of the final consumer.

Therefore, the specialists in marketing must ground the strategies taking into

consideration not only the final consumer, but all the factors which can influence this system of relationships (physicians from the primary assistance, the health care plans at the local, regional or national level etc).

- *The product* – in the health care domain, there is a very rich range of services which, in most of the cases, are offered in group. For example, a surgery supposes a series of procedures/services which, often, cannot be defined or measured with precision.

The specialists in marketing are facing some serious problems when they have to give a definition for these services. In the same time, for the majority of them there are no products which could be replaced, as it is the case of other types of services.

- *The staff* – the health care organizations are dominated by the medical staff and less by the managers; the last ones have different views regarding the organization's objectives. While the physicians take the decisions in favour of the patients, the managers are tempted to take these decisions in favour of the organization, meaning in terms of cost and efficiency.

Although the medical staff had to become more realistic regarding the manner in which it uses the resources, the interests of the organizations from the health care domain are, in most of the cases, financial. The conflict between the physicians' targets and the managers' ones is therefore inevitable, a situation which occurs more rarely in other domains of the services. This conflict is also aggravated by the increasing of the anti-profit orientation which characterises an important part of the medical staff who actually considers that applying the marketing in this domain is an inappropriate decision.

Consumers are different from those of other goods and services because of the lack of

information regarding the manner of carrying out a service and their price, because of the manner in which a decision is taken, because of the behaviour when buying and consuming, because of the limited capacity for evaluating the quality of the services and of the result.

One of the most important elements of any business plan is represented by the marketing plan; it is made of the strategic plan of marketing and the tactic plan. The strategic plan establishes the main objectives of the marketing activity and the appropriate strategy, on the basis of the analysis of the current situation of the market and of the occasions occurred on the market, and the tactic plan of marketing points out the marketing strategies specific to the strategy which was used (Kotler, 1998, p. 137). The marketing plan represents the central instrument for managing and coordinating the effort of marketing.

In the case of the institutions oriented towards the market, the marketing planning represent the starting point of the planning process as it supplies action directions for all the other functions inside the organization.

The first step in marketing planning is the establishment of the mission and of the objectives, as it determines the planning at the operational level, at the staff level and of the financial plan (Hillestad, Berkowitz, 1991, p. 48) (figure 1).

The processes and the relationships developed at the level of the inferior organizatory chains are the object of the strategic marketing and they are met again inside the actions of strategic marketing planning.

The strategic marketing planning implies the fulfilment of some stages inside of which a series of concepts afferent to the strategic marketing are used: segmentation, positioning and composition of the marketing mix (Olteanu, 2003, p. 154).

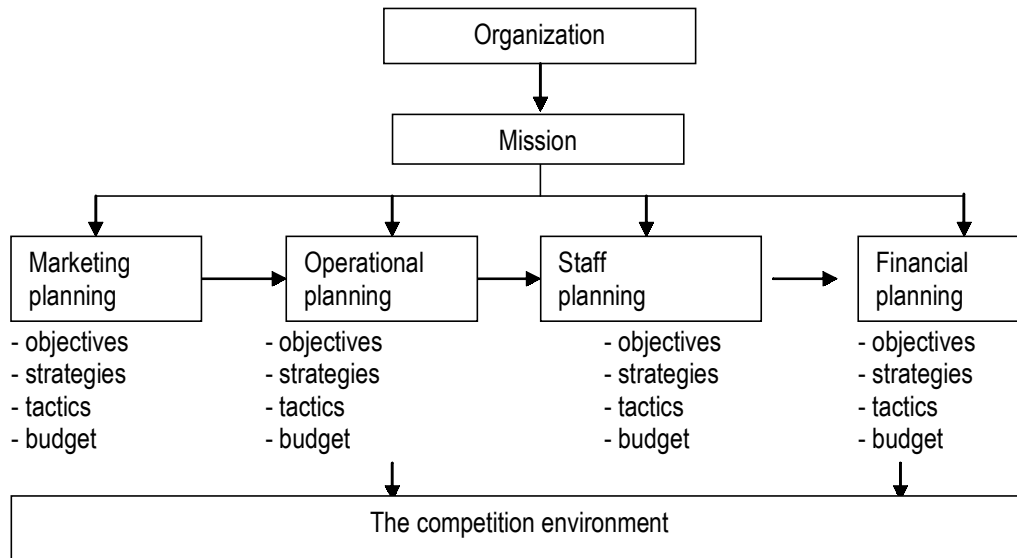


Figure 1. *The marketing planning*

3.1. The market segmentation

The market segmentation represents the process of division of a collectivity in homogenous groups, depending on some criteria and choosing a strategic alternative of approach of the identified segments.

