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ECONOPHYSICS Section

NEOCLASSICAL AND NEWTONIAN THEORY OF PRODUCTION: AN EMPIRICAL TEST

Matti ESTOLA*

***Abstract.** We search for regularities observed in the production of goods. Our first observation is that unit root is found in annual productions in all manufacturing industries in Finland and in Sweden. Thus annual industrial flows of production are observed to follow a first order difference equation (FDE). Industrial flows of production have also exogenous time dependencies, however, and we explain these by changes in the corresponding product prices due to the profit-seeking behavior of firms in the industries. We test the Newtonian theory of production against the neoclassical one in explaining how prices affect industrial flows of production. Our observations are that FDE outperforms the neoclassical theory in explaining the flows of production in every tested industry in both countries, and the Newtonian theory outperforms the FDE in 10 cases of 13 in Finnish industries, and in 14 cases of 18 in Swedish industries. Finally, the Newtonian theory outperforms the neoclassical one in every tested industry.*

***Keywords:** Industrial production, Neoclassical economics, Newtonian economics.*

JEL: C51, D21, D24.

1. Introduction

The neoclassical theory of production is presented in all textbooks of economics, even though its accuracy has not much been tested empirically. We have found only one article [1] that studies the empirical performance of the static neoclassical theory of production as it is presented in textbooks of economics. Appelbaum [1] summarizes his results as follows: “We find that except for one case the theory does not pass the proposed tests and furthermore, the primal and dual do not yield the same implications”.

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Even though the neoclassical theory of production as presented in textbooks has not got support in empirical tests, the theory relies on the success obtained in the estimation of neoclassical production functions, see [2, 3]. Even though the theory describes firms' behavior at micro-level, its testing has been made mostly by using industry or macro level data. In [2], the Cobb-Douglas – type of production function is introduced and estimated by aggregate level U.S. data of 1899-1922. The marginal productivity of labor is estimated to be $3/4$, and that of capital as $1/4$; thus constant returns to scale were observed in production. In spite of the immense problems in constructing a macro-level production function from various heterogeneous production processes [4], this has not stopped the estimation of aggregate level production functions, see e.g. [5, 6].

The results obtained in [2, 3] have been questioned in [7-10], however. These authors show that the observed success in estimating the neo-classical production functions at industrial and aggregate level data has been based on a misunderstanding; the true estimated relation has been an accounting identity, and not a physical production function. Thus all the empirical support for the neoclassical theory has been based on an error. According to Kirman [11], the economic crisis at 2008 showed that the representative agent based equilibrium macro models are useless in forecasting economic behavior and they should be replaced by modeling the interactions between heterogeneous agents. This would change current macroeconomic models – that are based on nineteenth-century physics – to resemble more twentieth-century physics where modeling techniques created for complex systems are applied. To get into that position, however, we need to take similar steps as have been taken in physics, that is, create Newtonian and Lagrangian mechanics for economics and this way enter into statistical and quantum economics. Here we follow this line of research and compare the empirical performance of the Newtonian theory of production introduced in [12] to the neoclassical one by applying Finnish and Swedish data. A similar test has been made in [13], but here our data of Finnish industries is longer and we also have data of the corresponding Swedish industries too.

This study is organized as follows. The data is described in Section 2 and its time series properties are analyzed in Section 3. The two theories to be tested are presented in Section 4, and in Section 5 are the results of this testing. Section 6 is a summary.

2. The data used in the study

We use annual production values at year 2010 prices measuring production volumes in Finnish and Swedish manufacturing industries [14, 15]. The Finnish data is in monetary terms and the Swedish data is indexes; in Finland, a less disaggregated data is available. The data contains the following 18 industries in Finland at 1975-2013, and in Sweden at 1981-2012: C10-C12: Food products, beverages and tobacco products, C13-C15: Textiles, clothing, and leather products, C16: Pulp, wood and wood products except furniture, C17: Paper and paper products, C18: Publishing and printing, C19: Refined petroleum products, coke and nuclear fuel, C20-C21: Chemicals and chemical products, C22: Rubber and plastic products, C23: Other non-metallic mineral products, C24: Basic metals, C25: Fabricated metal products, C26: Computer, electronic and optical products, C27: Electrical equipment, C28: Machinery and equipment, C29: Motor vehicles, trailers, and semi-trailers, C30: Other transport equipment, C31-C32: Furniture and other manufacturing, C33: Repair and installation of machinery and equipment. These sectors cover the whole Finnish and Swedish manufacturing.

We have current value time series $p_{in}q_{in}$ and fixed price time series at 2010 prices as $p_{i2010}q_{in}$, $i = 1, \dots, n$, where year 2010 price p_{i2010} (€/unit) is constant, and by q_{in} (unit/year) is denoted the flow of production in industry i . The estimates for industrial prices is obtained as $p_{in}q_{in}/(p_{i2010}q_{in}) = p_{in}/p_{i2010}$.

3. Time series properties of the data

The unit root tests in Table 1 show that in production volumes, only in industry C29-C30 in Finland the existence of unit root can be rejected at 5 % critical level. At 1 % critical level, the existence of unit root cannot be rejected in any industrial flow of production in both countries. In prices at 5 % critical level, in Finland only in industry C18 and in Sweden only in industries C13-C15, C27, C28, C29, and C31-C32 the existence of unit root can be rejected. In prices at 1 % level, only in Sweden in industries C13-C15 and C29 the existence of unit root can be rejected.

Table 1 implies that the time series of the annual flows of industrial productions follow the process

$$q_n = a_0 + a_1q_{n-1} + f(n), \quad (1)$$

where by n is denoted discrete time and if $a_1 = 1$, unit root exists in the series. Function $f(n)$ describes changes in the annual flow of production at time unit n independent of its past behavior. Now, according to Table 1, in all industrial flows of production holds approximately $a_1 = 1$, and then the solution of Eq.(1) is

$$q_n = q_0 + a_0 n + \sum_{i=0}^{n-1} f(1+i), q_0 \text{ constant.} \quad (2)$$

An essential difference in the behavior of industrial flows of production depends on whether a_0 deviates from zero. If $a_0 = 0$, the linear time trend $a_0 n$ vanishes in Eq. (2) and then q_n fluctuates solely due to function $f(n)$. To test this matter, we estimate the corresponding difference equations, see Table 2.

Table 1.
ADF unit root tests for the time series

Finland			Sweden		
<i>Industry</i>	<i>ADF (prob.), volume</i>	<i>ADF (prob.), price</i>	<i>Industry</i>	<i>ADF (prob.), volume</i>	<i>ADF (prob.), price</i>
C10-C12	-0.9 (0.76)	-2.0 (0.27)	C10-C12	-1.3(0.63)	-2.9(0.05)
C13-C15	-0.9 (0.79)	-2.8 (0.06)	C13-C15	-1.2(0.66)	-6.0(0.00)
C16-C17	-1.8 (0.38)	-1.9 (0.33)	C16	-1.6(0.46)	-1.6(0.49)
C18	-1.9 (0.34)	-3.6 (0.01)	C17	-1.3(0.63)	-2.3(0.18)
C19-C22	-0.4 (0.89)	-0.3 (0.92)	C18	-0.1(0.94)	-2.8(0.07)
C23	-1.6 (0.45)	-1.4 (0.55)	C19	-0.5(0.87)	-1.0(0.99)
C24	-1.5 (0.53)	-1.5 (0.52)	C20-C21	-0.7(0.84)	-2.4(0.14)
C25	-1.2 (0.67)	-0.7 (0.83)	C22	-1.7(0.42)	-2.0(0.30)
C26-27	-0.8 (0.81)	-1.8 (0.36)	C23	-0.5(0.87)	-2.2(0.20)
C28	-0.9 (0.78)	-0.8(0.82)	C24	-2.1(0.25)	-0.1(0.94)
C29-C30	-3.4 (0.02)	-1.5(0.54)	C25	-2.1(0.26)	-0.7(0.84)
C31-C32	-2.2 (0.19)	-1.5(0.54)	C26	-0.2(0.93)	-0.7(0.82)
C33	-1.7 (0.43)	-0.2(0.93)	C27	-1.0(0.75)	-3.1(0.04)
			C28	-1.1(0.69)	-3.0(0.04)
			C29	-1.4(0.58)	-4.8(0.00)
			C30	-1.7(0.41)	-0.0(0.95)
			C31-C32	-1.2(0.67)	-3.7(0.01)
			C33	-1.5(0.53)	-2.0(0.29)

Table 2.*First order difference equations (FDE) for annual production volumes*

Finland					Sweden				
Industry	a_0 (T-stat.)	a_1 (T-stat.)	Adj. R^2	Akaike	Industry	a_0 (T-stat.)	a_1 (T-stat.)	Adj. R^2	Akaike
C10-C12	306.0 (1.5)	1.0 (42.1)	0.98	13.6	C10-C12	8.9 (1.3)	0.9 (12.7)	0.84	4.0
C13-C15	-14.9(-0.2)	1.0 (32.7)	0.97	12.8	C13-C15	3.2 (0.5)	1.0 (23.8)	0.95	6.9
C16-C17	1548.1 (2.1)	0.9 (20.8)	0.92	17.1	C16	6.9 (1.5)	0.9 (17.3)	0.91	6.0
C18	156.1 (1.4)	0.9 (15.2)	0.86	12.4	C17	6.1 (1.6)	0.9 (20.6)	0.93	5.3
C19-C22	563.8 (1.5)	1.0 (35.8)	0.97	16.0	C18	-0.0 (-0.0)	1.0 (11.8)	0.82	6.4
C23	300.5 (1.8)	0.9 (12.6)	0.81	13.6	C19	4.9 (1.0)	1.0 (14.3)	0.87	6.1
C24	589.1 (1.9)	0.9 (20.2)	0.92	15.9	C20-C21	3.1 (1.9)	1.0 (44.6)	0.99	5.0
C25	342.3 (1.7)	0.9 (22.3)	0.93	15.4	C22	11.0 (1.9)	0.9 (13.4)	0.86	6.3
C26-27	628.8 (1.4)	1.0 (25.9)	0.95	18.1	C23	5.4 (0.7)	0.9 (9.4)	0.74	6.7
C28	649.9 (1.3)	1.0 (19.1)	0.91	16.9	C24	20.5 (2.2)	0.8 (7.8)	0.66	7.2
C29-C30	931.2 (2.4)	0.7 (6.0)	0.48	14.5	C25	14.4 (2.3)	0.9 (12.1)	0.83	6.9
C31-C32	175.4 (1.4)	0.9 (15.3)	0.86	12.9	C26	2.9 (1.6)	1.0 (29.2)	0.97	6.6
C33	269.4 (1.9)	0.9 (14.2)	0.84	13.4	C27	7.0 (1.1)	0.9 (12.8)	0.85	6.4
					C28	9.7 (1.3)	0.9 (10.4)	0.78	7.6
					C29	9.7 (1.6)	0.9 (12.5)	0.84	8.0
					C30	17.3 (1.7)	0.8 (7.5)	0.65	6.2
					C31-C32	4.8 (1.7)	1.0 (26.3)	0.96	5.8
					C33	5.8 (1.3)	0.9 (17.0)	0.91	6.2

Table 2 indicates that in Finland only industries C16-C17 and C29-C30, and in Sweden only industries C24 and C25 have a linear time trend in annual flows of production. Thus in most cases the time paths in production volumes originate from external sources and they must be explained by economic theories. The FDE explains the industrial flows of production relatively well, and next we test whether economic theories can better these results. Otherwise the conclusion is that annual productions are approximately equal as in previous year, and then economic theories are useless in explaining changes in annual flows of production.

4. The neoclassical and the Newtonian theory of production

In the following we assume that the external source that affects the annual flows of production together with their own history is the price of the produced good. Industrial flows of production are modeled by assuming that an industry operates like a representative firm that produces the whole production in the industry under perfect competition. A more detailed description of industrial productions can be made in the future, but

here we do not study differences in competition situations within industries and interdependencies between industries.

The profit function of a representative firm i in a perfectly competed industry is assumed as follows

$$\Pi_i(t) = p_i(t)q_i(t) - C_i(q_i(t), t), \quad i = 1, \dots, n, \quad (3)$$

where $\Pi_i(\text{€}/y)$ is the annual profit of the firm, $p_i(\text{€}/unit)$ the price of the product of the firm, $q_i(unit/y)$ the annual flow of production of the firm, and $C_i(\text{€}/y)$ the cost function of the firm; by y is denoted year. The following cost function is assumed for firm i

$$C_i(q_i(t), t) = c_{i0} + c_{i1}q_i(t) + \frac{1}{2}c_{i2}q_i^2(t) - c_{i3}tq_i(t), \quad (4)$$

where $c_{ij}, j = 0, \dots, 3$ are dimensional parameters; the last term describes decreasing costs with time due to technical development. In the neoclassical theory, the time passage is omitted (i.e. $t = 0$ is assumed in Eq. (4)) and the testable function for the neoclassical theory is

$$\frac{\partial \Pi_i}{\partial q_i} = 0 \Leftrightarrow p_i(t) = C'_i(q_i(t)) \Leftrightarrow q_i(t) = -\frac{c_{i1}}{c_{i2}} + \frac{1}{c_{i2}}p_i(t). \quad (5)$$

In Newtonian theory, the time passage is explicitly modeled and the following model is estimated for industrial prices

$$p_i(t) = a_{i0} + a_{i1}t + a_{i2} \sin(b_{i0}t + b_{i1}) + a_{i3} \sin(b_{i2}t + b_{i3}), \quad (6)$$

where $a_{ij}, b_{ik}, j, k = 0, \dots, 3$ are dimensional parameters to be estimated. The first sine-function describes normal business cycles with frequency and phase parameters b_{i0}, b_{i1} , respectively, and the second sine-function represents possible longer term cycles. A linear time trend exists in $p_i(t)$ if $a_{i1} \neq 0$.

Substituting Eqs. (4) and (6) in Eq. (3), we get the marginal profit function of firm i as

$$\begin{aligned} \frac{\partial \Pi_i}{\partial q_i} &= (a_{i0} - c_{i1}) - c_{i2}q_i(t) + (a_{i1} + c_{i3})t + \\ &+ a_{i2} \sin(b_{i0} + b_{i1}t) + a_{i3} \sin(b_{i2} + b_{i3}t). \end{aligned} \quad (7)$$

The Newtonian equation of production of a profit-seeking firm is (see [13])

$$\begin{aligned} m_i q'_i(t) = \frac{\partial \Pi_i}{\partial q_i} &\Leftrightarrow m_i q'_i(t) = z_{i0} - c_{i2}q_i(t) + \\ &+ z_{i1}t + a_{i2} \sin(b_{i0} + b_{i1}t) + a_{i3} \sin(b_{i2} + b_{i3}t), \end{aligned} \quad (8)$$

where $z_{i0} = a_{i0} - c_{i1}$, $z_{i1} = a_{i1} + c_{i3}$ and m_i with unit $\text{€} \times y^2/\text{unit}^2$ represents the inertia (“mass”) of production. Now, $\partial\Pi_i/\partial q_i$ with unit $\text{€}/\text{unit}$ is the reason (“force”) that causes the acceleration in production, $q_i'(t)(\text{unit}/y^2)$, of the profit-seeking firm. The solution of Eq. (8) is (see [13])

$$\begin{aligned}
q_i(t) = & B_{i0} + B_{i1}t \\
& + B_{i2} \sin(b_{i2}t) + B_{i3} \cos(b_{i2}t) + B_{i4} \sin(b_{i0}t + b_{i1}) \\
& + B_{i5} \cos(b_{i0}t + b_{i1}) + B_{i6} e^{-\frac{c_{i2}t}{m_i}}, \tag{9}
\end{aligned}$$

where $B_{ij}, b_{ik}, j = 0, \dots, 6, k = 0, \dots, 2$ are dimensional parameters to be estimated.

5. Empirical results

We compare empirically the neo-classical theory in Eq. (5) with the Newtonian one in Eq. (9), and these both are compared to the FDE in Eq.(1). Only statistically significant parameter estimates are reported in Tables 3-8, and the absolute values of pairwise correlations between explaining variables in any model are not allowed to exceed 0.5. The estimated models for industrial prices in Tables 3, 4, show that Eq. (6) works quite well for all industries in both countries. A linear or a more complicated time trend exists in every price, and Eq. (6) explains over 91% of price variation in Swedish industries and over 84% in Finnish industries. The Breusch-Godfrey serial correlation LM test statistic shows positive autocorrelation in residuals of all Finnish industries and in most Swedish industries too. This problem is not analyzed here further because the focus in this paper is in explaining industrial productions and not prices.

Table 3.*The estimated models for Finnish industrial prices.*

<i>Industry</i>	<i>Constant (T-test)</i>	<i>Time (T-test)</i>	$\sin(b_{i0}t + b_{i1})$ <i>(T-test)</i>	$\sin(b_{i2}t + b_{i3})$ <i>(T-test)</i>	<i>Adj. R²</i>	<i>B-G, F-prob.</i>
C10-C12	-13.3 (-11.8)	0.0 (12.4)	0.2 (12.1)	0.1 (15.5)	0.95	0.00
C13-C15	-0.7(-27.8)		0.0 (3.9)	-1.7 (-60.0)	0.99	0.00
C16-C17	-29.3 (-17.4)	0.0 (17.8)	0.1 (3.9)	-0.0 (-2.8)	0.91	0.00
C18	-33.4 (-38.3)	0.0 (38.1)	-0.4 (-12.4)		0.99	0.00
C19-C22	0.5 (46.3)		-0.1 (-9.4)	-6.6(-24.2)	0.94	0.01
C23	5.3 (46.2)		8.2 (40.1)		0.98	0.00
C24	-30.8(-13.2)	0.0 (13.5)	0.1 (2.9)		0.84	0.00
C25	-40.7 (-53.9)	0.0(54.8)			0.99	0.00
C26-C27	1.3(80.8)		0.4 (17.9)		0.89	0.00
C28	-46.0 (-54.2)	0.0 (54.9)			0.99	0.00
C29-C30	21.8 (37.5)		-0.0 (-2.1)	23.0 (36.4)	0.97	0.00
C31-C32	-42.0 (-84.8)	0.0 (86.2)			0.99	0.00
C33	-47.0 (-84.4)	0.0(85.6)			0.99	0.00

Table 4.*The estimated models for Swedish industrial prices.*

<i>Industry</i>	<i>Constant (T-test)</i>	<i>Time (T-test)</i>	$\sin(b_{i0}t + b_{i1})$ <i>(T-test)</i>	$\sin(b_{i2}t + b_{i3})$ <i>(T-test)</i>	<i>Adj. R²</i>	<i>B-G, F-prob.</i>
C10-C12	1.4 (27.8)		1.2 (17.3)		0.91	0.00
C13-C15	-102.7 (-85.5)		103.9 (86.4)		0.99	0.10
C16	-113.9 (-23.5)	0.06 (24.1)	0.2 (6.0)		0.95	0.07
C17	-120.4 (-17.3)	0.1 (17.7)	-0.1 (-3.2)	0.4 (5.4)	0.91	0.17
C18	-499.5 (-25.6)		503.7 (25.6)		0.95	0.00
C19	5.4 (38.2)		-0.3 (-3.0)	4.0 (21.1)	0.94	0.23
C20-C21	-238.1 (-29.2)	0.1 (29.9)	0.3 (5.4)		0.97	0.00
C22	-179.5 (-39.6)	0.1 (40.3)	0.1 (4.3)		0.98	0.00
C23	-175.0 (-84.9)	0.1 (86.2)	-0.2 (-8.2)		0.99	0.00
C24	-169.6 (-13.4)	0.1 (15.0)	0.2 (2.7)	10.2 (5.9)	0.92	0.00
C25	-292.7 (-68.2)	0.1 (69.3)			0.99	0.00
C26	-77.4 (-36.6)		-104.4 (-46.0)	-3.4 (-15.7)	0.99	0.02
C27	-139.7 (-46.2)	0.1 (47.1)	-0.3 (-8.7)		0.99	0.00
C28	-164.0 (-51.9)	0.1 (52.9)	0.2 (8.2)		0.99	0.00
C29	-232.5 (-35.6)	0.1 (36.4)	-0.7 (-15.3)		0.98	0.00
C30	-180.1 (-58.3)	0.1 (59.1)	-0.1 (-3.0)		0.99	0.00
C31-C32	-243.7 (-66.2)	0.1 (67.5)	-0.6 (-15.7)		0.99	0.00
C33	-193.6 (-71.6)	0.1 (72.8)	0.2 (9.2)		0.99	0.02

The estimated frequency and phase parameters of the sine-functions of all models are in the Appendix. The neoclassical models for industrial flows of production in Finland and in Sweden are in Tables 5 and 7 and the corresponding Newtonian models in Tables 6 and 8. According to adjusted R^2 and Akaike info criterion, by pairwise comparison the Newtonian models are all better than the corresponding neoclassical ones for industrial flows of production. In Finland, price has a statistically significant effect in all other neoclassical models except in industry C29-C30, but in industries C13-C15 and C26-C27, the parameter estimate is significantly negative. Thus, in these industries the theory does not work properly. The neoclassical models are, however, not accurate especially in industries C26-C27 and C29-C30 where the models explain only roughly 5% of observed variation. The Newtonian models work quite well in all other Finnish industries except in C18 and in C29-C30 where roughly 60% of observed variation is explained.

Table 5.