The heterogeneity of the market of health care services imposes the organization of the market on segments; the activity of segmentation may be analysed from two perspectives:

- The segmentation from the point of view of the offer implies the identification of some categories of services according to their particularities, which are dedicated to certain segments of consumers (for example, prevention, curative or paediatrics services, cardiology or dermatology services etc.)
- The segmentation of the demand imposes the consumers' regrouping according to their type, their expectations, the demographic, economic characteristics, the behaviour of buying and consumption.

A first step in the market segmentation, from the demand point of view, is represented by the identification of the type of clients to which the offer is dedicated and here we distinguish:

1. *legal persons-collective consumers* (the number of the providers of health care services who try to attract the clients/ companies is increasing, as they offer complete services for their employees, on the basis of some private health care insurances and some services of labour medicine);
2. *legal persons-medical cabinets* (for a series of suppliers of health care services – hospitals, clinics – the medical cabinets which offer primary assistance represent the main target as the family doctors are those who send the individual consumers);
3. *natural persons-individual consumer*.

The main criteria of segmentation of the collective and individual consumers are presented in the following table:

Criteria of segmentation of the health care services consumers

Table 1

Criteria of segmentation	Natural persons	Legal persons
Geographic	Country Region Environment of residence The locality size	Country Region Environment of residence
Demographic	Age Sex The family size The family structure The economic position The level of education and occupation Religion	The size of the company or cabinet The number of employees The structures of the employees The activity object The financial status
Psychographic	The social class The lifestyle The personality	The organizational culture The attitude in front of the risk
Behaviour	The advantages which are required The fidelity for the mark Sensibility regarding the price The use frequency Substitution options The importance of the service for the consumer	The advantages which are required The fidelity for the mark Sensibility regarding the price The use frequency Substitution options The importance of the service for the consumer

The market segmentation according to the mentioned criteria and to the evaluation of the mentioned segments, help the organization in establishing the target-market, namely the market segments which it desires to approach, according to its resources and objectives.

The marketing theory and practice has identified three strategic orientation of approaching the target-market: the focused strategy (specific to the situation in which the organization decides that the efforts should be concentrated towards just one segment – for example, the children with diseases of nutrition), differentiated strategy (acting over more segments – for example, the children with cardiac and respiratory problems) and undifferentiated strategy (approaching the market in an uniform manner – the sick children).

3.2. The services' positioning

The decision of buying the services is based on the image of the consumer regarding that particular product, the image determined by a series of endogen and hexogen factors.

Among these factors, an important role is played by the actions carried on by the organization and which try to identify, develop and transmit a competitive advantage to the client; therefore, the services should be seen as superior and different from those of the competition.

The positioning in services represents the action through which the offer and the image of an organization are projected in such a manner that it should have a distinct and considerable position in the eyes of the targeted buyers (Kotler, 1998, p. 39). The positioning implies a variety of strategic decisions linked by the size of the services range offered inside every segment, services with added value which can be included and the manners in which the competition's actions may be counteracted.

The market content which is part of the health care services imposes a different position inside the extern market and inside the interactive one. Therefore, inside the extern one, the organization must focus on the elements of differentiation as the notoriety, image, and inside the interactive one, on the real elements which touch the service, e.g.: ambiance, staff, equipments etc.

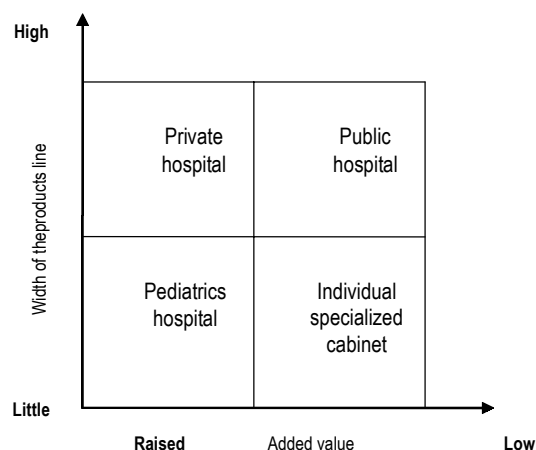
Taking into consideration every type or organization, the positioning may be made at different levels: at the level of the organization on the whole, at the level of some categories of services or positioning of a sole service. As there is a connection between the three levels, the image of one level can affect the image of others, too. For example, if the obstetrics services have a very good reputation inside a hospital, these services can be seen as a guarantee of the quality for the others services offered inside the hospital (paediatrics, surgery etc.)

In the end, the competitive advantage is obtained through the different perception of some attributes which express the characteristics of the service, and this perception may be sustained by the organization through adequate promotional techniques which are part of the actions which offer the difference regarding the image.

The specialists in marketing use for identifying the most efficient attributes of positioning, the “map of the consumers’ perception” which makes the differences between the attributes of the service by using the multidimensional scalar of the perception and of preferences (Kotler, Armstrong, 1994, p. 504). The execution of a positioning map will be made by taking into consideration two criteria; for example, in case of the health care services, the quality of the medical action and the level of the sophisticate equipments.

A method used by the organizations from the health care domain for establishing the position inside the market is the MAC Model (The Management Analysis Center) which focuses more on the current activity and less on its development and implies two dimensions: the added value and the width of the products line (Hillestd, Berkowitz, 1991, p. 111).

The term of added value for the health care services is referring to the programme of the units, the localization, the prestige, the programming system, the emergency phone line or other agents which can make the difference between one service and another. The term of width of the products line describes the number of the available services.



Source: Adaptation after Hillestad, S, Berkowitz, 1991.

Figure 2. *The MAC Model*

The MAC model identifies four alternative strategies:

- the high added value and a high number of services (private hospitals which offer high added value for all the specialities);
- The high added value and the reduced number of services (paediatrics hospital);
- The reduced added value and a reduced number of services (individual medical cabinet);
- The reduced added value and a high number of services which are offered (public hospitals).

As the hospitals, the clinics, the treatment and diagnosis centres and the medical cabinets have the possibility of selecting the market segments which they desire to deal with, they can project services with added value and they

can establish the services range which they offer; therefore, they often contribute in establishing a position within the market. In what the positioning is concerned, a very important role is played by the communication system, too, reason for which, in the operationalization, the positioning represents two hierarchical levels: a superior one, at the level of the entire organization when the action is carried on the basis of the decisions and instruments according to this level, and another one, inferior, at the level of the set of concrete marketing activities, when the action is carried on through promotional techniques (Olteanu, 2002, p. 85).

3.3. The formulation of the marketing strategy

Depending on its objectives, the organization may choose certain strategies in order to differentiate its activity, for obtaining the desired position on the target-market. The marketing strategies, subordinated to the general strategies of the organization, are referring to the manner in which the organization deals with the market and with the elements of marketing mix.

The formulation of the marketing strategies in the process of marketing planning starts from the generic strategy chosen by the organization, according to its mission and objectives.

The contemporary economic, social and technological dynamism where the health care organizations carry on their activity brings a very large diversity of the strategies which are used.

The factors specific to the services make quite difficult this action, therefore, when the market strategies are established, more criteria will be taken into consideration: the demand-offer report, the content of the organization's relations with the environment, the reports with the competition, the attitude for clients.

The demand-offer report has a specific evolution determined by the variability of the demand in time (it changes on a daily, weekly, monthly basis), a fact which imposes a new differentiated strategy or an undifferentiated strategy.

The temporal differentiation of the marketing activities is made through a concomitant action over the demand and offer, using strategies specific to these components, through a correct proportioning of the offer and the demand ordering.

The content of the organization's relationships with the environment suggests the possibility of using two strategic alternatives: promotion of some partnership relations or some relations which involve the competition. The partnership relations has particular forms in the organization's reports with each component of the environment: with the clients, there are preferential relationships; with the competition, there are relations of tolerance and cooperation; and with the suppliers (especially with those who supply the work force), relations of cooperation.