The neoclassical models for Finnish industries

<i>Industry</i>	<i>Constant (T-test)</i>	<i>p_{it}(T-test)</i>	<i>Adj. R^2</i>	<i>Akaike criterion</i>	<i>B-G, F-prob.</i>
C10-C12	3389.2 (3.5)	5659.6 (5.3)	0.42	17.0	0.00
C13-C15	4603.8 (22.4)	-3208.6 (-12.5)	0.80	14.6	0.00
C16-C17	-1304.9(-1.0)	21778.4 (13.5)	0.83	18.0	0.00
C18	1308.5 (8.8)	668.1 (3.4)	0.22	14.2	0.00
C19-C22	3529.2 (3.6)	15328.9 (10.7)	0.75	18.3	0.00
C23	1078.0 (7.5)	1835.3 (9.4)	0.70	14.1	0.00
C24	-293.4 (-0.4)	9381.7 (8.3)	0.64	17.4	0.00
C25	-1277.0 (-4.6)	7930.4 (21.2)	0.92	15.5	0.00
C26-C27	19883.0 (3.2)	-8320.4 (-1.9)	0.06	21.0	0.00
C28	874.6 (1.4)	12691.8 (14.2)	0.84	17.5	0.00
C29-C30	2910.9 (13.6)	462.7 (1.6)	0.04	15.1	0.00
C31-C32	1453.8 (8.4)	873.9 (3.7)	0.25	14.7	0.00
C33	1128.5 (12.8)	1691.3 (13.6)	0.83	13.6	0.00

Table 6.*The Newtonian models for Finnish industries.*

<i>Industry</i>	<i>Constant</i> (<i>T-test</i>)	<i>Time</i> (<i>T-test</i>)	$\sin(b_{i2}t)$ (<i>T-test</i>) $\cos(b_{i2}t)$ (<i>T-test</i>)	$\sin(b_{i0}t + b_{i1})$ (<i>T-test</i>) $\cos(b_{i0}t + b_{i1})$ (<i>T-test</i>)	<i>Adj. R</i> ²	<i>Akaike</i> <i>criterion</i>	<i>B-G,</i> <i>F, prob.</i>
C10-C12	-249152.2 (-50.2)	129.2 (51.9)		-172.6 (-4.3)	0.99	13.2	0.01
C13-C15	131805.1 (24.2)	-65.1 (-23.8)		-300.8 (-6.6) -217.3 (-5.0)	0.94	13.4	0.00
C16-C17	-671619.0 (-21.4)	344.7 (21.8)		1921.0(7.1) -545.8 (-2.2)	0.95	16.7	0.03
C18	-13795.5 (-2.3)	7.8 (2.7)		-299.9 (-6.6)	0.57	13.6	0.00
C19-C22	11107.6 (92.8)		-2199.9(-14.3)	6897.3 (40.4)	0.98	15.9	0.19
C23	-61693.4 (-9.7)	32.1 (10.1)		-225.1 (-4.8) -207.9 (-4.1)	0.83	13.6	0.00
C24	-411073.4 (-23.3)	209.3 (23.7)	-994.8 (-6.6)	- 867.9 (-6.0)	0.94	15.7	0.72
C25	-332281.3 (-23.1)	168.8 (23.4)	305.5 (2.7)	-468.3 (-3.9)	0.94	15.4	0.00
C26-C27	-1404851.0 (-19.5)	708.6 (19.6)	-3090.9 (-5.4)	-2263.4 (-3.8)	0.92	18.6	0.00
C28	-588035.7 (-19.3)	299.4 (19.6)	-954.8 (-3.7)	668.9 (2.8)	0.92	16.9	0.00
C29-C30	-19212.0 (-2.4)	11.3 (2.8)	-410.8 (-6.6)	-254.9 (-4.1) -194.7 (-3.0)	0.64	14.2	0.01
C31-C32	2015.4 (84.9)		318.8 (8.4) -282.4 (-9.7)	92.2 (2.8) -260.3 (-8.1)	0.89	12.8	0.00
C33	-78179.0 (-14.9)	40.3 (15.3)	-100.3 (-2.4)	-137.4 (-3.3)	0.87	13.4	0.87

Table 7.*The neoclassical models for Swedish industries.*

<i>Industry</i>	<i>Constant</i> (<i>T-test</i>)	p_{it} (<i>T-test</i>)	<i>Adj. R</i> ²	<i>Akaike</i> <i>criterion</i>	<i>B-G, F-prob.</i>
C10-C12	79.3 (30.5)	7.1 (6.2)	0.55	5.1	0.00
C13-C15	286.4 (33.0)	-144.5 (-16.9)	0.90	7.7	0.00
C16	25.7 (3.0)	21.4 (7.2)	0.62	7.5	0.00
C17	24.7 (4.0)	20.0 (9.7)	0.75	6.7	0.00
C18	146.7 (23.8)	-13.8 (-5.0)	0.43	7.5	0.00
C19	53.1 (15.2)	8.2 (7.1)	0.62	7.3	0.00
C20-C21	-31.0 (-3.9)	20.3 (13.1)	0.85	7.4	0.00
C22	43.1 (7.1)	13.6 (7.8)	0.66	7.2	0.00
C23	64.4 (8.6)	6.1 (2.4)	0.13	7.8	0.00
C24	64.9 (10.4)	9.6 (4.7)	0.41	7.8	0.00

C25	32.7 (5.7)	11.8 (9.9)	0.76	7.4	0.00
C26	130.5 (25.6)	-4.5 (-18.6)	0.92	7.5	0.00
C27	48.0 (5.9)	15.0 (5.1)	0.44	7.7	0.00
C28	11.3 (1.2)	22.2 (7.5)	0.64	8.0	0.00
C29	-25.5 (-1.4)	19.3 (5.9)	0.52	9.1	0.00
C30	76.7 (20.0)	6.3 (4.4)	0.37	6.8	0.00
C31-C32	-8.2 (-1.2)	18.4 (12.2)	0.83	7.3	0.00
C33	27.7 (4.4)	15.5 (8.7)	0.71	7.3	0.00

Table 8.
The Newtonian models for Swedish industries.

<i>Industry</i>	<i>Constant</i> (<i>T-test</i>)	<i>Time</i> (<i>T-test</i>)	$\sin(b_{12}t)$ (<i>T-test</i>) $\cos(b_{12}t)$ (<i>T-test</i>)	$\sin(b_{10}t + b_{11})$ (<i>T-test</i>) $\cos(b_{10}t + b_{11})$ (<i>T-test</i>)	<i>Adj.</i> R^2	<i>Akaike</i> <i>criterion</i>	<i>B-G.</i> <i>F-prob.</i>
C10-C12	-737.7 (-10.8)	0.4 (12.2)	-1.1 (-2.4)	1.2 (2.6)	0.83	4.12	0.00
C13-C15	7034.3 (29.8)	-3.5 (-29.2)	-12.7 (-8.2)	-4.2 (-2.7) 3.6 (2.3)	0.97	6.6	0.11
C16	-3206.1 (-21.6)	1.6 (22.1)	-2.3 (-2.5) -9.5 (-9.8)	-3.7 (-3.9) 1.9 (2.2)	0.95	5.6	0.02
C17	-2848.9 (-27.5)	1.5 (28.3)	-2.3 (-2.5)	-5.5 (-6.0)	0.97	4.7	0.59
C18	1551.3 (8.0)	-0.7 (-7.4)	-9.5 (-7.7)	3.8 (3.6) 4.6 (4.6)	0.91	5.8	0.11
C19	-2781.0 (-22.3)	1.4 (22.9)		1.7 (2.2) 3.2 (3.9)	0.95	5.3	0.24
C20-C21	65.8 (36.2)		-7.6 (-3.5) -41.4 (-66.0)	6.0 (11.2)	0.99	4.3	0.01
C22	-3082.7 (-15.3)	1.6 (15.7)	8.9 (6.6)	-4.6 (-3.6)	0.89	6.2	0.15
C23	-1217.3 (-5.9)	0.6 (6.3)	13.3 (10.2)	-3.8 (-2.9) -3.1 (-2.3)	0.83	6.3	0.00
C24	64.6 (22.7)		7.5 (4.2)	39.5 (10.7)	0.80	6.8	0.29
C25	-3827.9 (-11.9)	2.0 (12.2)		5.3 (2.7) 5.4 (2.6)	0.83	7.0	0.00
C26	-7341.4 (-28.1)	3.7 (28.3)	4.6 (2.8) 4.8 (3.0)	-5.0 (-2.9) 8.1 (4.7)	0.96	6.8	0.00
C27	-2708.9 (-12.8)	1.4 (13.2)		10.3 (7.2) -5.2 (-3.9)	0.87	6.3	0.01
C28	-4231.0 (-12.7)	2.2 (12.9)		-9.6 (-4.2)	0.85	7.2	0.01
C29	-6664.7 (-15.0)	3.4 (15.2)		-9.4 (-3.2) 14.7 (5.3)	0.89	7.7	0.04
C30	92.5 (137.5)		-7.7 (-8.0) 7.4 (7.8)	3.3 (3.4)	0.81	5.6	0.14
C31-C32	66.2 (12.4)		3.7 (4.0) -5.8 (-5.8)	-12.8 (-2.1) -44.8 (-29.2)	0.97	5.6	0.04
C33	-3043.9 (-13.7)	1.6 (14.0)		5.5 (3.6) -6.3 (-4.3)	0.88	6.5	0.00

In Finland, we obtained a statistically significant parameter for price in all other neoclassical models except in industry C29-C30, but in industries C13-C15 and C26-C27, the parameter estimate is significantly negative. Thus, in these industries the theory does not work properly. The neoclassical models are, however, not accurate especially in industries C26-C27 and C29-C30 where the models explain only roughly 5 % of observed variation. The Newtonian models are quite accurate in all other Finnish industries except in C18 and in C29-C30, where only roughly 60 % of observed variation is explained by the models.

In the case of Sweden, in all estimated neoclassical models a statistically significant estimate for price is obtained, but in industries C13-C15, C18, and C26, the estimate is significantly negative. On the average the neoclassical theory works better in Sweden than in Finland, and only in industry C23 in Sweden the model works badly, i.e. adjusted $R^2 = 0.13$. In terms of adjusted R^2 , in Sweden, however, in the best neoclassical models a negative parameter estimate is obtained for price. This further questions the empirical performance of the neoclassical theory. The Newtonian models are quite good for all Swedish industries, and in no industry less than 81 % of observed variation in production flows is explained by the models. One further advantage of the estimated Newtonian models as compared with the neo-classical ones is that the former can be used in forecasting simply by increasing time in the models. Using the neoclassical models in forecasting, on the other hand, industrial prices must be forecasted as well.

According to the Breusch-Godfrey serial correlation LM test statistic, positive autocorrelation problem exists in the residuals of all estimated functions. This shows that the estimated functional forms do not follow the observed data accurately enough. The autocorrelation problem is worse in the neoclassical than in the Newtonian models, however. This implies that there is room to better the obtained results. Two best neoclassical models for both countries are graphed in Figures 1, 3, 5, and 7, and the corresponding Newtonian ones in Figures 2, 4, 6, and 8.

6. Conclusions

We tested a Newtonian type of model for industrial flows of production against the neoclassical one, and these both were compared to the first order difference equation (FDE). Our observation is that the Newtonian theory and FDE outperform the neoclassical one in every industry in both countries, Finland and Sweden. In pairwise comparisons, the Newtonian theory is better than FDE in 24 cases of 31. These results imply that the neoclassical theory is not flexible enough to explain the industrial flows of production, and at worst it can explain only 4 % of observed variation of annual production in one industry. The Newtonian theory is more flexible, and at worst it can explain 57 % of observed variation in annual production in one industry.

Most of the estimated models were shown to have positive autocorrelation problem in residuals. This implies that more accurate functional forms can be found. In the neoclassical theory, however, there are no means to improve it. Game theory, on the other hand, could be useful in creating models where interdependencies between firms' productions are incorporated. In estimating this kind of models, however, firm level production data would be required, which is seldom available. On the other hand, interdependencies between industries may be modeled by taking account possible input-output -relations between industries. It would be interesting if similar tests as we made here are repeated with quarterly or monthly data, or with different countries and different levels of aggregation.

APPENDIX

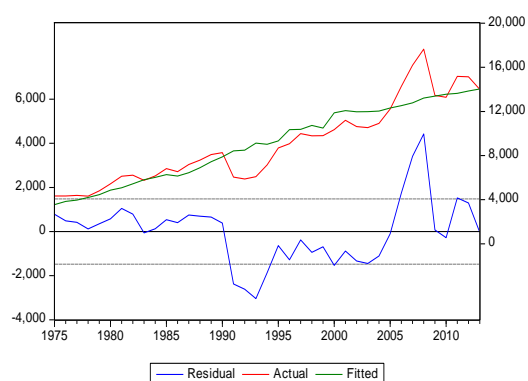


Figure 1. The neoclassical model for C28 in Finland.

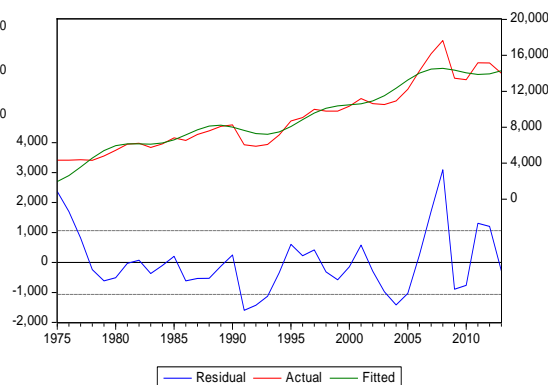


Figure 2. The Newtonian model for C28 in Finland.

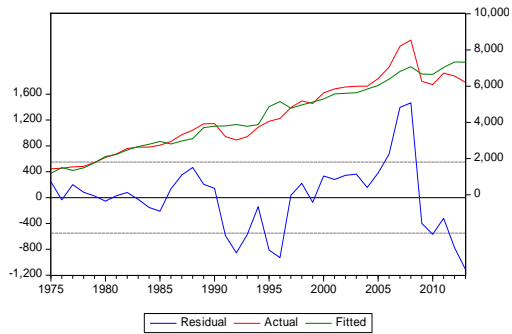


Figure 3. The neoclassical model for C25 in Finland.

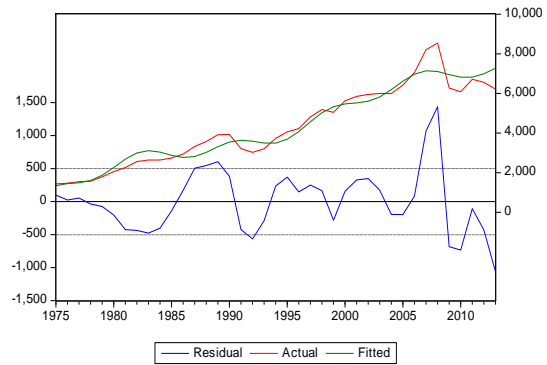


Figure 4. The Newtonian model for C25 in Finland.

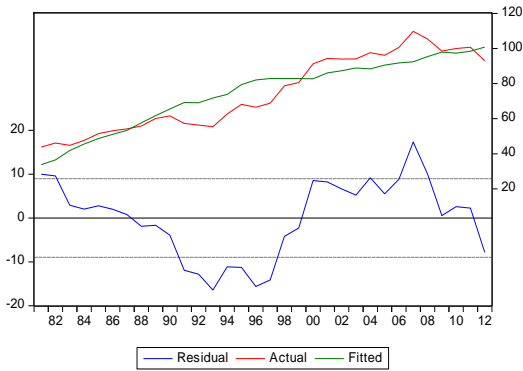


Figure 5. The neoclassical model for C31-C32 in Sweden.

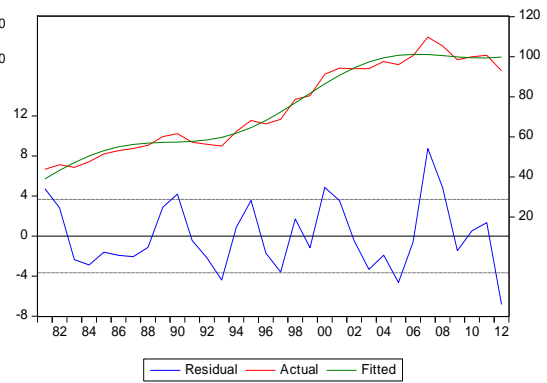


Figure 6. The Newtonian model for C31-C32 in Sweden.

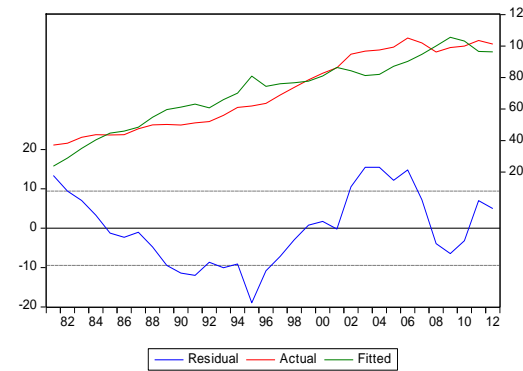


Figure 7. The neoclassical model for C20-C21 in Sweden.



Figure 8. The Newtonian model for C20-C21 in Sweden.

The estimated frequency and phase parameters of the sine-functions in models for industrial prices in Finland are: $b_{C_{10}C_{120}} = -18.77$, $b_{C_{10}C_{121}} = 0$, $b_{C_{10}C_{122}} = 0.2693$, $b_{C_{10}C_{123}} = 0$, $b_{C_{13}C_{150}} = 0.021$, $b_{C_{13}C_{151}} = -0.009$, $b_{C_{13}C_{152}} = -94.7$, $b_{C_{13}C_{153}} = 0.05$, $b_{C_{16}C_{170}} = -728.49$, $b_{C_{16}C_{171}} = 0.36$, $b_{C_{16}C_{172}} = 427.66$, $b_{C_{16}C_{173}} = -0.21$, $b_{C_{180}} = -18.8$, $b_{C_{181}} = 0$, $b_{C_{19}C_{220}} = 4429.44$, $b_{C_{19}C_{221}} = -2.2$, $b_{C_{19}C_{222}} = -0.00318$, $b_{C_{19}C_{223}} = 0.04$, $b_{C_{230}} = -0.00296$, $b_{C_{231}} = -5840$, $b_{C_{240}} = 483.34$, $b_{C_{241}} = 0.01$, $b_{C_{26}C_{270}} = 0.1504$, $b_{C_{26}C_{271}} = 141.6$, $b_{C_{29}C_{300}} = 24.478$, $b_{C_{29}C_{301}} = 0$, $b_{C_{29}C_{302}} = 0.00235$, $b_{C_{29}C_{303}} = 13$.

The frequency and phase parameters of the sine-functions in models for industrial prices in Sweden are: $b_{C_{10}C_{120}} = 0.06$, $b_{C_{10}C_{121}} = 0.43$, $b_{C_{13}C_{150}} = 0.0039$, $b_{C_{13}C_{151}} = 0.01$, $b_{C_{160}} = -107.11$, $b_{C_{161}} = 0.05$, $b_{C_{170}} = -130.88$, $b_{C_{171}} = 0.07$, $b_{C_{172}} = -106.7$, $b_{C_{173}} = 0.05$, $b_{C_{180}} = -0.0015$, $b_{C_{181}} = -498$, $b_{C_{190}} = 5.095$, $b_{C_{191}} = 0$, $b_{C_{192}} = -0.08127$, $b_{C_{193}} = 3.2$, $b_{C_{20}C_{210}} = 0.2$, $b_{C_{20}C_{211}} = 0.01$, $b_{C_{220}} = 0.31$, $b_{C_{221}} = 0.315$, $b_{C_{230}} = 0.125$, $b_{C_{231}} = 0.125$, $b_{C_{240}} = 332.59$, $b_{C_{241}} = -0.16$, $b_{C_{242}} = 0.029$, $b_{C_{243}} = -2.9$, $b_{C_{260}} = 1445.11$, $b_{C_{261}} = -0.71$, $b_{C_{262}} = 0.2988$, $b_{C_{263}} = -1564$, $b_{C_{270}} = -138.3568$, $b_{C_{271}} = 0.07$, $b_{C_{280}} = 0.268$, $b_{C_{281}} = 13.38$, $b_{C_{290}} = 0.188$, $b_{C_{291}} = 0.06$, $b_{C_{300}} = -200.71$, $b_{C_{301}} = 0.1$, $b_{C_{31}C_{320}} = 0.1121$, $b_{C_{31}C_{321}} = -5.2$, $b_{C_{330}} = -590.37$, $b_{C_{331}} = 0.29$.

The estimated frequency and phase parameters of the sine-functions in Newtonian models for production flows in Finland are: $b_{C_{10}C_{120}} = -248675.6$, $b_{C_{10}C_{121}} = 128.7$, $b_{C_{13}C_{150}} = 129125.5$, $b_{C_{13}C_{151}} = -64$, $b_{C_{16}C_{170}} = -648946.5$, $b_{C_{16}C_{171}} = 333$, $b_{C_{16}C_{172}} = 798253.4$, $b_{C_{180}} = -6911.7$, $b_{C_{181}} = 0.15$, $b_{C_{19}C_{220}} = -733605.8$, $b_{C_{19}C_{221}} = 37$, $b_{C_{19}C_{222}} = -56.7$, $b_{C_{230}} = -69008.6$, $b_{C_{231}} = 35.2$, $b_{C_{240}} = -380314.8$, $b_{C_{241}} = 19$, $b_{C_{242}} = 245.3$, $b_{C_{250}} = -325117.4$, $b_{C_{251}} = 16$, $b_{C_{252}} = -329923$, $b_{C_{26}C_{270}} = -1279733.8$, $b_{C_{26}C_{271}} = 64$, $b_{C_{26}C_{272}} = 396.0$, $b_{C_{280}} = -598731.7$, $b_{C_{281}} = 303.4$, $b_{C_{282}} = -601319.4$, $b_{C_{29}C_{300}} = -13491.0$, $b_{C_{29}C_{301}} = 8.2$, $b_{C_{29}C_{302}} = 43.6$, $b_{C_{31}C_{320}} = -32760.9$, $b_{C_{31}C_{321}} = 17.4$, $b_{C_{31}C_{322}} = -37.6$, $b_{C_{330}} = -74632.6$, $b_{C_{331}} = 3$, $b_{C_{332}} = -79676.6$.