A family doctor sending patients to a specialist, although they might be in competition, becomes the specialist's client, even if, in most of the cases, the specialist's activity represents an extension of the family doctor's activity.

The specialist may affect the reputation and the consumer's respect for the family doctor. Moreover, the family doctor wants more than his/her client's respect, he/she wishes to be a part of the team which treat the patient. In order to maintain a good relationship with his/her client, the family doctor, the specialist, must carry on the activity as good as possible, but also to place the family doctor, in the eyes of the patient, into a position of coordinator for the team which offers the treatment.

This action has positive effects on three dimensions: it maintains the family doctor's

feeling that he/she is involved in that particular case, it creates a good image of the specialist and of the family doctor, and it helps in the consolidation of the relationship between the patient and the doctor. Therefore, the specialist creates a unique service which demonstrates the partnership strategy: he/she continues to think about the client (in this case, the family doctor) and about his/her needs.

The attitude (position) in front of the clients is reflecting in a behaviour which expresses itself in two strategic alternatives: attracting, maintaining, recovering the clients who reflect the marketing vision and another characteristic of a traditional vision, the strategy of indifference which, unfortunately, is specific to many organizations from the health care domain.

Therefore, the strategy in the services domain must have, besides the essential characteristics and attributes which will correspond with the consumers' expectations, the attributes which will exceed these expectations (Cetină et al., 2006, p. 141).

3.4. The marketing programmes elaboration

The operationalization of the marketing strategies is made by a series of instruments specific to the marketing activity named marketing

programmes. The marketing programme is a developed plan of a complex marketing activity, made up of an ensemble of practical actions, echeloned in time, indicating the human, material and financial responsibilities which are implied in the development of every action.

The programme stages and the concrete activities in the health care services will be carried on taking into consideration the demands of the extern, intern and interactive marketing.

Therefore, the activities of the extern marketing are placed under the responsibility of some departments which usually are part of the superior management, those specific to the interactive marketing are part of the interactive marketing, and those specific to the intern marketing will represent the responsibility of managers, especially the managers responsible for the staff, for the sales and the operative managers (Olteanu, 2002, p. 286).

A very important stage for the achievement of the marketing programme is represented by the determination of the budget. The resources allocation is made according to the importance level of every marketing technique, component of the mix, specific for every stage which is part of the life cycle of the products and according to the total evolution of that particular market.

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The Influence of the Active Rate of Interest over the Financing Decision of the Enterprise

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Abstract. *The elaboration of some coherent strategies of development of the long term firms requires the existence of material resources which ensures, besides other necessary competences, the development and the pereniality of the firm. The enterprise has multiple choices of financing its activities: the credit lines, the treasury lines, the discount of the commerce effects, factoring, and leasing and investment credits. Tasking into account the Romanian market, one notices that the most important financing source at which the enterprises appeal to is represented by the nongovernmental credits. The main purpose of the article is to determine how the modification of the rate of interest can influence the structure of the capital and which are the particularities of this dependency for the Romanian market.*

Key words: rate of interest; degree of indebtedness; credits; termanent capital.

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JEL Codes: C10, G32.

REL Codes: 10B, 11E.

Introduction

In the financial administration of the enterprise, there are differences between the necessary and the already existing of the financial resources. This fact is due to the differences between the firm premises and the personal funds or is due to some disorders in the cashing of economic results.

In both situations, the enterprise will seek within the financing and credit market, the necessary specific products for the covering of these necessities.

In short, the financing of the enterprise can be made through credit and treasury lines, the discount of commerce effects, lump or factoring. On long terms, the financing is made in more cases for the implementation of an investment. In this respect, there are the investment and the leasing financing credits. One should not forget about the possibility of capital drawing through the stock exchange, stock issue or other specific products.

By taking into account the Romanian market, one notices a growth the nongovernmental credit and in a smaller measure of the volume of factoring or leasing operations. As a result, the following the research is oriented towards two directions and tries to answer two questions:

- 1) Does the modification of the active rate of interest influence the credit decision at the level of the enterprise?
- 2) In what way does the bank credit constitute a financing form of the enterprise?