The estimated frequency and phase parameters of the sine-functions in Newtonian models for production flows in Sweden are: $b_{C_{10}C_{120}} = -734.5$, $b_{C_{10}C_{121}} = 0.01$, $b_{C_{10}C_{122}} = 1.1$, $b_{C_{13}C_{150}} = 7358.1$, $b_{C_{13}C_{151}} = -3.6$, $b_{C_{13}C_{152}} = -0.3$, $b_{C_{160}} = -3104.7$, $b_{C_{161}} = 1.6$, $b_{C_{162}} = -0.3$, $b_{C_{170}} = -2707.7$, $b_{C_{171}} = 1.4$, $b_{C_{172}} = -0.3$, $b_{C_{180}} = 1577.7$, $b_{C_{181}} = -0.7$, $b_{C_{182}} = -0.2$, $b_{C_{190}} = 1551.4$, $b_{C_{191}} = -0.7$, $b_{C_{20}C_{210}} = 10982.7$, $b_{C_{20}C_{211}} = -5$, $b_{C_{20}C_{212}} = -0.1$, $b_{C_{220}} = -2558$, $b_{C_{221}} = 1$, $b_{C_{222}} = -0.4$, $b_{C_{230}} = -1130.4$, $b_{C_{231}} = 0.6$, $b_{C_{232}} = 0.3$, $b_{C_{240}} = -2626.3$, $b_{C_{241}} = 1.3$, $b_{C_{242}} = -0.3$, $b_{C_{250}} = -3442.8$, $b_{C_{251}} = 1.7$, $b_{C_{260}} = -7018$, $b_{C_{261}} = 3.5$, $b_{C_{262}} = 0.7$, $b_{C_{270}} = 42662.5$, $b_{C_{271}} = -25$, $b_{C_{280}} = -4009$, $b_{C_{281}} = 2$, $b_{C_{290}} = -5843.7$, $b_{C_{291}} = 3.5$, $b_{C_{300}} = 13068.4$, $b_{C_{301}} = -5$, $b_{C_{302}} = 0.2$, $b_{C_{31}C_{320}} = -4467.4$, $b_{C_{31}C_{321}} = 2$, $b_{C_{31}C_{322}} = 0.3$, $b_{C_{330}} = -3147.6$, $b_{C_{331}} = 2.5$.

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REALITIES AND PERSPECTIVES REGARDING THE FLOW OF ROMANIAN TOURISTS AT NATIONAL LEVEL

Cristina BURGHELEA *

***Abstract.** Research conducted aims to show that tourism activity as part of the national economy plays a significant role in achieving sustainable economic growth which is able to ensure a convincing view from outside according to strategies and rules of the European community. The study of tourism activity in terms of dynamics, trend and seasonality of the number of overnight stays has practical use to substantiate management decisions focused on achieving higher financial and economic results. The analysis undertaken in this study is based on a statistical methodology that identifies the extent to which tourism phenomenon is explained by the general trend variable, by the seasonal and residual variables respectively. The article shows the importance and dominant proportion of seasonality variable in the dynamics of overnight stays of Romanian tourists between 2007 and 2013.*

***Keywords:** Analysis of variance, Romanian tourists' dynamics, average coefficients of seasonality, econometric models.*

JEL classification: E24; F43.

1. Introduction

Tourism as economic phenomenon specific to modern civilization is inextricably linked to society and influences its development. Viewed in light of this major challenge it seems useful to elaborate studies to identify factors that influence the dynamics and causes of tourism activity [1].

Peculiarities of tourist activity are the footprint of consequences arising by increasing the dimension of free time. In this context influences intertwine both from objective factors (sex, age, marital status, occupation, income level) and subjective factors, such as individual preferences and options.

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In general, tourism is an industry that addresses all segments of society and involves significant human and material resources. The value of tourism in the national economy can be measured both by the final economic-financial results and by contribution brought to the gross domestic product, thereby increasing the educational level of the population, the health of the human as a whole, consisting of individuals and institutions, as well as the sustainable development of the country [2].

2. Methodology

For the application of analytical methods for analysis of the development, trend and seasonality of the number of overnight stays registered in Romania, we have established a dynamic series of quarterly levels over a period of 7 years 2007-2013.

Because the number of overnight stays dynamic series is only a limited time, consisting of seven years, it is estimated that it is treated as a sample extracted from the set of statistical data (time segments – years) in which the studied phenomenon existed, and in these conditions it is considered appropriate to proceed with testing the significance of the indicators presented in Table 1, using **analysis of variance**.

The analysis based on the dispersions ratio is a useful methodological solution to statistically substantiate a reliable assessment of: the significance and proportions of the role of the general trend variable; the significance and proportions of the role of the seasonality variable and the proportions of the role of the residual variable (error term).

Applying a specific methodology for econometric modeling, the dynamic series of quarterly number of overnight stays in 2007-2013 is expressed by an equation of the general trend adjusted with dummy variables of quarterly seasonality [3]. The model is subject to certification of sustainability using the following restrictions: the parameters of the model are statistically significant based on the "T-Criterion"; residual variable is distributed according to the normal distribution based on "Jarque-Bera criterion" and is not affected by a phenomenon of autocorrelation based on "Durbin-Watson statistic criterion"; series under analysis is stationary, based on the "White Heteroskedasticity Test" and that the "Augmented Dickey-Fuller" statistical test, and it should also be safe to develop a forecast scenario by consideration of "Theil's irregularity (inequality) coefficient".

3. Analysis of the dynamics, seasonality and trend of tourism activity

For the application of analytical methods for analysis of the development, trend and seasonality of the number of overnight stays registered in Romania, we have established a dynamic series of quarterly levels over a period of 7 years – 2007-2013 [4].

Because the number of overnight stays dynamic series is only a limited time, consisting of seven years, it is estimated that it is treated as a sample extracted from the set of statistical data (time segments - years) in which the studied phenomenon existed, and in these conditions it is considered appropriate to proceed with testing the significance of the indicators presented in Table 1, using analysis of variance.

The analysis based on the dispersions ratio is a useful methodological solution to statistically substantiate a reliable assessment of: the significance and proportions of the role of the general trend variable; the significance and proportions of the role of the seasonality variable and the proportions of the role of the residual variable (error term). [5]

Analysis of the dynamics, seasonality and trend of tourism activity in terms of number of overnight stays of Romanian tourists is informational supported by the data in the table. (See table 1)

Table 1

Overnight stays in the main facilities with tourist accommodation functions (Romanian tourists)

Year ($n = 7$)	Q1	Q2	Q3	Q4	Total	Quarterly average in each year of the period 2007-2013/ \bar{x}_i
2007 (1)	2335001	4039877	7212977	3413961	17001816	4250454
2008 (2)	2275507	4100178	7556936	3434116	17366737	4341684.25
2009 (3)	1827084	3515588	6522493	2792579	14657744	3664436
2010 (4)	1592183	3443211	5342828	2833776	13211998	3302999.5
2011 (5)	1788404	3390399	6533193	3139138	14851134	3712783.5
2012 (6)	1905302	3686616	7036308	3171649	15799875	3949968.75
2013 (7)	2024167	3587213	6864291	3354945	15830616	3957654
Total	13747648	25763082	47069026	22140164	108719920	
Quarterly average 2007-2013 \bar{x}_j	1963949.714	3680440.286	6724146.571	3162880.571		$\bar{x}_0 = 3882854.286$ Quarterly average value for the entire period

Source: own processing

Note: $i = 1, 2, 3, 4, 5, 6, 7$ ($n = 7$) = years; $j = 1, 2, 3, 4$ ($m = 4$) = quarters.

The analysis of the number of overnight stays for the Romanian tourists by applying analysis of dispersion takes into account the variation in the number of overnight stays calculation explained the general trend, seasonality and the error term. Indicators of variance representation are shown in the last column of Table 2: general trend estimate variance component S_1^2 ; variance component estimate seasonality S_2^2 ; residual variance component estimation error term or S_3^2 (see table 2).

Table 2

Analysis of dispersion methodological information table

Variation type	Sum of squared deviations	Number of degrees of freedom	Dispersion estimate
1. Variation of the number of overnight stays explained by the trend component, as effect of the action of essential factors	$m \cdot \sum_{i=1}^7 (\bar{x}_i - \bar{x}_0)^2 =$ $= 4 \cdot 768616.0 = 3074464.0$	$f = n - 1 =$ $= 7 - 1 = 6$	$S_1^2 = \frac{3074464.0}{6} =$ $= 512410.7$
2. Variation of the number of overnight stays explained by the seasonality component, as effect of the action of seasonal factors	$n \cdot \sum_{j=1}^4 (\bar{x}_j - \bar{x}_0)^2 =$ $= 7 \cdot 12314470.2 = 86201291.0$	$f = m - 1 =$ $= 4 - 1 = 3$	$S_2^2 = \frac{86201291.0}{3} =$ $= 28733763.8$
3. Variation of the number of overnight stays explained by the residual component, as effect of the action of random factors	$\sum_{i=1}^7 \sum_{j=1}^4 (x_{ij} - \bar{x}_i - \bar{x}_j + \bar{x}_0)^2 =$ $= 1291113$	$f = (n-1) \cdot (m-1) =$ $= 6 \cdot 3 = 18$	$S_3^2 = \frac{1291113}{18} =$ $= 71728.5$
4. Total variation of overnight stays (no. 4 = 1+2+3)	$\sum_{i=1}^7 \sum_{j=1}^4 (x_{ij} - \bar{x}_0)^2 =$ $= 90566868$ $= 3074464 + 86201291 + 1291113$	$f = n \cdot m - 1 =$ $= 7 \cdot 4 - 1 = 27$	

Source: own processing

The sum of squared deviations for trend and seasonality respectively can be presented, in terms of mathematical formalization, as follows:

$$\sum_{j=1}^4 \sum_{i=1}^7 (\bar{x}_i - \bar{x}_0)^2 = m \cdot \sum_{i=1}^7 (\bar{x}_i - \bar{x}_0)^2 ; \sum_{i=1}^7 \sum_{j=1}^4 (\bar{x}_j - \bar{x}_0)^2 = n \cdot \sum_{j=1}^4 (\bar{x}_j - \bar{x}_0)^2.$$

Check for the null hypothesis on the significance of the trend component:

$$F_{statistic} = \frac{s_1^2}{s_3^2} = \frac{5124107}{71728.5} = 71.438 > F_{table} = F_{q=0.05; f_1=6; f_2=18} = 2.66.$$

Check for the null hypothesis on the significance of the seasonality component:

$$F_{statistic} = \frac{s_2^2}{s_3^2} = \frac{28733763.8}{71728.5} = 400.591 > F_{table} = F_{q=0.05; f_1=3; f_2=18} = 3.16.$$

F_{table} is extracted from the Fisher table of distribution function for a 95% probability (5% significance level) and number of degrees of freedom f_1 and f_2 .

Checking the significance of the indicator system, which refers to the dynamics of the number of overnight stays (Romanian tourists), using the "F-Criterion" (analysis of variance) provides the following information:

– Trend in the number of overnight stays is a real component of the development or it is statistically significant because $F_{statistic}$ is higher than F_{table} . *The trend component* accounts for 3.39% of the total variance in the number of overnight stays;

– Based on the same statistical criterion, quarterly seasonality is also present and confirmed statistically. The seasonal component is responsible for 95.18% of the total variance in the number of overnight stays and is the main feature of the evolution of the number of overnight stays;

– *Residual component*, as an expression of the action of random or nonessential factors, holds a share of 1.43% of the total variance in the number of overnight stays.

Based on the results obtained by applying the "**Criterion F**" (analysis of variance) and the conclusions drawn, secured by a 95% (significance level equal to 5%), it is justified to develop a model for identifying both general trend and the trend adjusted for seasonality represented by average seasonality coefficients calculated for each quarter.

To specify the model structure and to support performing an analysis of the dynamic series through identifying the trend [6], the seasonality and the residual component the less rigorous variant, to study the graphic representation (waveforms) may be chosen as a solution safe enough [7].

As a result, by applying analysis of variance, 95.18% of the total variance in the number of overnight stays is explained by the seasonality variable, and in these circumstances the dynamic series of the number of overnight stays will be subject to adjustment methodologies [8] that will use an econometric model that highlights the general trend and seasonality simultaneously using dummy variables for quarterly seasonality.

Analysis will be performed for Romanian, based on the quarterly registered information in the period 2007-2013 (see table no. 3), and will be completed by estimating the likely levels of overnight stays for the quarters of 2014.

Table 3

System of variables analyzed by trend and seasonality of the number of overnight stays of Romanian tourists by introducing seasonality dummy variables quarterly.

Time interval	Actual levels of number of overnight stays (thousand day-tourists) x_i	Dummy Q_1 D_1	Dummy Q_2 D_2	Dummy Q_3 D_3	Dummy Q_4 D_4	Time Variable t
2007:1	2335.001	1.000000	0.000000	0.000000	0.000000	1
2007:2	4039.877	0.000000	1.000000	0.000000	0.000000	2
2007:3	7212.977	0.000000	0.000000	1.000000	0.000000	3
2007:4	3413.961	0.000000	0.000000	0.000000	1.000000	4
2008:1	2275.507	1.000000	0.000000	0.000000	0.000000	5
2008:2	4100.178	0.000000	1.000000	0.000000	0.000000	6
2008:3	7556.936	0.000000	0.000000	1.000000	0.000000	7
2008:4	3434.116	0.000000	0.000000	0.000000	1.000000	8
2009:1	1827.084	1.000000	0.000000	0.000000	0.000000	9
2009:2	3515.588	0.000000	1.000000	0.000000	0.000000	10
2009:3	6522.493	0.000000	0.000000	1.000000	0.000000	11
2009:4	2792.579	0.000000	0.000000	0.000000	1.000000	12
2010:1	1592.183	1.000000	0.000000	0.000000	0.000000	13
2010:2	3443.211	0.000000	1.000000	0.000000	0.000000	14
2010:3	5342.828	0.000000	0.000000	1.000000	0.000000	15
2010:4	2833.776	0.000000	0.000000	0.000000	1.000000	16

2011:1	1788.404	1.000000	0.000000	0.000000	0.000000	17
2011:2	3390.399	0.000000	1.000000	0.000000	0.000000	18
2011:3	6533.193	0.000000	0.000000	1.000000	0.000000	19
2011:4	3139.138	0.000000	0.000000	0.000000	1.000000	20
2012:1	1905.302	1.000000	0.000000	0.000000	0.000000	21
2012:2	3686.616	0.000000	1.000000	0.000000	0.000000	22
2012:3	7036.308	0.000000	0.000000	1.000000	0.000000	23
2012:4	3171.649	0.000000	0.000000	0.000000	1.000000	24
2013:1	2024.167	1.000000	0.000000	0.000000	0.000000	25
2013:2	3587.213	0.000000	1.000000	0.000000	0.000000	26
2013:3	6864.291	0.000000	0.000000	1.000000	0.000000	27
2013:4	3354.945	0.000000	0.000000	0.000000	1.000000	28
Total	108719.9					

Data source: www.insse.ro

3.1. Defining the econometric model

Graphical representation of the number of overnight stays (see Figure 1) illustrates a development that may be deemed to have a general change trend easily assimilated to linear or slight parabolic shape, marked by quarterly cyclical fluctuations of seasonal nature.

The analytical form of the econometric model can be expressed synthetically through an equation that captures both the general trend and seasonality quarterly by introducing dummy variables in the system:

– for the linear general trend with quarterly seasonal dummy variables:

$$y = (a_1D_1 + a_2D_2 + a_3D_3 + a_4D_4) + bt$$

– for the parabolic general trend with quarterly seasonal dummy variables:

$$y = (a_1D_1 + a_2D_2 + a_3D_3 + a_4D_4) + bt + ct^2$$

Note: The dummy variable is an artificial variable is used in the following situations:

- Correction of outliers or abnormal values;
- Modeling dynamic series whose levels are indented by seasonal fluctuations;
- To highlight qualitative variables.

Dummy variable values are given as follows:

- 1, when there are items that must be identified;
- 0, when the considered element is missing.

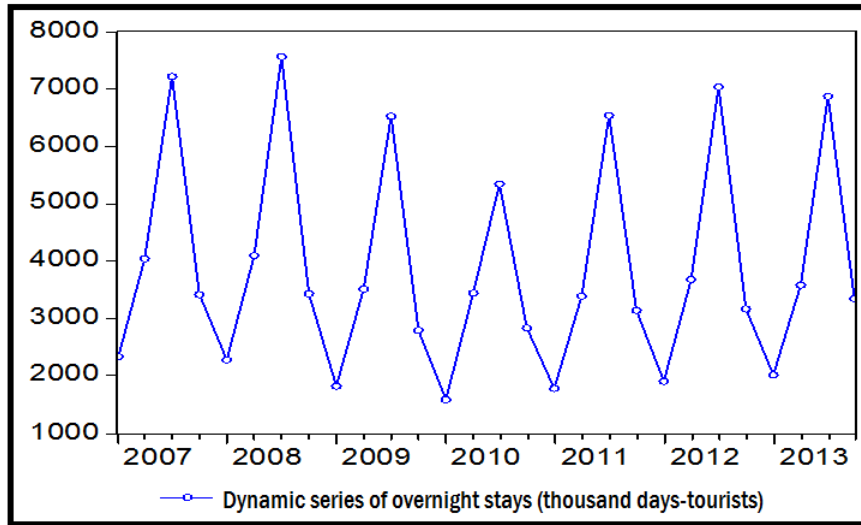


Figure 1. Graphical representation of the number of overnight stays.

Source: own processing

3.1.a. Calculation and graphic chart of the econometric representation indicators in general linear trend variant with quarterly seasonality dummy variables

In the case of the general linear trend represented by dummy variables for quarterly seasonality, the numeric expression of the parameters in the agreed trend equation is estimated using the method of least squares, and the resulting values are shown in the synoptic panel of the representation of econometric indicators (see table no. 4).

The system of equations used for this purpose is:

$$\left\{ \begin{array}{l} \sum D_1 x = a_1 \sum D_1^2 + a_2 \sum D_1 D_2 + a_3 \sum D_1 D_3 + a_4 \sum D_1 D_4 + b \sum D_1 t \\ \sum D_2 x = a_1 \sum D_1 D_2 + a_2 \sum D_2^2 + a_3 \sum D_2 D_3 + a_4 \sum D_2 D_4 + b \sum D_2 t \\ \sum D_3 x = a_1 \sum D_1 D_3 + a_2 \sum D_2 D_3 + a_3 \sum D_3^2 + a_4 \sum D_3 D_4 + b \sum D_3 t \\ \sum D_4 x = a_1 \sum D_1 D_4 + a_2 \sum D_2 D_4 + a_3 \sum D_3 D_4 + a_4 \sum D_4^2 + b \sum D_4 t \\ \sum tx = a_1 \sum t D_1 + a_2 \sum t D_2 + a_3 \sum t D_3 + a_4 \sum t D_4 + b \sum t^2 \end{array} \right.$$

Thus, the analytical form of the statistical validity of the development of the number of overnight stays of Romanian tourists by quarters in the period 2007-2013 is

$$y = (2151.229049 D_1 + 3882.125723 D_2 + 6940.238112 D_3 + 3393.378214 D_4) - 14.40610268 t .$$

Table 4

*Synoptic panel of the econometric representation indicators
(model for econometric representation of the statistical series of the number of overnight stays by using dummy seasonality on a general linear trend variables)*

Dependent Variable: Number of overnight stays (thousand days-tourists)				
Method: Least Squares				
Sample: 2007: 1 - 2013:4 ; Number of observations included in the model: 28				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D_1 Q1 „ a_1 ”	2151.229	202.9306	10.60081	0.0000
D_2 Q2 „ a_2 ”	3882.126	209.2774	18.55014	0.0000
D_3 Q3 „ a_3 ”	6940.238	215.8866	32.14761	0.0000
D_4 Q4 „ a_4 ”	3393.378	222.7348	15.23506	0.0000
Tendința „ b ”	-14.40610	9.843581	-1.463502	0.1569
R-squared	0.955904	Mean dependent var		3882.854
Adjusted R-squared	0.948235	S.D. dependent var		1831.483
S.E. of regression	416.6987	Akaike info criterion		15.06304
Sum squared resid	3993669	Schwarz criterion		15.30093
Log likelihood	-205.8825	Durbin-Watson stat		0.889971

Source: own processing

Note: The indicators presented in synoptic panel of the econometric representation were obtained using the Eviews software application.

As found in the "synoptic panel of econometric representation indicators" (see table 4), the estimated coefficients of the model are significant (non-zero), in statistical terms, under "t criteria" parameter except which "b" is not attested statistically as significantly different from

zero because it is associated with a significance level higher than 5% ($q = 15.69\%$)

The trend equation, by the estimated value of the coefficient "b" attests the downward trend in the number of overnight stays namely that on average, the number of overnight stays has decreased in each time segment (quarter) during the analyzed period thousands by 14.40610 overnights (thousand day-tourists).

Average error estimate of the trend equation corrected by applying quarterly dummy seasonality variables in absolute expression is:

$$\hat{\sigma}_{x;y} = \sqrt{\frac{\Sigma(x_i - y_i)^2}{n - k}} = \sqrt{\frac{3993669}{28 - 5}} = \sqrt{173637.7826} = \pm 416.6987$$

thousand day - tourists

where "n" is the number of observations – 28 – and the constant "k" is the number of parameters in the equation of trend adjusted by quarterly seasonal dummy variables – 5 –.

To appreciate the power of the econometric model based on the error estimate average trend equation corrected by the use of dummy variables, the estimated average error *in relative expression* can be calculated:

$$\hat{V}_{x \cdot y} = \frac{\hat{\sigma}_{x;y}}{\bar{x}} \cdot 100 = \frac{416.6987}{3882.854} \cdot 100 = 10.73\%$$

This indicator expresses, therefore, the "power" of the econometric model, when used in extrapolation or forecasting calculations. Principially, it is considered a very good value for an estimate of the average relative error when positioned within a maximum of 10%.

A similar significance indicator is the "Theil irregularity coefficient" which supports the viability of the model because it has a value ($Th = 4.42\%$ – Figure 4), which does not exceed 5%, considered restrictive enough to justify the use of the model for the calculation of estimates of the number of overnight stays related to future time segments.

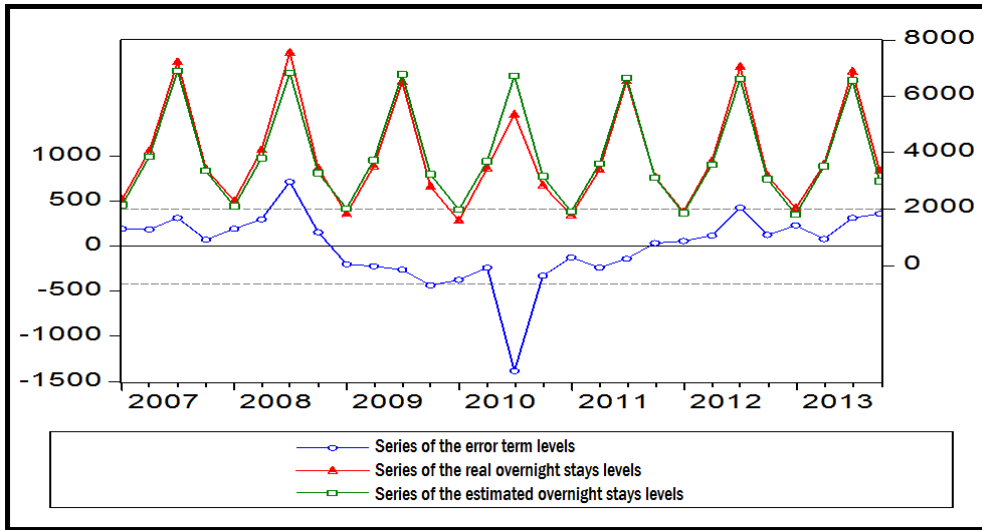


Figure 2. Graphical representation of the number of overnight stays (actual data, estimated data based on linear model with dummy variables for quarterly seasonality and residual term values).

Source: own processing.

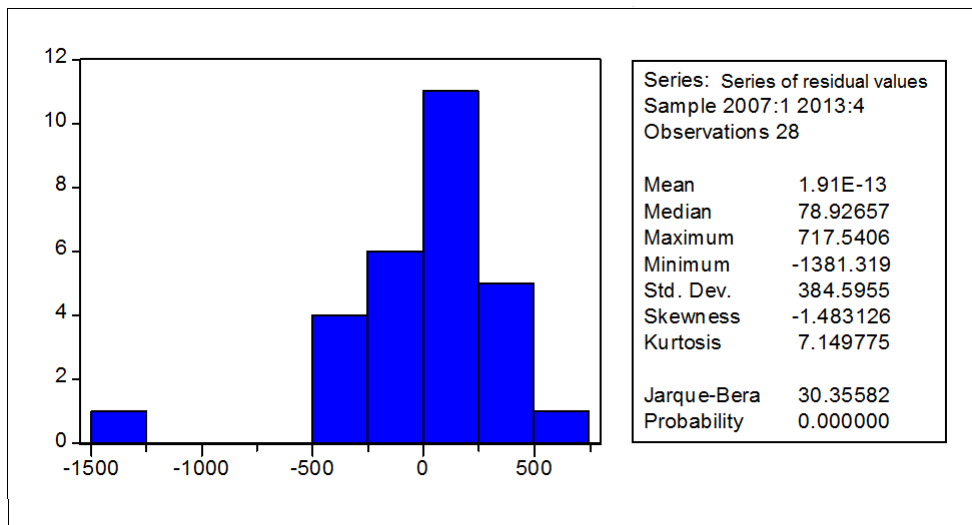


Figure 3. Statistic description and testing for normality of the distribution of the residual variable (linear model adjusted with quarterly seasonal dummy variables)

Source: own processing.

Calculation and interpretation of the Jarque-Bera Criterion shows that the series of residuals are not distributed normally, fact that alters the viability of the model (the null hypothesis is rejected). Inside the box in Figure 3, the Jarque-Bera statistic coefficient has a value of 30.35582, for

which a probability of 0.0000 is recorded as argument for accepting the null hypothesis under the law of distribution χ^2 with 2 degrees of freedom.

Consequences of non-normality of the distribution of errors are: estimators of the model parameters do not have the property of maximum likelihood; the *t*-statistic (Student) test applied to analyze the significance of estimators (coefficients) of the model has a distorted representation.

Analysis of the residual values series based on their arrangement in relation to the average estimate error, $\hat{\sigma}_{x,y} = \pm 416,6987$, and with the origin allows us to see that there is no convenient alternation to assess the non-autocorrelation status. The conclusion made is supported by the value of the Durbin-Watson statistic coefficient, which as shown in the overview (see table no. 4) is equal to 0.889971 certifying the autocorrelation status of the residuals.

The information provided by the Durbin-Watson coefficient has additional significance in this case because it is considered that no full relevance econometric model has a parameter-free period (ratio) distinct, marking the ordinate origin.

The information provided by the *Durbin-Watson coefficient* has additional significance in this case because it is considered that there is no full relevance, and the econometric model has no distinct free-term parameter (ratio), marking the ordinate at origin.

Table 5

Augmented Dickey-Fuller test statistic synoptic panel

Null Hypothesis: D(Overnight stays) has a unit root				
Exogenous: Constant				
Lag Length: 2 (Automatic based on SIC. MAXLAG=8)				
			<i>t</i> -Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-27.45019	0.0001
Test critical values:	1% level		-3.737853	
	5% level		-2.991878	
	10% level		-2.635542	
*MacKinnon (1996) one-sided <i>p</i> -values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(Înnoptări.2)				

Method: Least Squares				
Sample (adjusted): 2008:1 – 2013:4				
Included observations: 24 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Overnights (-1))	-3.885765	0.141557	-27.45019	0,0000
D(Overnights (-1).2)	1.931945	0.088591	21.80757	0,0000
D(Overnights (-2).2)	0.953337	0.063905	14.91812	0,0000
C	-47.12125	105.7567	-0.445563	0,6607
R-squared	0.985162	Mean dependent var		12.06958
Adjusted R-squared	0.982936	S.D. dependent var		3965.466
S.E. of regression	517.9987	Akaike info criterion		15.48883
Sum squared resid	5366453.	Schwarz criterion		15.68518
Log likelihood	-181.8660	F-statistic		442.6346
Durbin-Watson stat	1.270534	Prob (F-statistic)		0.000000

Source: own processing

Based on the results presented in the *Synoptic Panel of the White Heteroskedasticity Test* (Table 6) we can conclude that the residual variable is not heteroscedastic (rejecting the hypothesis of heteroscedasticity) and therefore the residual variable is homoscedastic, the dispersion of the residual variable is constant. This conclusion is validated both under *F* Criterion and the χ^2 Criterion, significance thresholds justifies rejecting the hypothesis of heteroscedasticity due to the fact that they exceed the maximum permissible limit of 5%.

Table 6

*White Heteroskedasticity Test Synoptic Panel
(linear model with dummy variables for quarterly seasonality)*

White Heteroskedasticity Test:			
F-statistic	0.801071	Probability (significance threshold)	0.609212
Obs*R-squared	7.062178	Probability (significance threshold)	0.529939
Test Equation: Dependent Variable: RESID^2			
Method: Least Squares (Metoda celor mai mici pătrate)			
Sample: 2007:1 2013:4; Included observations: 28			

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-235589.7	396943.4	-0.593510	0,5598
D_1	136279.8	426981.6	0.319170	0,7531
D_1*t	37076.94	37299.49	0.994034	0,3327
D_2	118770.3	429256.0	0.276689	0,7850
D_2*t	38289.85	39551.95	0.968090	0,3452
D_3	512237.2	434690.0	1.178397	0,2532
D_3*t	36867.29	41836.40	0.881225	0,3892
D_4*t	47795.08	44147.87	1.082614	0,2925
t^2	-1443.007	1266.027	-1.139791	0,2685
R-squared	0.252221	Mean dependent var		142631.0
Adjusted R-squared	-0.062634	S.D. dependent var		360197.6
S.E. of regression	371306.5	Akaike info criterion		28.74254
Sum squared resid	2.62E+12	Schwarz criterion		29.17074
Log likelihood	-393.3955	F-statistic		0.801071
Durbin-Watson stat	2.074377	Prob (F-statistic)		0.609212

Source: own processing

The graphical representation in Figure 4 illustrates the viability of the model by means of an arrangement of the estimates of the number of overnights certified by Theil's inequality index with a value lower than the 5% restrictive limit ($Th = 4.42\%$). It also highlights the confidence interval in which every value is positioned, based on an estimate of the limit or maximum allowable error under a statistical certification probability for intervals of 95%. In this case the critical value t was used, $t = \pm 2,069$ which follows a Student distribution.

Note: *The limit error required to estimate the confidence interval of the number of overnight stays is the product of probability factor (critical value $\pm t = \pm 2,069$) and the estimate of the average error corrected of the trend equation adjusted with the seasonality factor represented by dummy variables, as follows:*

$$\Delta = \pm t_{q = 0.05; f = n - k = 28 - 5 = 23} \cdot \hat{\sigma}_{y; \hat{y}} = \pm 2.069 \cdot 416.6987.$$

Limitele intervalului de încredere în care se poziționează nivelurile estimate ale numărului de înnoptări sunt calculate astfel:

$$\text{Limita superioară: } ls = y + 2,069 \cdot 416,6987$$

$$\text{Limita inferioară: } li = y - 2,069 \cdot 416,6987$$

The limits of the confidence interval in which the positions of the estimated number of overnight stays are calculated as follows:

$$\text{Upper limit: } ls = y + 2.069 \cdot 416.6987$$

$$\text{Lower limit: } li = y - 2.069 \cdot 416.6987 .$$

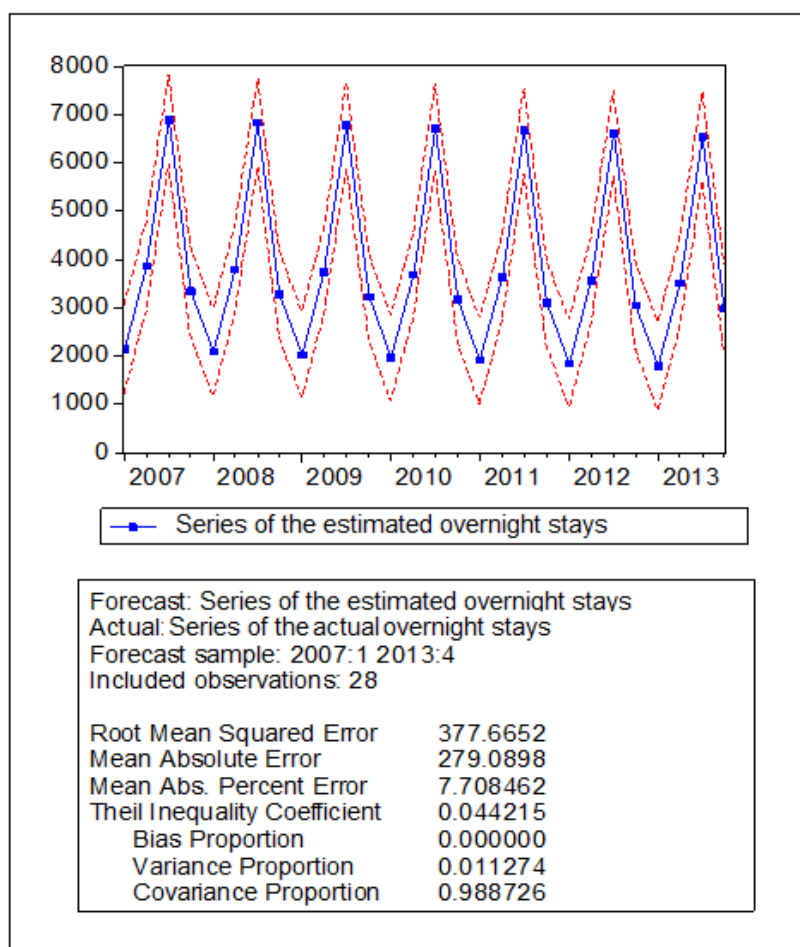


Figure 4. Graphical representation of the estimated levels of the number of overnight stays and limits that fall within the terms of $\pm 2,069$ estimates of the average error of the trend equation (based on the Student distribution law with bilateral significance threshold arrangement) for a significance level of 5% and 23 degrees of freedom

$$(\pm t_{q=0.05; f=n-k=28-5=23} \cdot \hat{\sigma}_{x;y} = \pm 2.069 \cdot 416.6987)$$

Source: own processing

3.1.b. Calculation and graphic representation of the econometric indicators in parabolic general trend variant using dummy variables quarterly seasonality

In the case of the model represented by parabolic general tendency with dummy variables of quarterly seasonality, the digital dimension of the parameters of the agreed tendency equation is estimated by the method of least squares [9], and the resulting values are presented in the synoptic panel of econometric representation indicators.

The system of equations used for this purpose is:

$$\left\{ \begin{array}{l} \Sigma D_1 x = a_1 \Sigma D_1^2 + a_2 \Sigma D_1 D_2 + a_3 \Sigma D_1 D_3 + a_4 \Sigma D_1 D_4 + b \Sigma D_1 t + c \Sigma D_1 t^2 \\ \Sigma D_2 x = a_1 \Sigma D_1 D_2 + a_2 \Sigma D_2^2 + a_3 \Sigma D_2 D_3 + a_4 \Sigma D_2 D_4 + b \Sigma D_2 t + c \Sigma D_2 t^2 \\ \Sigma D_3 x = a_1 \Sigma D_1 D_3 + a_2 \Sigma D_2 D_3 + a_3 \Sigma D_3^2 + a_4 \Sigma D_3 D_4 + b \Sigma D_3 t + c \Sigma D_3 t^2 \\ \Sigma D_4 x = a_1 \Sigma D_1 D_4 + a_2 \Sigma D_2 D_4 + a_3 \Sigma D_3 D_4 + a_4 \Sigma D_4^2 + b \Sigma D_4 t + c \Sigma D_4 t^2 \\ \Sigma t x = a_1 \Sigma t D_1 + a_2 \Sigma t D_2 + a_3 \Sigma t D_3 + a_4 \Sigma t D_4 + b \Sigma t^2 + c \Sigma t^3 \\ \Sigma t^2 x = a_1 \Sigma t^2 D_1 + a_2 \Sigma t^2 D_2 + a_3 \Sigma t^2 D_3 + a_4 \Sigma t^2 D_4 + b \Sigma t^3 + c \Sigma t^4 \end{array} \right.$$

It follows that the analytical form of the statistical regularity of the number of overnight stays of Romanian tourists in quarters, from the period 2007-2013, in the parabolic general trend variant with dummy variables of quarterly seasonality [10] will be:

$$y = (2730.117867 D_1 + 4469.054664 D_2 + 7527.167052 D_3 + 3972.267032 D_4) - 130.9878785 t + 4.020061237 t^2$$

Table 7

*Synoptic panel of econometric representing indicators
(econometric model of the statistical series representation of the number of overnight stays by using dummy variables on a quarterly seasonality on a parabolic general trend)*

Dependent Variable: Overnight stays				
Method: Least Squares				
Sample: 2007:1- 2013:4 ; Included observations: 28				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D_1 Q1 „ a_1 ”	2730.118	225.6260	12.10019	0,0000
D_2 Q2 „ a_2 ”	4469.055	230.8106	19.36243	0,0000
D_3 Q3 „ a_3 ”	7527.167	234.6959	32.07200	0,0000
D_4 Q4 „ a_4 ”	3972.267	237.3459	16.73620	0,0000
„ b ”	-130.9879	32.43468	-4.038513	0,0005
„ c ”	4.020061	1.084778	3.705884	0,0012
R-squared	0.972851	Mean dependent var		3882.854
Adjusted R-squared	0.966681	S.D. dependent var		1831.483
S.E. of regression	334.3088	Akaike info criterion		14.64942
Sum squared resid	2458772	Schwarz criterion		14.93489
Log likelihood	-199.0918	Durbin-Watson stat		1.436676

Source: own processing.

The synoptic panel of the econometric representing indicators (Table 7) exposes the estimate average error of the parabolic trend equation corrected by applying quarterly seasonality dummy variables, in absolute, which is calculated as follows [11]:

$$\hat{\sigma}_{x;y} = \sqrt{\frac{\sum(x_i - y_i)^2}{n - k}} = \sqrt{\frac{2458772}{28 - 6}} = \sqrt{111762,363 \ 6} = \pm 334.3088$$

thousand days - tourists

where "n" is the number of observations = 28, and the constant "k" is the number of parameters in the equation of parabolic trend corrected by applying quarterly seasonality dummy variables = 6.

To assess the viability of the econometric model based on the average error estimate of the equation trend corrected by applying dummy variables, the mean error estimate is calculated in *relative expression*:

$$\hat{V}_{x \cdot y} = \frac{\hat{\sigma}_{x; y}}{\bar{x}} \cdot 100 = \frac{334.3088}{3882.854} \cdot 100 = 8.61\%$$

This indicator expresses therefore the "power" of the econometric model, when used in extrapolating or forecasting calculations. In principle, it is considered an estimate of the average relative error of a very good value when positioned within a maximum of 10%.

A similar significance indicator is "Theil's coefficient of inequality" which sustains the viability of the model because it has a value (Th = 3.4667% – Figure 7) not exceeding the 5% threshold considered sufficiently restrictive to justify using the model to calculate the estimate of the number of overnight stays in future time segments.

The residual values series shows an arrangement in relation to the average error estimate of the regression equation $\hat{\sigma}_{x; y} = \pm 334,3088$, and to the origin of which follows a certain alternation which confirms that this variable is affected by a phenomenon of autocorrelation. The conclusion made is supported by the value of the Durbin-Watson statistic coefficient, which as shown in the overview (see Table 7) is equal to 1.436676, attesting the non-autocorrelation status of the residuals.

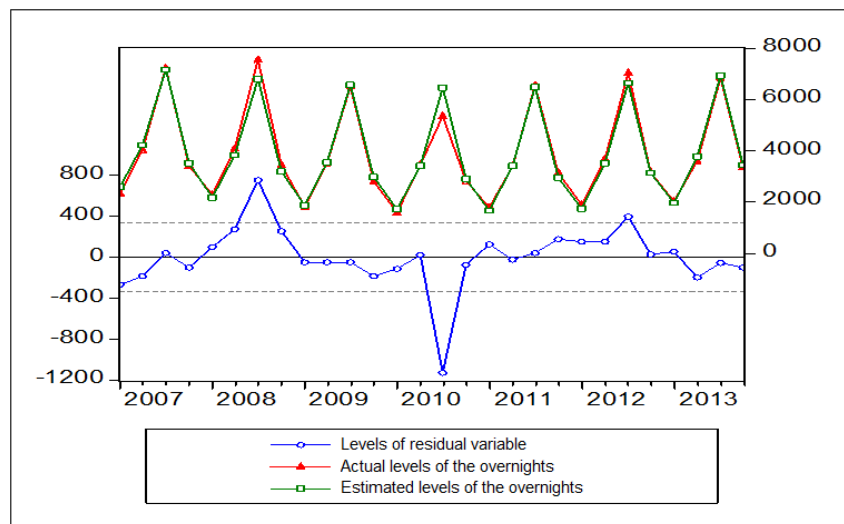


Figure 5. Graphical representation of the number of overnight stays (actual data, estimated data based on parabolic model with dummy variables for quarterly seasonality term residual values).

Source: own processing

A useful information points to the graphical representation in Figure 5, in which the chronographs of the actual number of overnight stays and those of estimated levels based on parabolic model with quarterly seasonality dummy variables have overlapping shapes, which induces the viability assessment for the econometric model [12]. The graph also displays the chronographs of the values of the error (residual) term, reproducing the error interval in Table 10. Residuals are compared with the limits marked by an estimate of the average error of the parabolic trend equation corrected by applying quarterly seasonality dummy variables, $\hat{\sigma}_{x,y} = \pm 334.3088$ thousand overnights.

The graph in Figure 5 highlights three residue marker points are that stand out of the bounds represented by a mean estimate of error, but not positioned outside the limits defined by error or maximum permissible limit established under the Student distribution law by taking into consideration the value of the critical factor (probability) relating to a significance threshold of 5% and 22 degrees of freedom. Limit error is therefore defined as: $\pm t_{q=0.05; f=n-k=28-6=22} \cdot \hat{\sigma}_{x,y} = \pm 2.074 \cdot 334.3088$.

The graphic representation in Figure 6 shows the histogram of the residuals and the box next to the chart presents the statistical indicators that describe the series of the residual term values: mean, median [13], maximum and minimum value, standard deviation estimate, statistic coefficients of asymmetry (Skewness) and vaulting / flattening (Kurtosis), as well as Jarque-Bera statistic coefficient to which is associated the probability of attesting the normal shape of the compliance of the distribution of residues with the normal distribution law.

The "Jarque-Bera criterion" provides information that the series of residues of the parabolic model with quarterly seasonality dummy variables is not normally distributed, because the probability associated to the statistical Jarque-Bera coefficient (JB = 50.53875) is 0.00000 under the distribution law, χ^2 with two degrees of freedom.

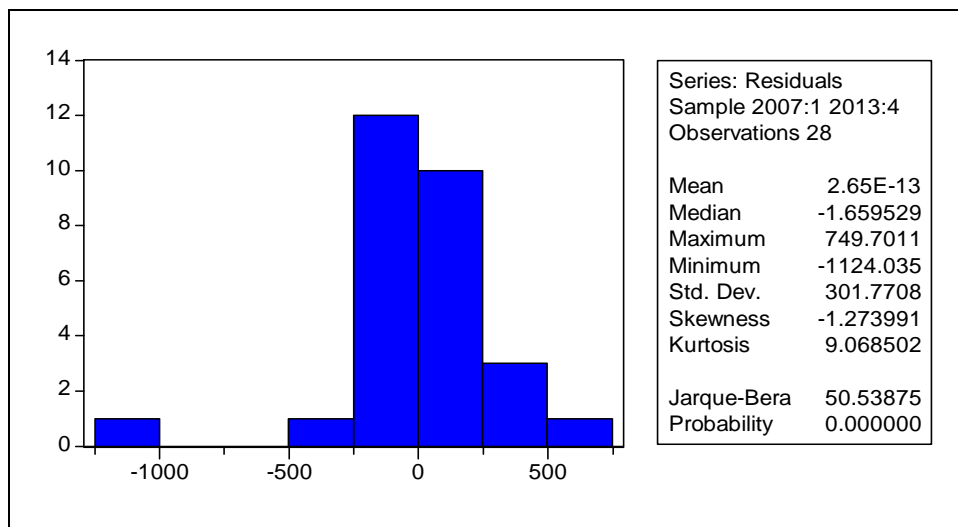


Figure 6. Statistical description and test for normality of the distribution of the residual variable (parabolic model with dummy variables for quarterly seasonality).