2. The wording problem

Starting from the idea that the active rate of interest has an influence over the credit decision adopted at the level of the enterprise

through the study that we continue to develop we will try to determine in what way does the modification of the rate of interest determine the capital structure within the enterprise and which are the particularities of this dependency on the Romanian market. By using some statistical mathematical models, we will quantify the nature of the correlation between sizes, as well as its force.

The study is based on the real data, extracted from the financial situations of an enterprise, which uses the bank credit as a form of finance. For the rate of interest they used data published by the Romanian National Bank and for the considered enterprise, the indicators were calculated based on financial situations. Thus, a package of *entry data* of the models which are presented used within the analyzed model.

3. The correlation analysis

The correlation analysis is used in order to study the intensity of the connection between two or more variables. In a strict sense, the correlation is a measure of intensity of the connection between variables. The statistic connections, taking into account the type of the considered variables, can express either associations (in the case of nominal variables), or correlations (in the case of numeric variables). In the considered model, the correlation will be measured. This can be expressed through covariance, the Pearson correlation coefficient of the Spearman and Kendall correlation orders. Within the following made analysis we will refer to the Pearson correlation coefficient.

The Pearson correlation coefficient is noted with $\rho(X,Y)$, and is defined by the relation:

$$\rho(X,Y) = \frac{\text{cov}(X,Y)}{\sigma_x \times \sigma_y} = \frac{\sum_{i=1}^N (x_i - \mu_x)(y_i - \mu_y)}{N \times \sigma_x \times \sigma_y}, \quad i = \overline{1, N}$$

in which:

$\text{cov}(X, Y)$ means covariance;

x_i, y_i, μ_x, μ_y are values of the correlated variables and their medium level;

N - number of the pair of values;

σ_x, σ_y - quadric medium exception for X and Y .

The correlation coefficient is obtained through the standardization of the covariance. The value of the correlation coefficient is between -1 and +1. If this one receives the zero value, then there is no relation between variables. The ρ plus signal shows a direct connection (as the values of the X variable grow, the values of the Y variable grow, too) and the minus signal, a reverse connection (as the values of the X variable grow, the values of the Y variable decrease). The absolute value of ρ indicates the intensity of the connection, which is: the closer it gets with more than 1, the stronger the connection, respectively the closer it gets to zero, the weaker the connection when the correlation coefficient equals with +1, it indicates a perfect connection between variables, and when a correlation coefficient equals with -1 it indicates a perfect reverse connection.

4. The econometric model of analysis of the rate of interest - the indebtedness degree correlation

In order to emphasize the influence of the modification of the active rate of interest over the credit decision over the level of an enterprise, we will relate at two indicators which quantify the debt, i.e. the general debt degree and the financing debt degree. These were calculated for the October 2000-March 2004 period at each of the moments in which it was appealed to the banking credit financing.

Let us note the general debt by GD , the total debts by TD , the personal capitals by PC , the financing debt degree by FDD , the long and medium financial debt by $LMFD$, and by PEC the permanent capitals. For the calculation of these indicators the following formulae were used:

$$GD = \frac{TD}{PC};$$

$$FDD = \frac{LMFD}{PEC}.$$

Based on the data extracted from the financing situations of the enterprises one calculated two indicators, the results being presented in Table 1. For the entrance variable named *rate of interest*, the data were extracted from the Romanian National Bank communications at the respective data.

Based on the entrance data the Pearson correlation coefficients were calculated for the connections: The rate of interest - The financing debt degree, The rate of interest - The general debt degree and The general debt degree - The financing debt degree (Table 2).

In Table 2 the Pearson correlation coefficients are presented under the form of a matrix. Each hole contains information regarding the correlation between two variables (the horizontal and the vertical ones), the corresponding signification threshold and the considered number of observations (N). In the considered model, the variables are the following: the active rate of interest, the general debt threshold and the financing debt threshold.