Source: own processing

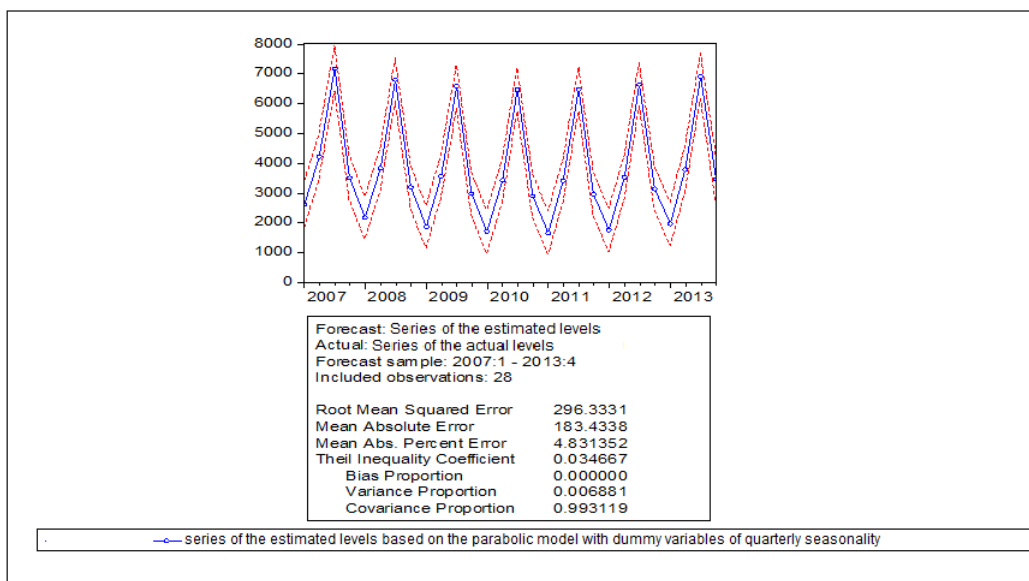


Figure 7. Graphical representation of the estimated levels of the number of overnight stays and limits that fall within the terms of the ± 2.074 estimates of the average error of the trend equation (by the Student distribution law with bilateral arrangement of the significance threshold) for a significance threshold of 5% and 22 degrees of freedom

$$(\pm t_{q=0.05; f=n-k=28-6=22} \cdot \hat{\sigma}_{x;y} = \pm 2.074 \cdot 334.3088).$$

Source: own processing

To test the state of heteroscedasticity / homoscedasticity of the residuals, the White test was used. Results in the *Synoptic panel of White Heteroskedasticity Test* (Table 8) certify that the residual variable is not heteroscedastic (rejecting hypothesis of heteroscedasticity) and therefore the residual variable is homoscedastic. In these conditions the residual variable dispersion is constant. The conclusion is validated both under **f-Criterion** and the χ^2 **Criterion**, the significance thresholds of 70.1611% and 57.5497% justify the rejection of the hypothesis of heteroscedasticity as exceeding the maximum permissible limit, which is 5%.

Table 8

*Synoptic panel of White Heteroskedasticity Test
(parabolic model with dummy variables for quarterly)*

White Heteroskedasticity Test:				
<i>F</i> -statistic	0.742002	Probability threshold	(significance)	0.701611
Obs* <i>R</i> -squared	11.42216	Probability threshold	(significance)	0.575497
Test Equation:				
Dependent Variable: RESID ²				
Method: Least Squares				
Sample: 2007:1 - 2013:4 ; Included observations: 28				
Variable	Coefficient	Std. Error	<i>t</i> -Statistic	Prob.
C	32396.96	615300.1	0.052652	0,9588
<i>D</i> ₁	68953.28	563146.1	0.122443	0,9043
<i>D</i> ₁ * <i>t</i>	-43969.70	160496.4	-0.273961	0,7881
<i>D</i> ₁ * <i>t</i> ²	6890.412	22390.35	0.307740	0,7628
<i>D</i> ₂	86257.98	555933.3	0.155159	0,8789
<i>D</i> ₂ * <i>t</i>	-45070.35	173983.1	-0.259050	0,7994
<i>D</i> ₂ * <i>t</i> ²	6898.907	22730.22	0.303513	0,7660
<i>D</i> ₃	-203684.3	568334.8	-0.358388	0,7254
<i>D</i> ₃ * <i>t</i>	71300.61	182721.9	0.390214	0,7023
<i>D</i> ₃ * <i>t</i> ²	2748.247	22849.43	0.120276	0,9060
<i>D</i> ₄ * <i>t</i>	-26081.02	186513.9	-0.139834	0,8908
<i>D</i> ₄ * <i>t</i> ²	6174.445	22751.45	0.271387	0,7901
<i>t</i> * <i>t</i> ²	-404.7532	1152.928	-0.351066	0,7308
<i>t</i> ⁴	7.793182	19.72179	0.395156	0,6987
<i>R</i> -squared	0.407934	Mean dependent var		87813.29
Adjusted <i>R</i> -squared	-0.141841	S.D. dependent var		254011.8
S.E. of regression	271429.2	Akaike info criterion		28.16764
Sum squared resid	1.03E+12	Schwarz criterion		28.83375
Log likelihood	-380.3470	<i>F</i> -statistic		0.742002
Durbin-Watson stat	2.039575	Prob (<i>F</i> -statistic)		0.701611

Source: own processing

3.2. Interpretation of econometric representation indicators and conclusions on the model viability assessment

Calculations allow us to appreciate that the model built on a parabolic general trend equation corrected with dummy variables of quarterly seasonality statistically has a more convincing support than the linear model.

Therefore the model considered as sufficiently reliable analytical expression of the dynamics of the number of overnights spent in the period 2007-2013 is:

$$y = (2730.117867 D_1 + 4469.054664 D_2 + 7527.167052 D_3 + 3972.267032 D_4) - 130.9878785 t + 4.020061237t^2.$$

In support of that assessment are the following results:

1. Under the ***t-Criterion***, the parameters of the general trend equation of parabolic shape adjusted with dummy variables of quarterly seasonality have had values significantly different from zero. Checking the null hypothesis of each parameter is assessed by thresholds lower than 5% and is therefore invalidated.

By this finding it is concluded that the model was correctly specified and the trend equation parameters show good efficiency when used for the calculation of forecasts. However there is a certain moderation on the correctness of that conclusion since the error distribution does not have the statistical confirmation of formal similarity with normal distribution based on the Jarque-Bera statistical criterion (Figure 6).

In case of the linear model with dummy correction the statistical quality of being significantly different from zero of the "*b*" parameter for which the significance threshold is 15.69% is refuted on ***t-Criterion***, well above the limit of 5% and thus the null hypothesis is accepted.

2. In the context of the analysis of the dynamics of the number of overnight stays, the Durbin Watson statistic coefficient is irrelevant because the econometric model has no distinct parameter (coefficient) marking the ordinate at origin.

3. The relative expression of the standard error estimate of the equation of parabolic trend with dummy variables quarterly seasonally adjusted in relation to the average number of overnight stays is 8.61%, a suitable value, positioned below the 10% required to considered viable model.

4. Theil's irregularity (inequality) coefficient reconfirms by its value, $Th = 3.4667\%$, the conclusion offered in the form of relative standard error of the estimate equation parabolic trend adjusted with quarterly seasonally dummy variables, the econometric model is viable, properly formalizing the evolution and trend of the number of overnight stays.

In the case of the linear model with dummy correction, Theil's irregularity (inequality) coefficient has a higher value ($Th = 4.4215\%$) compared with parabolic correction dummy model, which ensures a better statistical viability of the latter.

5. The White test confirms the stationary state of the dynamic series and thus sustaining the viability of model, the residual variable is homoscedastic, which will ensure the calculation an efficient estimate of the number of overnights levels that will be recorded in future time segments.

6. The Augmented Dickey-Fuller statistical test also indicates that the error associated to rejecting the hypothesis that the overnights series has a unit root, is 0.01% , lower than the standard threshold of 5% . In these circumstances it supports the hypothesis that the *series is stationary*.

7. The statistical test that propagates a particular vulnerability to the parabolic model with dummy correction is the test for normality of distribution of the residual variable, the Jarque-Bera criterion. This test provides information that the residues series is not normally distributed which alters the viability of the model.

Calculating the estimated number of overnight stays for 2014

The econometric model represented by the equation

$$y = (2730.117867 D_1 + 4469.054664 D_2 + 7527.167052 D_3 + 3972.267032 D_4) - 130.9878785 t + 4.020061237t^2$$

has the statistical confirmation of viability to provide decision makers the scientific basis for the operation of forecasting calculations.

In these circumstances the probable levels of the number of overnight stays is estimated, by quarters in 2014.

The estimate required will be assessed by calculating a confidence interval guaranteed with a 95% probability (the significance threshold, $q = 5\%$, is distributed bilaterally), under the Student distribution law, as the number of observations (n) is less than 40.

The limit error estimate that we will be taking into account for estimating the confidence interval is expressed in thousand overnight stays and has the following value:

$$\Delta = \pm t_{q = 0.05; f = n - k = 28 - 6 = 22} \cdot \hat{\sigma}_{y; \hat{y}} = \pm 2.074 \cdot 334.3088 = \pm 693.3564512$$

Note: The critical value of *t*-tabulated = $\pm 2,074$ is extracted from the table of Student distribution function values, for a significance level of 5% – arranged bilaterally – and 22 degrees of freedom.

– Punctual value estimated for the 1st quarter of 2014 (2014:1):

$$y = (2730.117867 D_1 + 4469.054664 D_2 + 7527.167052 D_3 + 3972.267032 D_4) - 130.9878785 \cdot 29 + 4.020061237 \cdot 29^2 = 2312.340891 \text{ thousand overnights}$$

– Punctual value estimated for the 2nd quarter of 2014 (2014:2):

$$y = (2730.117867 D_1 + 4469.054664 D_2 + 7527.167052 D_3 + 3972.267032 D_4) - 130.9878785 \cdot 30 + 4.020061237 \cdot 30^2 = 4157.473422 \text{ thousand overnights}$$

– Punctual value estimated for the 3rd quarter of 2014 (2014:3):

$$y = (2730.117867 D_1 + 4469.054664 D_2 + 7527.167052 D_3 + 3972.267032 D_4) - 130.9878785 \cdot 31 + 4.020061237 \cdot 31^2 = 7329.821667 \text{ thousand overnights}$$

– Punctual value estimated for the 4th quarter of 2014 (2014:4):

$$y = (2730.117867 D_1 + 4469.054664 D_2 + 7527.167052 D_3 + 3972.267032 D_4) - 130.9878785 \cdot 32 + 4.020061237 \cdot 32^2 = 3897.197627 \text{ thousand overnights}$$

The lower limit of the confidence interval of the predicted value of the number of overnight stays for each quarter of 2014 is obtained by subtracting from the punctual value the estimated limit error and the upper limit of the confidence interval of the projected value is obtained by adding to the punctual value the limit error estimation.

Thus, the performed calculations define a possible interval in which the number of overnight stays will fall for each of the quarters of 2014.

4. Conclusions

Following this analysis it appears that the stream of Romanian tourists is positioned on an upward trend at the end of 2013 with real growth prospects in the coming years. This tourist flow demonstrates the ability of the national economy to attract and ensure internationally competitive conditions in particular against neighboring tourist areas. The sustainability of tourism activities is given by the desire of each individual to do something new, to visit new areas, together with the improvement of the infrastructure and the behavior of service providers. One can see the tendency to offer tourist services as complex and qualitatively superior as possible, customized for every tourist in part, as secure basis for attracting new investment in this sector. This sector has become in the last decade one that has contributed to increasing GDP per capita and welfare of the entire population including job growth.

Diversification of travel options linking leisure with the development of knowledge of history and culture, with support for the increasing interest in health services provides broad prospects for enhancing tourism activities.

Policies and European standards focused on innovation emphasize the need for adaptability of travel services according to market demands based on traditions and preferences particular to each group of tourists and education of each population group in this respect will lead in fact to the creation of equal opportunities and prospects in this sector.

The study gives reliable information for decision-makers within the meaning of the mobilization effort for the development of material and human factor competitiveness.

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REALITIES AND PERSPECTIVES REGARDING THE FLOW OF ROMANIAN TOURISTS AT NATIONAL LEVEL

Cristina BURGHELEA *

***Abstract.** Research conducted aims to show that tourism activity as part of the national economy plays a significant role in achieving sustainable economic growth which is able to ensure a convincing view from outside according to strategies and rules of the European community. The study of tourism activity in terms of dynamics, trend and seasonality of the number of overnight stays has practical use to substantiate management decisions focused on achieving higher financial and economic results. The analysis undertaken in this study is based on a statistical methodology that identifies the extent to which tourism phenomenon is explained by the general trend variable, by the seasonal and residual variables respectively. The article shows the importance and dominant proportion of seasonality variable in the dynamics of overnight stays of Romanian tourists between 2007 and 2013.*

***Keywords:** Analysis of variance, Romanian tourists' dynamics, average coefficients of seasonality, econometric models.*

JEL classification: E24; F43.

1. Introduction

Tourism as economic phenomenon specific to modern civilization is inextricably linked to society and influences its development. Viewed in light of this major challenge it seems useful to elaborate studies to identify factors that influence the dynamics and causes of tourism activity [1].

Peculiarities of tourist activity are the footprint of consequences arising by increasing the dimension of free time. In this context influences intertwine both from objective factors (sex, age, marital status, occupation, income level) and subjective factors, such as individual preferences and options.

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In general, tourism is an industry that addresses all segments of society and involves significant human and material resources. The value of tourism in the national economy can be measured both by the final economic-financial results and by contribution brought to the gross domestic product, thereby increasing the educational level of the population, the health of the human as a whole, consisting of individuals and institutions, as well as the sustainable development of the country [2].

2. Methodology

For the application of analytical methods for analysis of the development, trend and seasonality of the number of overnight stays registered in Romania, we have established a dynamic series of quarterly levels over a period of 7 years 2007-2013.

Because the number of overnight stays dynamic series is only a limited time, consisting of seven years, it is estimated that it is treated as a sample extracted from the set of statistical data (time segments – years) in which the studied phenomenon existed, and in these conditions it is considered appropriate to proceed with testing the significance of the indicators presented in Table 1, using **analysis of variance**.

The analysis based on the dispersions ratio is a useful methodological solution to statistically substantiate a reliable assessment of: the significance and proportions of the role of the general trend variable; the significance and proportions of the role of the seasonality variable and the proportions of the role of the residual variable (error term).

Applying a specific methodology for econometric modeling, the dynamic series of quarterly number of overnight stays in 2007-2013 is expressed by an equation of the general trend adjusted with dummy variables of quarterly seasonality [3]. The model is subject to certification of sustainability using the following restrictions: the parameters of the model are statistically significant based on the "T-Criterion"; residual variable is distributed according to the normal distribution based on "Jarque-Bera criterion" and is not affected by a phenomenon of autocorrelation based on "Durbin-Watson statistic criterion"; series under analysis is stationary, based on the "White Heteroskedasticity Test" and that the "Augmented Dickey-Fuller" statistical test, and it should also be safe to develop a forecast scenario by consideration of "Theil's irregularity (inequality) coefficient".

3. Analysis of the dynamics, seasonality and trend of tourism activity

For the application of analytical methods for analysis of the development, trend and seasonality of the number of overnight stays registered in Romania, we have established a dynamic series of quarterly levels over a period of 7 years – 2007-2013 [4].

Because the number of overnight stays dynamic series is only a limited time, consisting of seven years, it is estimated that it is treated as a sample extracted from the set of statistical data (time segments - years) in which the studied phenomenon existed, and in these conditions it is considered appropriate to proceed with testing the significance of the indicators presented in Table 1, using analysis of variance.

The analysis based on the dispersions ratio is a useful methodological solution to statistically substantiate a reliable assessment of: the significance and proportions of the role of the general trend variable; the significance and proportions of the role of the seasonality variable and the proportions of the role of the residual variable (error term). [5]

Analysis of the dynamics, seasonality and trend of tourism activity in terms of number of overnight stays of Romanian tourists is informational supported by the data in the table. (See table 1)

Table 1

Overnight stays in the main facilities with tourist accommodation functions (Romanian tourists)

Year ($n = 7$)	Q1	Q2	Q3	Q4	Total	Quarterly average in each year of the period 2007-2013/ \bar{x}_i
2007 (1)	2335001	4039877	7212977	3413961	17001816	4250454
2008 (2)	2275507	4100178	7556936	3434116	17366737	4341684.25
2009 (3)	1827084	3515588	6522493	2792579	14657744	3664436
2010 (4)	1592183	3443211	5342828	2833776	13211998	3302999.5
2011 (5)	1788404	3390399	6533193	3139138	14851134	3712783.5
2012 (6)	1905302	3686616	7036308	3171649	15799875	3949968.75
2013 (7)	2024167	3587213	6864291	3354945	15830616	3957654
Total	13747648	25763082	47069026	22140164	108719920	
Quarterly average 2007-2013 \bar{x}_j	1963949.714	3680440.286	6724146.571	3162880.571		$\bar{x}_0 = 3882854.286$ Quarterly average value for the entire period

Source: own processing

Note: $i = 1, 2, 3, 4, 5, 6, 7$ ($n = 7$) = years; $j = 1, 2, 3, 4$ ($m = 4$) = quarters.

The analysis of the number of overnight stays for the Romanian tourists by applying analysis of dispersion takes into account the variation in the number of overnight stays calculation explained the general trend, seasonality and the error term. Indicators of variance representation are shown in the last column of Table 2: general trend estimate variance component S_1^2 ; variance component estimate seasonality S_2^2 ; residual variance component estimation error term or S_3^2 (see table 2).

Table 2

Analysis of dispersion methodological information table

Variation type	Sum of squared deviations	Number of degrees of freedom	Dispersion estimate
1. Variation of the number of overnight stays explained by the trend component, as effect of the action of essential factors	$m \cdot \sum_{i=1}^7 (\bar{x}_i - \bar{x}_0)^2 =$ $= 4 \cdot 768616.0 = 3074464.0$	$f = n - 1 =$ $= 7 - 1 = 6$	$S_1^2 = \frac{3074464.0}{6} =$ $= 512410.7$
2. Variation of the number of overnight stays explained by the seasonality component, as effect of the action of seasonal factors	$n \cdot \sum_{j=1}^4 (\bar{x}_j - \bar{x}_0)^2 =$ $= 7 \cdot 12314470.2 = 86201291.0$	$f = m - 1 =$ $= 4 - 1 = 3$	$S_2^2 = \frac{86201291.0}{3} =$ $= 287337638$
3. Variation of the number of overnight stays explained by the residual component, as effect of the action of random factors	$\sum_{i=1}^7 \sum_{j=1}^4 (x_{ij} - \bar{x}_i - \bar{x}_j + \bar{x}_0)^2 =$ $= 1291113$	$f = (n-1) \cdot (m-1) =$ $= 6 \cdot 3 = 18$	$S_3^2 = \frac{1291113}{18} =$ $= 717285$
4. Total variation of overnight stays (no. 4 = 1+2+3)	$\sum_{i=1}^7 \sum_{j=1}^4 (x_{ij} - \bar{x}_0)^2 =$ $= 90566868$ $= 3074464 + 86201291 + 1291113$	$f = n \cdot m - 1 =$ $= 7 \cdot 4 - 1 = 27$	

Source: own processing

The sum of squared deviations for trend and seasonality respectively can be presented, in terms of mathematical formalization, as follows:

$$\sum_{j=1}^4 \sum_{i=1}^7 (\bar{x}_i - \bar{x}_0)^2 = m \cdot \sum_{i=1}^7 (\bar{x}_i - \bar{x}_0)^2 ; \sum_{i=1}^7 \sum_{j=1}^4 (\bar{x}_j - \bar{x}_0)^2 = n \cdot \sum_{j=1}^4 (\bar{x}_j - \bar{x}_0)^2.$$

Check for the null hypothesis on the significance of the trend component:

$$F_{statistic} = \frac{s_1^2}{s_3^2} = \frac{5124107}{71728.5} = 71.438 > F_{table} = F_{q=0.05; f_1=6; f_2=18} = 2.66.$$

Check for the null hypothesis on the significance of the seasonality component:

$$F_{statistic} = \frac{s_2^2}{s_3^2} = \frac{28733763.8}{71728.5} = 400.591 > F_{table} = F_{q=0.05; f_1=3; f_2=18} = 3.16.$$

F_{table} is extracted from the Fisher table of distribution function for a 95% probability (5% significance level) and number of degrees of freedom f_1 and f_2 .

Checking the significance of the indicator system, which refers to the dynamics of the number of overnight stays (Romanian tourists), using the "F-Criterion" (analysis of variance) provides the following information:

– Trend in the number of overnight stays is a real component of the development or it is statistically significant because $F_{statistic}$ is higher than F_{table} . *The trend component* accounts for 3.39% of the total variance in the number of overnight stays;

– Based on the same statistical criterion, quarterly seasonality is also present and confirmed statistically. The seasonal component is responsible for 95.18% of the total variance in the number of overnight stays and is the main feature of the evolution of the number of overnight stays;

– *Residual component*, as an expression of the action of random or nonessential factors, holds a share of 1.43% of the total variance in the number of overnight stays.

Based on the results obtained by applying the "**Criterion F**" (analysis of variance) and the conclusions drawn, secured by a 95% (significance level equal to 5%), it is justified to develop a model for identifying both general trend and the trend adjusted for seasonality represented by average seasonality coefficients calculated for each quarter.

To specify the model structure and to support performing an analysis of the dynamic series through identifying the trend [6], the seasonality and the residual component the less rigorous variant, to study the graphic representation (waveforms) may be chosen as a solution safe enough [7].

As a result, by applying analysis of variance, 95.18% of the total variance in the number of overnight stays is explained by the seasonality variable, and in these circumstances the dynamic series of the number of overnight stays will be subject to adjustment methodologies [8] that will use an econometric model that highlights the general trend and seasonality simultaneously using dummy variables for quarterly seasonality.

Analysis will be performed for Romanian, based on the quarterly registered information in the period 2007-2013 (see table no. 3), and will be completed by estimating the likely levels of overnight stays for the quarters of 2014.

Table 3

System of variables analyzed by trend and seasonality of the number of overnight stays of Romanian tourists by introducing seasonality dummy variables quarterly.

Time interval	Actual levels of number of overnight stays (thousand day-tourists) x_i	Dummy Q_1 D_1	Dummy Q_2 D_2	Dummy Q_3 D_3	Dummy Q_4 D_4	Time Variable t
2007:1	2335.001	1.000000	0.000000	0.000000	0.000000	1
2007:2	4039.877	0.000000	1.000000	0.000000	0.000000	2
2007:3	7212.977	0.000000	0.000000	1.000000	0.000000	3
2007:4	3413.961	0.000000	0.000000	0.000000	1.000000	4
2008:1	2275.507	1.000000	0.000000	0.000000	0.000000	5
2008:2	4100.178	0.000000	1.000000	0.000000	0.000000	6
2008:3	7556.936	0.000000	0.000000	1.000000	0.000000	7
2008:4	3434.116	0.000000	0.000000	0.000000	1.000000	8
2009:1	1827.084	1.000000	0.000000	0.000000	0.000000	9
2009:2	3515.588	0.000000	1.000000	0.000000	0.000000	10
2009:3	6522.493	0.000000	0.000000	1.000000	0.000000	11
2009:4	2792.579	0.000000	0.000000	0.000000	1.000000	12
2010:1	1592.183	1.000000	0.000000	0.000000	0.000000	13
2010:2	3443.211	0.000000	1.000000	0.000000	0.000000	14
2010:3	5342.828	0.000000	0.000000	1.000000	0.000000	15
2010:4	2833.776	0.000000	0.000000	0.000000	1.000000	16

2011:1	1788.404	1.000000	0.000000	0.000000	0.000000	17
2011:2	3390.399	0.000000	1.000000	0.000000	0.000000	18
2011:3	6533.193	0.000000	0.000000	1.000000	0.000000	19
2011:4	3139.138	0.000000	0.000000	0.000000	1.000000	20
2012:1	1905.302	1.000000	0.000000	0.000000	0.000000	21
2012:2	3686.616	0.000000	1.000000	0.000000	0.000000	22
2012:3	7036.308	0.000000	0.000000	1.000000	0.000000	23
2012:4	3171.649	0.000000	0.000000	0.000000	1.000000	24
2013:1	2024.167	1.000000	0.000000	0.000000	0.000000	25
2013:2	3587.213	0.000000	1.000000	0.000000	0.000000	26
2013:3	6864.291	0.000000	0.000000	1.000000	0.000000	27
2013:4	3354.945	0.000000	0.000000	0.000000	1.000000	28
Total	108719.9					

Data source: www.insse.ro

3.1. Defining the econometric model

Graphical representation of the number of overnight stays (see Figure 1) illustrates a development that may be deemed to have a general change trend easily assimilated to linear or slight parabolic shape, marked by quarterly cyclical fluctuations of seasonal nature.

The analytical form of the econometric model can be expressed synthetically through an equation that captures both the general trend and seasonality quarterly by introducing dummy variables in the system:

– for the linear general trend with quarterly seasonal dummy variables:

$$y = (a_1D_1 + a_2D_2 + a_3D_3 + a_4D_4) + bt$$

– for the parabolic general trend with quarterly seasonal dummy variables:

$$y = (a_1D_1 + a_2D_2 + a_3D_3 + a_4D_4) + bt + ct^2$$

Note: The dummy variable is an artificial variable is used in the following situations:

- Correction of outliers or abnormal values;
- Modeling dynamic series whose levels are indented by seasonal fluctuations;
- To highlight qualitative variables.

Dummy variable values are given as follows:

- 1, when there are items that must be identified;
- 0, when the considered element is missing.

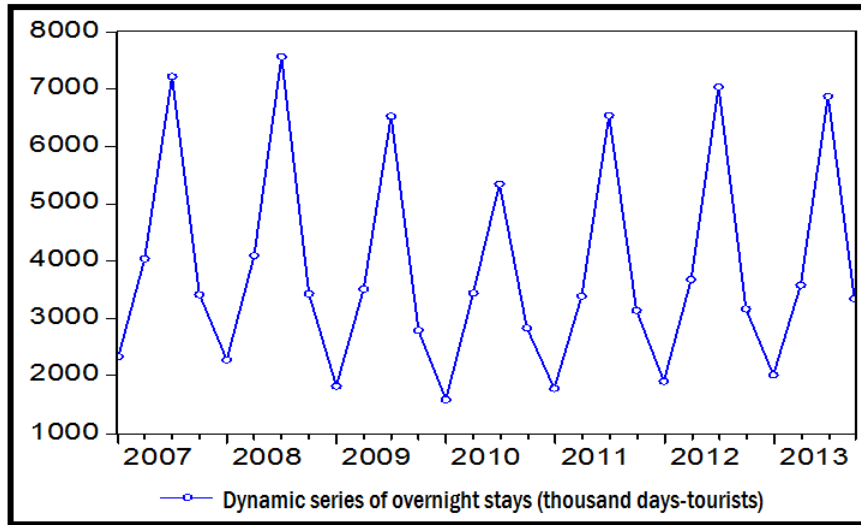


Figure 1. Graphical representation of the number of overnight stays.

Source: own processing

3.1.a. Calculation and graphic chart of the econometric representation indicators in general linear trend variant with quarterly seasonality dummy variables

In the case of the general linear trend represented by dummy variables for quarterly seasonality, the numeric expression of the parameters in the agreed trend equation is estimated using the method of least squares, and the resulting values are shown in the synoptic panel of the representation of econometric indicators (see table no. 4).

The system of equations used for this purpose is:

$$\left\{ \begin{array}{l} \sum D_1 x = a_1 \sum D_1^2 + a_2 \sum D_1 D_2 + a_3 \sum D_1 D_3 + a_4 \sum D_1 D_4 + b \sum D_1 t \\ \sum D_2 x = a_1 \sum D_1 D_2 + a_2 \sum D_2^2 + a_3 \sum D_2 D_3 + a_4 \sum D_2 D_4 + b \sum D_2 t \\ \sum D_3 x = a_1 \sum D_1 D_3 + a_2 \sum D_2 D_3 + a_3 \sum D_3^2 + a_4 \sum D_3 D_4 + b \sum D_3 t \\ \sum D_4 x = a_1 \sum D_1 D_4 + a_2 \sum D_2 D_4 + a_3 \sum D_3 D_4 + a_4 \sum D_4^2 + b \sum D_4 t \\ \sum tx = a_1 \sum t D_1 + a_2 \sum t D_2 + a_3 \sum t D_3 + a_4 \sum t D_4 + b \sum t^2 \end{array} \right.$$

Thus, the analytical form of the statistical validity of the development of the number of overnight stays of Romanian tourists by quarters in the period 2007-2013 is

$$y = (2151.229049 D_1 + 3882.125723 D_2 + 6940.238112 D_3 + 3393.378214 D_4) - 14.40610268 t .$$

Table 4

*Synoptic panel of the econometric representation indicators
(model for econometric representation of the statistical series of the number of overnight stays by using dummy seasonality on a general linear trend variables)*

Dependent Variable: Number of overnight stays (thousand days-tourists)				
Method: Least Squares				
Sample: 2007: 1 - 2013:4 ; Number of observations included in the model: 28				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D_1 Q1 „ a_1 ”	2151.229	202.9306	10.60081	0.0000
D_2 Q2 „ a_2 ”	3882.126	209.2774	18.55014	0.0000
D_3 Q3 „ a_3 ”	6940.238	215.8866	32.14761	0.0000
D_4 Q4 „ a_4 ”	3393.378	222.7348	15.23506	0.0000
Tendința „ b ”	-14.40610	9.843581	-1.463502	0.1569
R-squared	0.955904	Mean dependent var		3882.854
Adjusted R-squared	0.948235	S.D. dependent var		1831.483
S.E. of regression	416.6987	Akaike info criterion		15.06304
Sum squared resid	3993669	Schwarz criterion		15.30093
Log likelihood	-205.8825	Durbin-Watson stat		0.889971

Source: own processing

Note: The indicators presented in synoptic panel of the econometric representation were obtained using the Eviews software application.

As found in the "synoptic panel of econometric representation indicators" (see table 4), the estimated coefficients of the model are significant (non-zero), in statistical terms, under "t criteria" parameter except which "b" is not attested statistically as significantly different from

zero because it is associated with a significance level higher than 5% ($q = 15.69\%$)

The trend equation, by the estimated value of the coefficient "b" attests the downward trend in the number of overnight stays namely that on average, the number of overnight stays has decreased in each time segment (quarter) during the analyzed period thousands by 14.40610 overnights (thousand day-tourists).

Average error estimate of the trend equation corrected by applying quarterly dummy seasonality variables in absolute expression is:

$$\hat{\sigma}_{x;y} = \sqrt{\frac{\Sigma(x_i - y_i)^2}{n - k}} = \sqrt{\frac{3993669}{28 - 5}} = \sqrt{173637.7826} = \pm 416.6987$$

thousand day - tourists

where "n" is the number of observations – 28 – and the constant "k" is the number of parameters in the equation of trend adjusted by quarterly seasonal dummy variables – 5 –.

To appreciate the power of the econometric model based on the error estimate average trend equation corrected by the use of dummy variables, the estimated average error *in relative expression* can be calculated:

$$\hat{V}_{x \cdot y} = \frac{\hat{\sigma}_{x;y}}{\bar{x}} \cdot 100 = \frac{416.6987}{3882.854} \cdot 100 = 10.73\%$$

This indicator expresses, therefore, the "power" of the econometric model, when used in extrapolation or forecasting calculations. Principially, it is considered a very good value for an estimate of the average relative error when positioned within a maximum of 10%.

A similar significance indicator is the "Theil irregularity coefficient" which supports the viability of the model because it has a value ($Th = 4.42\%$ – Figure 4), which does not exceed 5%, considered restrictive enough to justify the use of the model for the calculation of estimates of the number of overnight stays related to future time segments.

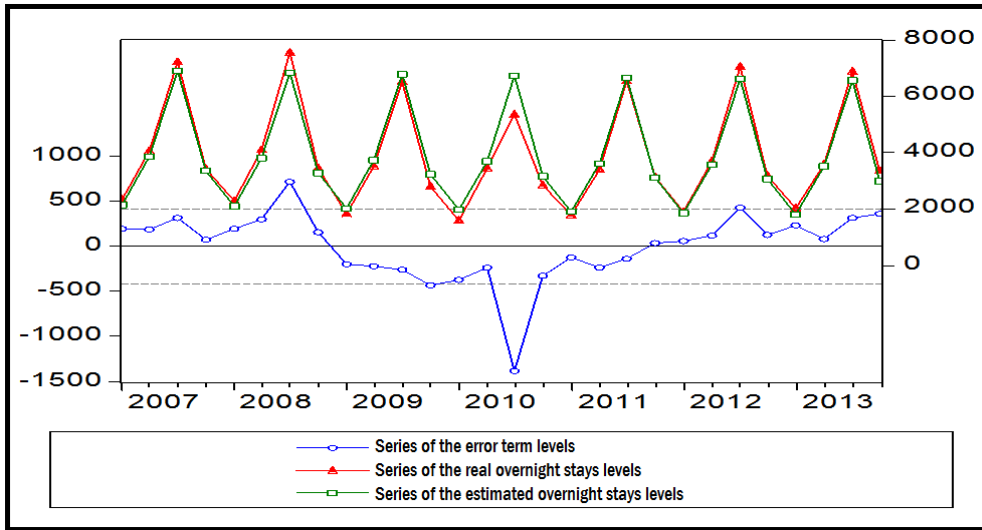


Figure 2. Graphical representation of the number of overnight stays (actual data, estimated data based on linear model with dummy variables for quarterly seasonality and residual term values).

Source: own processing.

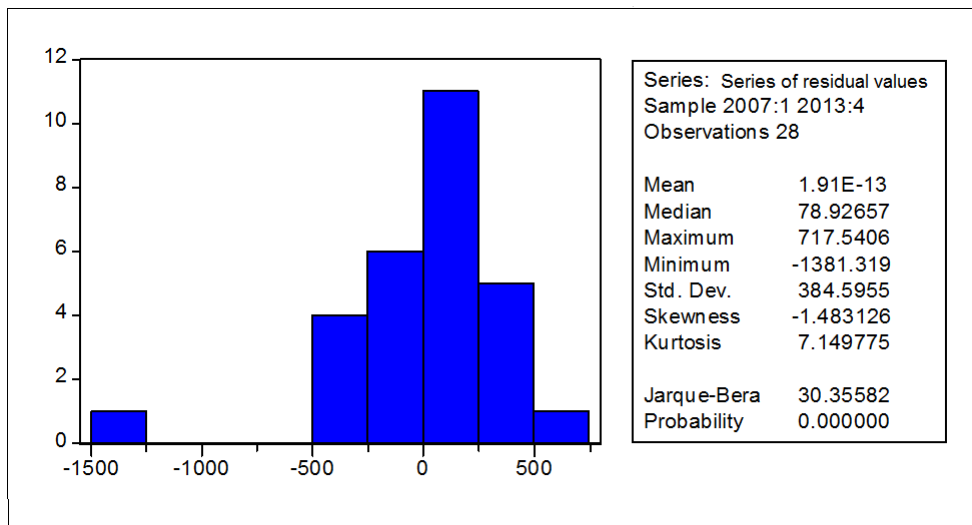


Figure 3. Statistic description and testing for normality of the distribution of the residual variable (linear model adjusted with quarterly seasonal dummy variables)

Source: own processing.

Calculation and interpretation of the Jarque-Bera Criterion shows that the series of residuals are not distributed normally, fact that alters the viability of the model (the null hypothesis is rejected). Inside the box in Figure 3, the Jarque-Bera statistic coefficient has a value of 30.35582, for

which a probability of 0.0000 is recorded as argument for accepting the null hypothesis under the law of distribution χ^2 with 2 degrees of freedom.

Consequences of non-normality of the distribution of errors are: estimators of the model parameters do not have the property of maximum likelihood; the t -statistic (Student) test applied to analyze the significance of estimators (coefficients) of the model has a distorted representation.

Analysis of the residual values series based on their arrangement in relation to the average estimate error, $\hat{\sigma}_{x,y} = \pm 416,6987$, and with the origin allows us to see that there is no convenient alternation to assess the non-autocorrelation status. The conclusion made is supported by the value of the Durbin-Watson statistic coefficient, which as shown in the overview (see table no. 4) is equal to 0.889971 certifying the autocorrelation status of the residuals.

The information provided by the Durbin-Watson coefficient has additional significance in this case because it is considered that no full relevance econometric model has a parameter-free period (ratio) distinct, marking the ordinate origin.

The information provided by the *Durbin-Watson coefficient* has additional significance in this case because it is considered that there is no full relevance, and the econometric model has no distinct free-term parameter (ratio), marking the ordinate at origin.

Table 5

Augmented Dickey-Fuller test statistic synoptic panel

Null Hypothesis: D(Overnight stays) has a unit root				
Exogenous: Constant				
Lag Length: 2 (Automatic based on SIC. MAXLAG=8)				
			t -Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-27.45019	0.0001
Test critical values:	1% level		-3.737853	
	5% level		-2.991878	
	10% level		-2.635542	
*MacKinnon (1996) one-sided p -values.				
Augmented Dickey-Fuller Test Equation				
Dependent Variable: D(Înnoptări.2)				

Method: Least Squares				
Sample (adjusted): 2008:1 – 2013:4				
Included observations: 24 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Overnights (-1))	-3.885765	0.141557	-27.45019	0,0000
D(Overnights (-1).2)	1.931945	0.088591	21.80757	0,0000
D(Overnights (-2).2)	0.953337	0.063905	14.91812	0,0000
C	-47.12125	105.7567	-0.445563	0,6607
R-squared	0.985162	Mean dependent var		12.06958
Adjusted R-squared	0.982936	S.D. dependent var		3965.466
S.E. of regression	517.9987	Akaike info criterion		15.48883
Sum squared resid	5366453.	Schwarz criterion		15.68518
Log likelihood	-181.8660	F-statistic		442.6346
Durbin-Watson stat	1.270534	Prob (F-statistic)		0.000000

Source: own processing

Based on the results presented in the *Synoptic Panel of the White Heteroskedasticity Test* (Table 6) we can conclude that the residual variable is not heteroscedastic (rejecting the hypothesis of heteroscedasticity) and therefore the residual variable is homoscedastic, the dispersion of the residual variable is constant. This conclusion is validated both under *F* Criterion and the χ^2 Criterion, significance thresholds justifies rejecting the hypothesis of heteroscedasticity due to the fact that they exceed the maximum permissible limit of 5%.

Table 6

*White Heteroskedasticity Test Synoptic Panel
(linear model with dummy variables for quarterly seasonality)*

White Heteroskedasticity Test:			
F-statistic	0.801071	Probability (significance threshold)	0.609212
Obs*R-squared	7.062178	Probability (significance threshold)	0.529939
Test Equation: Dependent Variable: RESID^2			
Method: Least Squares (Metoda celor mai mici pătrate)			
Sample: 2007:1 2013:4; Included observations: 28			

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-235589.7	396943.4	-0.593510	0,5598
D_1	136279.8	426981.6	0.319170	0,7531
D_1*t	37076.94	37299.49	0.994034	0,3327
D_2	118770.3	429256.0	0.276689	0,7850
D_2*t	38289.85	39551.95	0.968090	0,3452
D_3	512237.2	434690.0	1.178397	0,2532
D_3*t	36867.29	41836.40	0.881225	0,3892
D_4*t	47795.08	44147.87	1.082614	0,2925
t^2	-1443.007	1266.027	-1.139791	0,2685
R-squared	0.252221	Mean dependent var		142631.0
Adjusted R-squared	-0.062634	S.D. dependent var		360197.6
S.E. of regression	371306.5	Akaike info criterion		28.74254
Sum squared resid	2.62E+12	Schwarz criterion		29.17074
Log likelihood	-393.3955	F-statistic		0.801071
Durbin-Watson stat	2.074377	Prob (F-statistic)		0.609212

Source: own processing

The graphical representation in Figure 4 illustrates the viability of the model by means of an arrangement of the estimates of the number of overnights certified by Theil's inequality index with a value lower than the 5% restrictive limit ($Th = 4.42\%$). It also highlights the confidence interval in which every value is positioned, based on an estimate of the limit or maximum allowable error under a statistical certification probability for intervals of 95%. In this case the critical value t was used, $t = \pm 2,069$ which follows a Student distribution.

Note: *The limit error required to estimate the confidence interval of the number of overnight stays is the product of probability factor (critical value $\pm t = \pm 2,069$) and the estimate of the average error corrected of the trend equation adjusted with the seasonality factor represented by dummy variables, as follows:*

$$\Delta = \pm t_{q = 0.05; f = n - k = 28 - 5 = 23} \cdot \hat{\sigma}_{y; \hat{y}} = \pm 2.069 \cdot 416.6987.$$

Limitele intervalului de încredere în care se poziționează nivelurile estimate ale numărului de înnoptări sunt calculate astfel:

$$\text{Limita superioară: } ls = y + 2,069 \cdot 416,6987$$

$$\text{Limita inferioară: } li = y - 2,069 \cdot 416,6987$$

The limits of the confidence interval in which the positions of the estimated number of overnight stays are calculated as follows:

$$\text{Upper limit: } ls = y + 2.069 \cdot 416.6987$$

$$\text{Lower limit: } li = y - 2.069 \cdot 416.6987 .$$

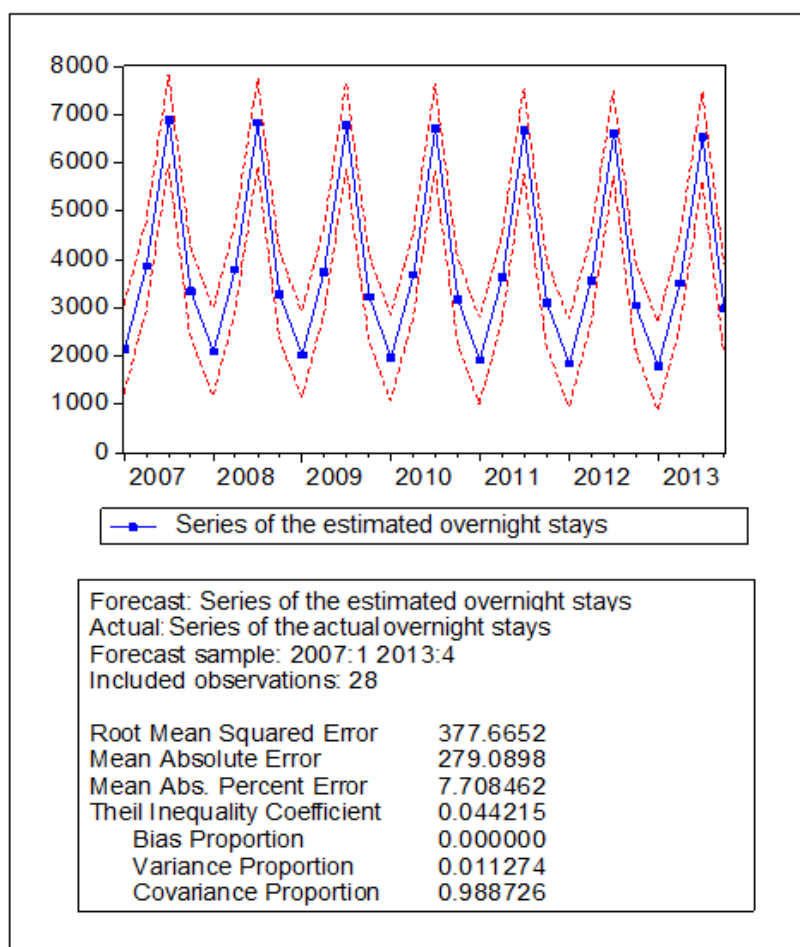


Figure 4. Graphical representation of the estimated levels of the number of overnight stays and limits that fall within the terms of $\pm 2,069$ estimates of the average error of the trend equation (based on the Student distribution law with bilateral significance threshold arrangement) for a significance level of 5% and 23 degrees of freedom

$$(\pm t_{q=0.05; f=n-k=28-5=23} \cdot \hat{\sigma}_{x;y} = \pm 2.069 \cdot 416.6987)$$

Source: own processing

3.1.b. Calculation and graphic representation of the econometric indicators in parabolic general trend variant using dummy variables quarterly seasonality

In the case of the model represented by parabolic general tendency with dummy variables of quarterly seasonality, the digital dimension of the parameters of the agreed tendency equation is estimated by the method of least squares [9], and the resulting values are presented in the synoptic panel of econometric representation indicators.