The entrance data of the correlation model

N	Data	The active rate of interest (%)	The general debt degree (%)	The financing debt degree (%)
1	30-Cct-04	18.75	33.20	22.52
2	31-Dec-04	17.96	34.99	24.95
3	30-Mar-05	10.75	120.50	130.30
4	30-Iun-05	8.00	205.30	180.60
5	30-Sep-05	8.25	204.50	190.50
6	31-Dec-05	7.50	229.43	194.88
7	31-Mar-06	8.47	163.56	108.97
8	30-Iun-06	8.50	184.49	110.03
9	31-Dec-06	8.75	136.81	80.93
10	31-Mar-07	8.08	113.49	83.03

Source: Personal calculations made based on the financing situations of the enterprise and the National Romanian Bank Reports 2004-2007.

The number of observations $N=10$ refers to reference numbers. These are presented in the first column in Table 1 and correspond to calendar data when the report was done, covering the October 2004-March 2007 period. Suitable to each N observation (that is the calendar data) there are three variables of the model to be considered: the rate of interest (column 3, Table 1), the general debt degree (column 4, Table 1) and the financing debt degree (column 5, Table 1).

The signification threshold offers information about the probability of correcting the obtained results. In other words, it will indicate us the error degree of the model, for the analyzed enterprise. As one can see the results can be considered significant, the error probability being less than 1%.

The Pearson correlation coefficient

Table 2

		The rate of interest	The general debt degree	The financing debt degree
The rate of interest	The Pearson coefficient	1,000	-0,885*	-0,772*
	The signification threshold	-	0,001	0,009
	N	10	10	10
The general debt degree	The Pearson coefficient	-0,885*	1,000	0,928*
	The signification threshold	0,001	-	0,000
	N	10	10	10
The financing debt degree	The Pearson coefficient	-0,772*	0,928*	1,000
	The signification threshold	0,009	0,000	-
	N	10	10	10

* The correlation is significant - the probability to mistake is less than 1%

5. The dissemination of results

If one follows the first line of Table 2, one notices the three corresponding coefficients of the connections between the rate of interest and the other variables. It is obvious that the relation between the rate of interest and the rate of interest is a direct and perfect correlation, that is why the value of the indicator is 1 and the threshold signification result has an error less 0,000 %.

For the relations between the rate of interest and the general debt degree and the rate of interest and the financing debt degree correlations, the values of the Pearson coefficient are -0,885 and, respectively, -0,772. These values show a very strong connection between the two pairs of variables, since they are so close to -1. From the presentation of the model, one remembers the idea in accordance with which the value of the coefficient gets closer to 1 or -1 as the connection between the two variables becomes stronger. The minus signal indicates the nature of the correlation, which in the two analyzed cases is indirect: a growth of the rate of interest determined a subtraction of the debt degree and the other way around.

The second line of the table indicates the values of the Pearson correlation coefficient calculated for the connections between the general debt degree and the other variables. One notices the value of +0,928 of the coefficient for the connection: the general debt degree - the financing debt degree. The value being very close to +1 it certifies a direct and strong connection between the two variables. Due to the fact that the importance of the result is very big we can come up with the idea that for this enterprise financing is almost one hundred per cent identified with the bank crediting.

One can notice the big threshold of signification of the proposed model, the error probability being less than 1%.

6. Conclusions

The results of the research made will be made in two directions: one refers to the

proposed model and the other to the financing of the enterprise. The realized shaping leads us to the following conclusions:

1. There are some connections between the three variables.

2. The results of the statistical-mathematical shaping certify the indirect correlation between the Rate of value and the General debt degree, which means that it sustains the fact that a growth of the rate of value on the financial market lead to a subtraction of the general debt degree and the other way around.

3. The proposed model certifies an indirect connection between the Rate of interest and the Financing debt degree.

4. The proposed model can be considered relevant because in a big measure the results are significant, taking into account the fact that error probability is in most of the cases less than 1%. This means that the results are relevant, the probability to be correct being higher than 99%.

Regarding the financing of the enterprise the present study certifies through the proposed econometric model that there is a strong connection between the modification of the rate of interest and the financing decision of the enterprise. The correlation between the General debt degree and the Financing debt degree is given by the values of the Pearson coefficient, very closed to +1.

Thus, within this study case a characteristic of the Romanian financing market is: although there is a large palette of financing products, the enterprises chose in most cases the banking credit.

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