The system of equations used for this purpose is:

$$\left\{ \begin{array}{l} \Sigma D_1 x = a_1 \Sigma D_1^2 + a_2 \Sigma D_1 D_2 + a_3 \Sigma D_1 D_3 + a_4 \Sigma D_1 D_4 + b \Sigma D_1 t + c \Sigma D_1 t^2 \\ \Sigma D_2 x = a_1 \Sigma D_1 D_2 + a_2 \Sigma D_2^2 + a_3 \Sigma D_2 D_3 + a_4 \Sigma D_2 D_4 + b \Sigma D_2 t + c \Sigma D_2 t^2 \\ \Sigma D_3 x = a_1 \Sigma D_1 D_3 + a_2 \Sigma D_2 D_3 + a_3 \Sigma D_3^2 + a_4 \Sigma D_3 D_4 + b \Sigma D_3 t + c \Sigma D_3 t^2 \\ \Sigma D_4 x = a_1 \Sigma D_1 D_4 + a_2 \Sigma D_2 D_4 + a_3 \Sigma D_3 D_4 + a_4 \Sigma D_4^2 + b \Sigma D_4 t + c \Sigma D_4 t^2 \\ \Sigma t x = a_1 \Sigma t D_1 + a_2 \Sigma t D_2 + a_3 \Sigma t D_3 + a_4 \Sigma t D_4 + b \Sigma t^2 + c \Sigma t^3 \\ \Sigma t^2 x = a_1 \Sigma t^2 D_1 + a_2 \Sigma t^2 D_2 + a_3 \Sigma t^2 D_3 + a_4 \Sigma t^2 D_4 + b \Sigma t^3 + c \Sigma t^4 \end{array} \right.$$

It follows that the analytical form of the statistical regularity of the number of overnight stays of Romanian tourists in quarters, from the period 2007-2013, in the parabolic general trend variant with dummy variables of quarterly seasonality [10] will be:

$$y = (2730.117867 D_1 + 4469.054664 D_2 + 7527.167052 D_3 + 3972.267032 D_4) - 130.9878785 t + 4.020061237 t^2$$

Table 7

*Synoptic panel of econometric representing indicators
(econometric model of the statistical series representation of the number of overnight stays by using dummy variables on a quarterly seasonality on a parabolic general trend)*

Dependent Variable: Overnight stays				
Method: Least Squares				
Sample: 2007:1- 2013:4 ; Included observations: 28				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D_1 Q1 „ a_1 ”	2730.118	225.6260	12.10019	0,0000
D_2 Q2 „ a_2 ”	4469.055	230.8106	19.36243	0,0000
D_3 Q3 „ a_3 ”	7527.167	234.6959	32.07200	0,0000
D_4 Q4 „ a_4 ”	3972.267	237.3459	16.73620	0,0000
„ b ”	-130.9879	32.43468	-4.038513	0,0005
„ c ”	4.020061	1.084778	3.705884	0,0012
R-squared	0.972851	Mean dependent var		3882.854
Adjusted R-squared	0.966681	S.D. dependent var		1831.483
S.E. of regression	334.3088	Akaike info criterion		14.64942
Sum squared resid	2458772	Schwarz criterion		14.93489
Log likelihood	-199.0918	Durbin-Watson stat		1.436676

Source: own processing.

The synoptic panel of the econometric representing indicators (Table 7) exposes the estimate average error of the parabolic trend equation corrected by applying quarterly seasonality dummy variables, in absolute, which is calculated as follows [11]:

$$\hat{\sigma}_{x;y} = \sqrt{\frac{\sum(x_i - y_i)^2}{n - k}} = \sqrt{\frac{2458772}{28 - 6}} = \sqrt{111762,363 \ 6} = \pm 334.3088$$

thousand days - tourists

where "n" is the number of observations = 28, and the constant "k" is the number of parameters in the equation of parabolic trend corrected by applying quarterly seasonality dummy variables = 6.

To assess the viability of the econometric model based on the average error estimate of the equation trend corrected by applying dummy variables, the mean error estimate is calculated in *relative expression*:

$$\hat{V}_{x \cdot y} = \frac{\hat{\sigma}_{x; y}}{\bar{x}} \cdot 100 = \frac{334.3088}{3882.854} \cdot 100 = 8.61\%$$

This indicator expresses therefore the "power" of the econometric model, when used in extrapolating or forecasting calculations. In principle, it is considered an estimate of the average relative error of a very good value when positioned within a maximum of 10%.

A similar significance indicator is "Theil's coefficient of inequality" which sustains the viability of the model because it has a value (Th = 3.4667% – Figure 7) not exceeding the 5% threshold considered sufficiently restrictive to justify using the model to calculate the estimate of the number of overnight stays in future time segments.

The residual values series shows an arrangement in relation to the average error estimate of the regression equation $\hat{\sigma}_{x; y} = \pm 334,3088$, and to the origin of which follows a certain alternation which confirms that this variable is affected by a phenomenon of autocorrelation. The conclusion made is supported by the value of the Durbin-Watson statistic coefficient, which as shown in the overview (see Table 7) is equal to 1.436676, attesting the non-autocorrelation status of the residuals.

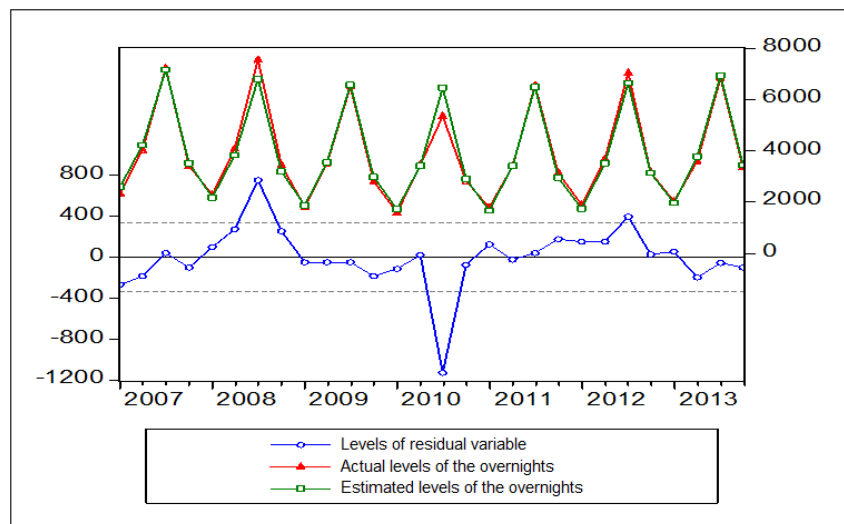


Figure 5. Graphical representation of the number of overnight stays (actual data, estimated data based on parabolic model with dummy variables for quarterly seasonality term residual values).

Source: own processing

A useful information points to the graphical representation in Figure 5, in which the chronographs of the actual number of overnight stays and those of estimated levels based on parabolic model with quarterly seasonality dummy variables have overlapping shapes, which induces the viability assessment for the econometric model [12]. The graph also displays the chronographs of the values of the error (residual) term, reproducing the error interval in Table 10. Residuals are compared with the limits marked by an estimate of the average error of the parabolic trend equation corrected by applying quarterly seasonality dummy variables, $\hat{\sigma}_{x,y} = \pm 334.3088$ thousand overnights.

The graph in Figure 5 highlights three residue marker points are that stand out of the bounds represented by a mean estimate of error, but not positioned outside the limits defined by error or maximum permissible limit established under the Student distribution law by taking into consideration the value of the critical factor (probability) relating to a significance threshold of 5% and 22 degrees of freedom. Limit error is therefore defined as: $\pm t_{q=0.05; f=n-k=28-6=22} \cdot \hat{\sigma}_{x,y} = \pm 2.074 \cdot 334.3088$.

The graphic representation in Figure 6 shows the histogram of the residuals and the box next to the chart presents the statistical indicators that describe the series of the residual term values: mean, median [13], maximum and minimum value, standard deviation estimate, statistic coefficients of asymmetry (Skewness) and vaulting / flattening (Kurtosis), as well as Jarque-Bera statistic coefficient to which is associated the probability of attesting the normal shape of the compliance of the distribution of residues with the normal distribution law.

The "Jarque-Bera criterion" provides information that the series of residues of the parabolic model with quarterly seasonality dummy variables is not normally distributed, because the probability associated to the statistical Jarque-Bera coefficient (JB = 50.53875) is 0.00000 under the distribution law, χ^2 with two degrees of freedom.

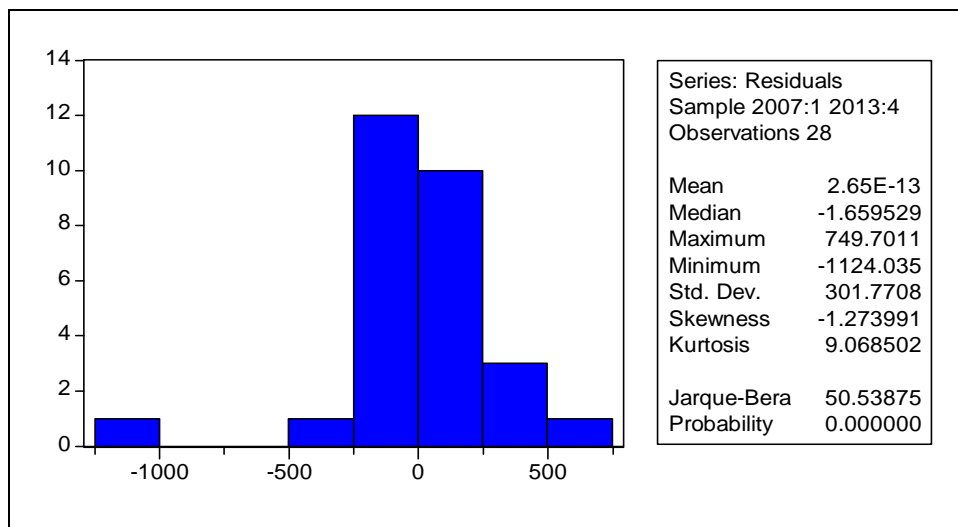


Figure 6. Statistical description and test for normality of the distribution of the residual variable (parabolic model with dummy variables for quarterly seasonality).

Source: own processing

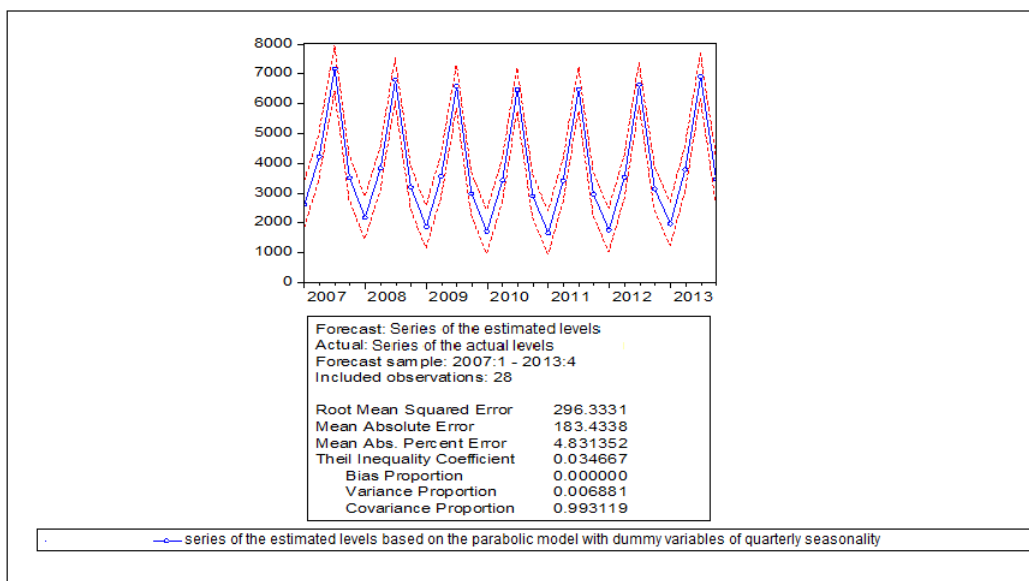


Figure 7. Graphical representation of the estimated levels of the number of overnight stays and limits that fall within the terms of the ± 2.074 estimates of the average error of the trend equation (by the Student distribution law with bilateral arrangement of the significance threshold) for a significance threshold of 5% and 22 degrees of freedom

$$(\pm t_{q=0.05; f=n-k=28-6=22} \cdot \hat{\sigma}_{x;y} = \pm 2.074 \cdot 334.3088).$$

Source: own processing

To test the state of heteroscedasticity / homoscedasticity of the residuals, the White test was used. Results in the *Synoptic panel of White Heteroskedasticity Test* (Table 8) certify that the residual variable is not heteroscedastic (rejecting hypothesis of heteroscedasticity) and therefore the residual variable is homoscedastic. In these conditions the residual variable dispersion is constant. The conclusion is validated both under **f-Criterion** and the χ^2 **Criterion**, the significance thresholds of 70.1611% and 57.5497% justify the rejection of the hypothesis of heteroscedasticity as exceeding the maximum permissible limit, which is 5%.

Table 8

*Synoptic panel of White Heteroskedasticity Test
(parabolic model with dummy variables for quarterly)*

White Heteroskedasticity Test:				
<i>F</i> -statistic	0.742002	Probability threshold	(significance)	0.701611
Obs* <i>R</i> -squared	11.42216	Probability threshold	(significance)	0.575497
Test Equation:				
Dependent Variable: RESID ²				
Method: Least Squares				
Sample: 2007:1 - 2013:4 ; Included observations: 28				
Variable	Coefficient	Std. Error	<i>t</i> -Statistic	Prob.
C	32396.96	615300.1	0.052652	0,9588
<i>D</i> ₁	68953.28	563146.1	0.122443	0,9043
<i>D</i> ₁ * <i>t</i>	-43969.70	160496.4	-0.273961	0,7881
<i>D</i> ₁ * <i>t</i> ²	6890.412	22390.35	0.307740	0,7628
<i>D</i> ₂	86257.98	555933.3	0.155159	0,8789
<i>D</i> ₂ * <i>t</i>	-45070.35	173983.1	-0.259050	0,7994
<i>D</i> ₂ * <i>t</i> ²	6898.907	22730.22	0.303513	0,7660
<i>D</i> ₃	-203684.3	568334.8	-0.358388	0,7254
<i>D</i> ₃ * <i>t</i>	71300.61	182721.9	0.390214	0,7023
<i>D</i> ₃ * <i>t</i> ²	2748.247	22849.43	0.120276	0,9060
<i>D</i> ₄ * <i>t</i>	-26081.02	186513.9	-0.139834	0,8908
<i>D</i> ₄ * <i>t</i> ²	6174.445	22751.45	0.271387	0,7901
<i>t</i> * <i>t</i> ²	-404.7532	1152.928	-0.351066	0,7308
<i>t</i> ⁴	7.793182	19.72179	0.395156	0,6987
<i>R</i> -squared	0.407934	Mean dependent var		87813.29
Adjusted <i>R</i> -squared	-0.141841	S.D. dependent var		254011.8
S.E. of regression	271429.2	Akaike info criterion		28.16764
Sum squared resid	1.03E+12	Schwarz criterion		28.83375
Log likelihood	-380.3470	<i>F</i> -statistic		0.742002
Durbin-Watson stat	2.039575	Prob (<i>F</i> -statistic)		0.701611

Source: own processing

3.2. Interpretation of econometric representation indicators and conclusions on the model viability assessment

Calculations allow us to appreciate that the model built on a parabolic general trend equation corrected with dummy variables of quarterly seasonality statistically has a more convincing support than the linear model.

Therefore the model considered as sufficiently reliable analytical expression of the dynamics of the number of overnights spent in the period 2007-2013 is:

$$y = (2730.117867 D_1 + 4469.054664 D_2 + 7527.167052 D_3 + 3972.267032 D_4) - 130.9878785 t + 4.020061237t^2.$$

In support of that assessment are the following results:

1. Under the ***t-Criterion***, the parameters of the general trend equation of parabolic shape adjusted with dummy variables of quarterly seasonality have had values significantly different from zero. Checking the null hypothesis of each parameter is assessed by thresholds lower than 5% and is therefore invalidated.

By this finding it is concluded that the model was correctly specified and the trend equation parameters show good efficiency when used for the calculation of forecasts. However there is a certain moderation on the correctness of that conclusion since the error distribution does not have the statistical confirmation of formal similarity with normal distribution based on the Jarque-Bera statistical criterion (Figure 6).

In case of the linear model with dummy correction the statistical quality of being significantly different from zero of the "*b*" parameter for which the significance threshold is 15.69% is refuted on ***t-Criterion***, well above the limit of 5% and thus the null hypothesis is accepted.

2. In the context of the analysis of the dynamics of the number of overnight stays, the Durbin Watson statistic coefficient is irrelevant because the econometric model has no distinct parameter (coefficient) marking the ordinate at origin.

3. The relative expression of the standard error estimate of the equation of parabolic trend with dummy variables quarterly seasonally adjusted in relation to the average number of overnight stays is 8.61%, a suitable value, positioned below the 10% required to considered viable model.

4. Theil's irregularity (inequality) coefficient reconfirms by its value, $Th = 3.4667\%$, the conclusion offered in the form of relative standard error of the estimate equation parabolic trend adjusted with quarterly seasonally dummy variables, the econometric model is viable, properly formalizing the evolution and trend of the number of overnight stays.

In the case of the linear model with dummy correction, Theil's irregularity (inequality) coefficient has a higher value ($Th = 4.4215\%$) compared with parabolic correction dummy model, which ensures a better statistical viability of the latter.

5. The White test confirms the stationary state of the dynamic series and thus sustaining the viability of model, the residual variable is homoscedastic, which will ensure the calculation an efficient estimate of the number of overnights levels that will be recorded in future time segments.

6. The Augmented Dickey-Fuller statistical test also indicates that the error associated to rejecting the hypothesis that the overnights series has a unit root, is 0.01% , lower than the standard threshold of 5% . In these circumstances it supports the hypothesis that the *series is stationary*.

7. The statistical test that propagates a particular vulnerability to the parabolic model with dummy correction is the test for normality of distribution of the residual variable, the Jarque-Bera criterion. This test provides information that the residues series is not normally distributed which alters the viability of the model.

Calculating the estimated number of overnight stays for 2014

The econometric model represented by the equation

$$y = (2730.117867 D_1 + 4469.054664 D_2 + 7527.167052 D_3 + 3972.267032 D_4) - 130.9878785 t + 4.020061237t^2$$

has the statistical confirmation of viability to provide decision makers the scientific basis for the operation of forecasting calculations.

In these circumstances the probable levels of the number of overnight stays is estimated, by quarters in 2014.

The estimate required will be assessed by calculating a confidence interval guaranteed with a 95% probability (the significance threshold, $q = 5\%$, is distributed bilaterally), under the Student distribution law, as the number of observations (n) is less than 40.

The limit error estimate that we will be taking into account for estimating the confidence interval is expressed in thousand overnight stays and has the following value:

$$\Delta = \pm t_{q = 0.05; f = n - k = 28 - 6 = 22} \cdot \hat{\sigma}_{y; \hat{y}} = \pm 2.074 \cdot 334.3088 = \pm 693.3564512$$

Note: The critical value of *t*-tabulated = $\pm 2,074$ is extracted from the table of Student distribution function values, for a significance level of 5% – arranged bilaterally – and 22 degrees of freedom.

– Punctual value estimated for the 1st quarter of 2014 (2014:1):

$$y = (2730.117867 D_1 + 4469.054664 D_2 + 7527.167052 D_3 + 3972.267032 D_4) - 130.9878785 \cdot 29 + 4.020061237 \cdot 29^2 = 2312.340891 \text{ thousand overnights}$$

– Punctual value estimated for the 2nd quarter of 2014 (2014:2):

$$y = (2730.117867 D_1 + 4469.054664 D_2 + 7527.167052 D_3 + 3972.267032 D_4) - 130.9878785 \cdot 30 + 4.020061237 \cdot 30^2 = 4157.473422 \text{ thousand overnights}$$

– Punctual value estimated for the 3rd quarter of 2014 (2014:3):

$$y = (2730.117867 D_1 + 4469.054664 D_2 + 7527.167052 D_3 + 3972.267032 D_4) - 130.9878785 \cdot 31 + 4.020061237 \cdot 31^2 = 7329.821667 \text{ thousand overnights}$$

– Punctual value estimated for the 4th quarter of 2014 (2014:4):

$$y = (2730.117867 D_1 + 4469.054664 D_2 + 7527.167052 D_3 + 3972.267032 D_4) - 130.9878785 \cdot 32 + 4.020061237 \cdot 32^2 = 3897.197627 \text{ thousand overnights}$$

The lower limit of the confidence interval of the predicted value of the number of overnight stays for each quarter of 2014 is obtained by subtracting from the punctual value the estimated limit error and the upper limit of the confidence interval of the projected value is obtained by adding to the punctual value the limit error estimation.

Thus, the performed calculations define a possible interval in which the number of overnight stays will fall for each of the quarters of 2014.

4. Conclusions

Following this analysis it appears that the stream of Romanian tourists is positioned on an upward trend at the end of 2013 with real growth prospects in the coming years. This tourist flow demonstrates the ability of the national economy to attract and ensure internationally competitive conditions in particular against neighboring tourist areas. The sustainability of tourism activities is given by the desire of each individual to do something new, to visit new areas, together with the improvement of the infrastructure and the behavior of service providers. One can see the tendency to offer tourist services as complex and qualitatively superior as possible, customized for every tourist in part, as secure basis for attracting new investment in this sector. This sector has become in the last decade one that has contributed to increasing GDP per capita and welfare of the entire population including job growth.

Diversification of travel options linking leisure with the development of knowledge of history and culture, with support for the increasing interest in health services provides broad prospects for enhancing tourism activities.

Policies and European standards focused on innovation emphasize the need for adaptability of travel services according to market demands based on traditions and preferences particular to each group of tourists and education of each population group in this respect will lead in fact to the creation of equal opportunities and prospects in this sector.

The study gives reliable information for decision-makers within the meaning of the mobilization effort for the development of material and human factor competitiveness.

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STOCK PRICE DYNAMICS AT THE MARKET CRASHES

Rodion REMOROV*

Abstract. *The time dependence of the stock price was analyzed during the major stock market crashes from beginning of the Wall Street Crash 1929 to the recent financial crises. It was shown that the stock price dynamics during the stock market crisis is extended by two consequent processes. For the first process during the macroeconomic crisis, a selling-off decision of the investors is driven by the pessimistic investor sentiments. In this case, the daily stock price is inversely proportional to the trading period of the stock price decline. For the second process, the market crash or sharp price decline is explained by the herd behaviour process, for which new information of the stock price decline may cause the next initiation of new selling-off of the shares. The proposed model is confirmed by the observations of the stock price decline of Enron, Citigroup, AIG and so on.*

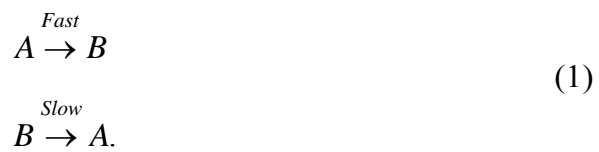
Keywords: *market crash, kinetic models, stock price dynamics, herd behaviour.*

1. Introduction

The panic crowd behaviour of investors was impressively presented in the scientific, documentary, and fiction literature. The stock market crashes ideally describe the phenomena of herd behaviour for the market disequilibrium through the social interactions between market participants. The market disequilibrium is explained by a wide range of quantitative and qualitative models. Economists graphically explain market disequilibrium as an excess of the supply or demand. In contrast to the market disequilibrium, the market equilibrium concept plays a key role in the Efficient Markets Hypothesis (EMH) as a random walk of the stock price return. The assumption of the random walk of the return movement was suggested more than 100 years ago by Bachelier in 1900 [1]. Stock returns were considered as a series of independent "shocks", which, by the Central Limit theorem, leads to the Gaussian distribution of returns. The EMH assumes that market participants possess homogeneous information, and therefore the hypothesis can be applied in limited real-life settings.

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The most interesting model approach of the stock market crash was presented by the Catastrophe Theory. The Catastrophe Theory was developed by Thom (1960) [2] and by Zeeman (1974) [3, 4]. The Catastrophe Theory represents a universal approach for the empirical modeling of the non-equilibrium dynamics in social and biological systems. By analogy with the chemical processes, Zeeman tried to describe the non-equilibrium dynamics as a competition between fast and slow processes with application of the differential equations for the simulations of the disequilibrium:



According to Zeeman's approach, the rate of change was regarded as the dependent variable:

$$J = \frac{dI}{dt}, \quad (2)$$

where J is the rate of change, I is the Dow-Jones index. $J > 0$ and $J < 0$ represents bullish and bearish market, respectively. From the Catastrophe Theory, the variable I follows by equation

$$\frac{dI}{dt} = -\frac{d\Psi(I)}{dt}, \quad (3)$$

where $\Psi(I)$ is the potential function. In the case of $\frac{d\Psi(I)}{dt} = 0$, the system moves toward an equilibrium state. The detailed application of the potential function was described by Trotman and Zeeman [5], and Wagenmakers et al [6]. The catastrophic theory was also implemented by Pruden and Miler in 2005 for the technical analysis for the stock price forecast [7].

Barunik and Vosvrda [8] developed a cusp catastrophe model for the stock market with the focus on the stock market crashes. Barunik and Vosvrda showed an interesting application of the bifurcation approach of the catastrophe theory. They demonstrated that using the fitting cusp potential function, the proposed model was able to fit data of the market crash of October 19, 1987; although authors pointed out that it was not true for the US market crash in 2001.

The main drawback of the Zeeman's implication of the catastrophic theory consists in the abstractive approach without taking into account the

macroeconomic factors in the equity market. Zahler and Sussmann pointed out in 1977 [9], that the catastrophe theory is considered by some scientist as the theory with practical limits and unfinished resources. However, some concepts of the catastrophe theory are useful for the development of the model of the stock market disequilibrium.

The Sornette [10] proposes an empirical model, which describes the market crashes through the “bubble” unstable growth of the stock market before the market crisis. The market unstable growth of stock prices was fitted by the mathematical fitting function, which includes the power, logarithm and cosine functions. This fitting function satisfactorily fitted the growth of the SP500 index, Nasdaq, implied volatility, Dow Jones, exchange rates. Kozłowska and Kutner [11] used a Mittag-Leffler fitting function for fitting macroeconomic factors at the market crashes.

Recently, Remorov [12] demonstrated an analytical functional dependence between the stock price and trading volume during market crashes. It was analytically showed that during market crises, trading volume is inversely proportional to the square of the stock price. The model (Remorov [12]) incorporates a mechanism for the share exchange between buyers and sellers while taking into account their cash balances. The model is empirically supported in price and volume data for major recent US stock bankruptcies, including Lehman Brothers Inc, Enron, Wachovia, Washington Mutual, and MF Global.

Many of the study in the literature rely on the empirical studies of time-series dependence of the stock price return using numerous fitting techniques, such as GARCH or AR(1), which allow to fit the various time-dependences for different bullish and bearish market regimes. However, we believe that the application of abstractive fitting functions can not explain the nature of the boom or market crashes. The *time-series dependence of the stock price* during the market crashes has received relatively little attention in the academic literature. There are different contradictive theoretical approaches of the description of the market crashes. In the current paper, we aim to develop the model of the price dynamics in the context of the application of the ordinary differential equations for the description of the dynamic processes. Although the catastrophe model represents an extension to the traditional empirical models (linear regression, VAR models), the simple kinetic approach was presented in the current paper to explain the stock price dynamics at the market crisis. The stock price time dependence during the financial crises is analytically shown taking into account the panic behavioral process through the impact of the public available information.

2. Market Crash Model

By analogy with microstructure model (see, for example, the review of Madhavan [13], Flood [14], Brennan and Subrahmanyam [15]), we assume that the stock price is driven by the interaction between market-makers that leads to the equilibrium between demand and supply quantity. Two groups of shares are considered in the stock shares dynamics: outstanding shares actively traded by market-makers and not-actively traded outstanding shares in inventory or in long-term investment portfolios. The exchange process between two groups of outstanding shares is driven by investors based on the rational and/or irrational behaviour. In contrast to the microstructure model and the Zeeman's implementation of the catastrophe theory (Zeeman [3]), the number of the outstanding shares is assumed as a model variable in the current model rather than the stock price return variable. The proposed variable allows us to apply the kinetic approach using differential equations for the description of the dynamic systems. The application of differential equations for description of the dynamic system is well-known in the diffusion gas-phase kinetics (see, for example, Fick's first law, Adolf Fick (1855) [16]).

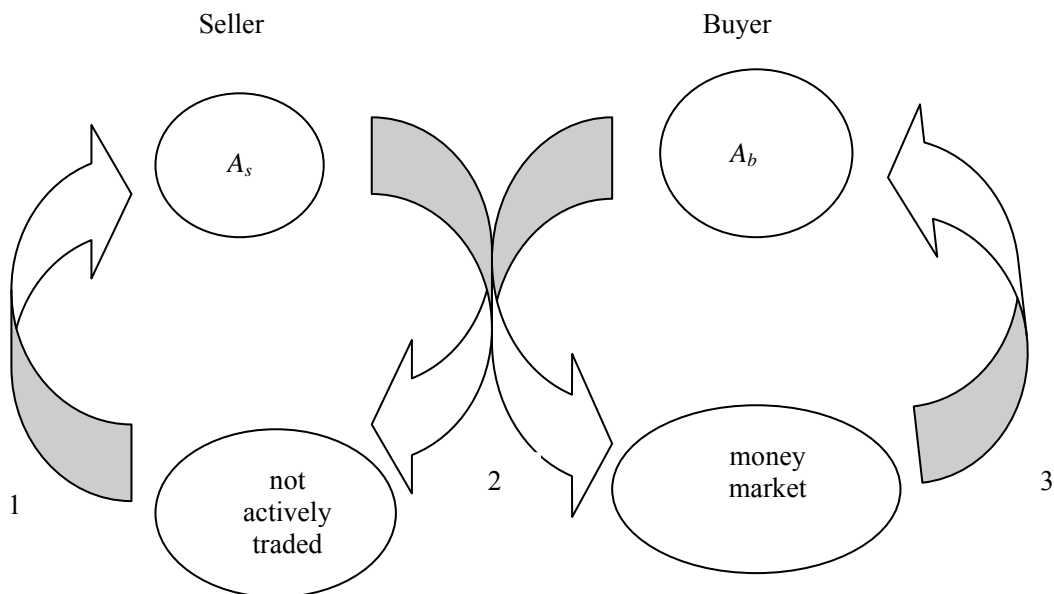


Figure 1. Cash-share exchange scheme.

The trading process can be viewed as an exchange of cash and shares between the market participants. The exchange between buyers and sellers

is driven by different views for the valuation of the shares, with the buyers viewing the shares as undervalued, and the sellers viewing them as overvalued. The cash-shares exchange can be described as cash-share cycle through three main cash-shares flows: the share supply flow for trading ($J_{1,i}$), exchange flow ($J_{2,i}$), cash supply flow for trading or demand flow ($J_{3,i}$). We consider two types of outstanding shares: actively traded outstanding shares or shares for short-term trading and non-actively traded outstanding shares (Remorov (2014)). The schematic diagram of the cash-shares exchange is presented in Figure 1. We assume that the buyer intends to spend C_a in cash on the shares of a particular stock, and values the undervalued stock at P_b . Then we can define his *hypothetical* number of shares as:

$$A_b = \frac{C_a}{P_b}, \quad (4)$$

The number of shares A_s is known for a seller s . The proposed assumption of the hypothetical buyer's shares allows us to apply the interaction between the buyers and shares in the same dimensionality.

According to the proposed kinetic scheme, the cash and share volumes can be estimated by the solution of kinetic equations for each specific group of agents i :

$$\frac{dA_{b,i}}{dt} = J_{3,i} - J_{2,i} \quad (5)$$

$$\frac{dA_{s,i}}{dt} = J_{1,i} - J_{2,i}. \quad (6)$$

For panic market, $J_{1,i} \gg J_{2,i}$; and the rate of total process will be limited by the slow exchange flow $J_{2,i}$.

The proposed kinetic scheme (Equation (5) and (6)) partially supports the kinetic scheme with the asset flow differential equations proposed by Caginalp et al. [17, 18]. Caginalp and collaborators developed a two-state transition model between stock and cash with the transition probabilities of k and $1-k$. Therefore, we may consider that our proposed scheme significantly extends the Cagnilap model with the consideration of interaction between the seller and buyer through the share and cash flow dynamics.

The kinetic scheme of the share-cash exchange can also be applied for the boom market. As can be seen from kinetic Equations (5, 6), the

price growth can be explained by decreasing the share supply flow $J_{1,i}$ or by increasing cash flow $J_{3,i}$. In contrast to the market panic conditions, the boom market is characterized by different buyer's expectations of the stock price.

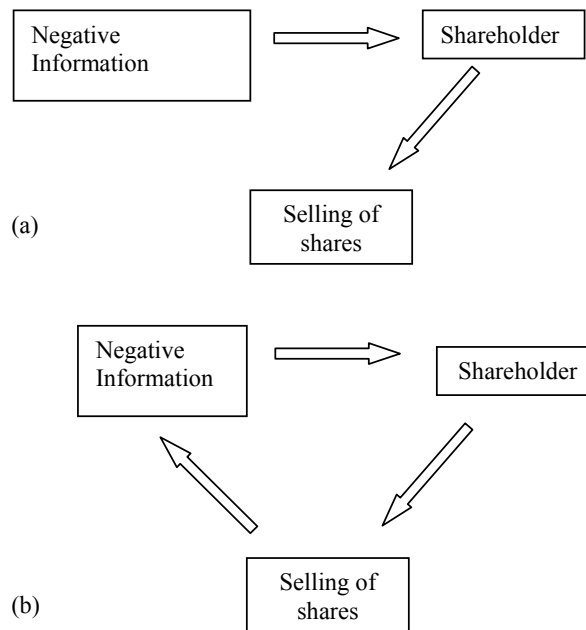


Figure 2. Two information-transfer processes were proposed for the description of the negative information impact on the investors at the market crashes.

Let us consider how the shareholders are accepting the decisions for selling of the shares. The investor's decision for selling of the shares is effected by the negative public information of the company business performance. Two processes are proposed in the current model. The first process describes selling-off of the shares by investors from the public negative information of the business company performance as shown in Figure 2(a), since the negative company-specific information effects the investor's decision to sell their shares from his portfolio. For the first process, the shareholders react according to negative public information without performing using the information from the stock price decline. Hong and Stein [19] supported this assumption suggesting that "(1) firm-specific information diffuses gradually across the investing public; (2) investors cannot perform the rational-expectations tricks of extracting information from prices".

The information impact on investor's opinion is driven by the macroeconomic factors and, in this case of the economic recession, the

stock prices sustainably decline due to the issue of pessimistic public news. Remorov (Remorov, [20]) showed that the number of issued macro-economic news considerably increased during financial crisis. Moreover, the correlation of the number of pessimistic news with VIX index or stock market index (SP500) is sustainably high for stock market crisis. Thus, we suggest that the growth of the selling shares is controlled by the information-impact process, i.e. investor's decision is controlled by the appearance of the negative information, and, if the shareholder have almost similarity in the "herd" panic decision for selling, the growth of the selling shares is proportional to the probability of the share selling per unite of time. Therefore, the growth of the number of shares for selling is expressed by equation (for the panic market conditions, $J_{1,i} \gg J_{2,i}$):

$$\frac{dA_s}{dt} = J_{1,i} - J_{2,i} \approx J_{1,i} = k_i \quad (7)$$

where A_s is the number of selling shares, k_i is the information-impact probabilistic rate, which defines the impact of the negative information. For hypothesis test, the information-impact rate was assumed constant. The information-impact rate depends on the number of shareholders, number of brokers, trading system (order-driven market), outstanding shares. Caginalp and Balinoch [17] also applied the constant rates in the model of the money flows with application of the ordinary differential equations. The solution of Equation (7) is

$$A_s(t) - A_s(t_0) = k_i(t - t_0). \quad (8)$$

Using the ratio $A_s(t) = C / P(t)$, where $P(t)$ is stock price, C is the cash volume. Remorov [12] empirically showed that that the cash volume is stable in cash-share cycle during market crisis, i.e. $C \approx const$. The dependence between stock prices and the trading time has the form:

$$\frac{1}{P(t)} - \frac{1}{P(t_0)} = \frac{k_i}{C}(t - t_0). \quad (9)$$

The negative information from selling of shares can affect the investor's decision of share selling, since the new information of the stock price decline may cause the next initiation of the new share selling. Therefore, the information-impact process from the price decay is the cycle chain process, see Figure 2(b). The reflexivity model of George Soros [21] also supports this cycle chain process. The second process exhibits the "snowfall" effect of the growth of the selling shares. Combining two

process (a) and (b), Figure 2, the share growth rate will be proportional to the selling shares:

$$\frac{dA_s}{dt} = k_i + k_c A_s \quad (10)$$

where k_c is the probabilistic parameter, which describes the chain process. Using $C \approx const$, the solution of Equation (10) is:

$$\frac{1}{P(t)} = \left(\frac{k_i}{Ck_c} + \frac{1}{P(t_0)} \right) \exp(k_c(t - t_0)) - \frac{k_i}{Ck_c}. \quad (11)$$

Thus, stock price dynamics of the herd behaviour can be described by two different process: one process is effected by the negative public information and does not depends on the information of the stock price decline, Equation (9); the second process includes the contribution from both the negative public information and the information of the stock price decline, Equation (11).

Empirical Tests of Stock Price Dynamics at the Market Crashes

The time dependences of the stock price at the panic market conditions were tested using daily stock price data for US stock market crashes. Following market data was used for the empirical test: Dow Jones (1929), Enron (2001), Lehman Brothers Inc (2007), Wachovia (2008), Washington Mutual (2008), Citigroup Inc. (2008), AIG (2008). We used daily historic data of the stock prices of the large companies during the period of its respective collapse, i.e. stock price data was selected for period of the stock market crisis, which corresponds the period from the price peak to minimum historical stock prices.

Two formulas from Equations (9) and (11) were used for fitting the stock price decay as the dependence of the inverse price on the trading time:

for slow price decay:

$$\frac{1}{P(t)} = \frac{1}{P(t_0)} + a(t - t_0) \quad (12)$$

and the sharp price decay:

$$\frac{1}{P(t)} = \left(\frac{a}{b} + \frac{1}{P(t_0)} \right) \exp(b(t - t_0)) - \frac{a}{b}. \quad (13)$$

Where a and b are linear and exponential parameters, respectively:

$$a = \frac{k_i}{C} \quad (14)$$

$$b = k_c. \quad (15)$$

Indeed, if we build the graph of the dependence of inverse stock price of Enron in 2001 on the trading time during the stock price decay, the linear dependence of the inverse stock price on time is clearly observed for long period from 01/26/2001 to 10/17/2001 with a high R -squared value of 83%, see Figure 3. From 10/18/2001, the stock price is followed by the exponential stock price decay according to Equation (13). The sharp change in the slope between linear and exponential dependences is explained by issued dramatic news of financial statement report of 1 billion of charges and losses in 10/18/2001 (NyTimes.com: Enron Reports \$1 Billion in Charges and a Loss). Thus, the panic chain process is initiated by critical news, which caused the panic “snowball” effect of selling of the shares.

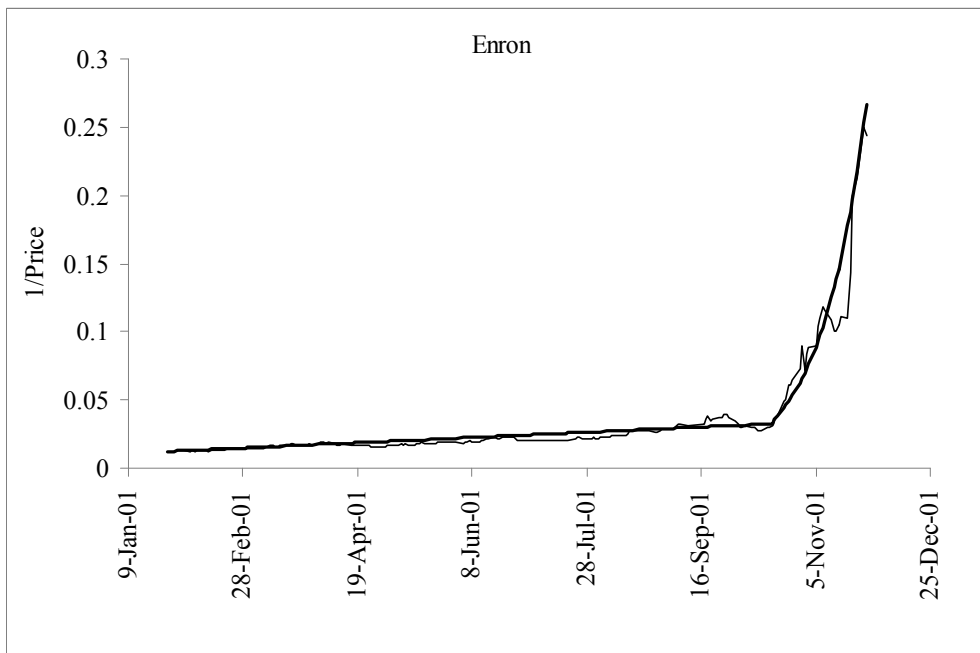


Figure 3. The stock price dynamics during stock market decay in the case of Enron 2001 (Data source: Google Finance). The linear dependence of the inverse stock price on time is observed from 01/26/2001 to 10/17/2001. The exponential decay of the stock price is initiated by dramatic news after 10/17/2001 (NYTIMES, October 17, 2001, "Enron Reports \$1 Billion In Charges And a Loss").

Similar linear and exponential dependences of (1/Price) on time are observed during financial crises for Lehman Brothers Inc. (2007), Wachovia (2008) (Figure 4), Dow Jones (1929) (Figure 5), Citigroup Inc. (2008), AIG (2008) (Figure 6). For all cases, the exponential stock price decay was initiated by the issue of dramatic news of the specific company. Table 1 summarizes the results of the fitting using Equations (12) and (13) for linear and exponential slope parameters a and b with the information of issued dramatic news.

Table 1.
Summary of the regression tests.

Company or Index	Information impact process $a = \frac{k_i}{C}$, (dollar day) ⁻¹	Chain process $b = k_c$, day ⁻¹	Critical News
Lehman Brothers	$1.44 \cdot 10^{-5}$	$9.90 \cdot 10^{-3}$	Reuters, April 29, 2008, "Merrill now in shorts' sights as Lehman crumbles"
Wachovia	$4.17 \cdot 10^{-5}$	$1.09 \cdot 10^{-2}$	Bloomberg, May 6, 2008, "Wachovia Widens First-Quarter Loss 80% on Insurance"
Enron	$7.68 \cdot 10^{-5}$	$4.60 \cdot 10^{-2}$	NYTIMES, October 17, 2001, "Enron Reports \$1 Billion In Charges And a Loss"
Washington Mutual	$1.95 \cdot 10^{-4}$	$9.60 \cdot 10^{-3}$	Bloomberg, June 2, 2008, "Washington Mutual CEO to step down"
Citigroup	$1.75 \cdot 10^{-5}$	$2.01 \cdot 10^{-2}$	Reuters, Dec 10, 2008, "Citigroup's Egg fined over insurance sales"
AIG	$8.72 \cdot 10^{-6}$	$1.23 \cdot 10^{-2}$	Reuters, Sep 16, 2008, "AIG struggles to survive financial tsunami"
Dow Jones 1929	$7.80 \cdot 10^{-6}$	$1.72 \cdot 10^{-2}$	"Black Thursday"

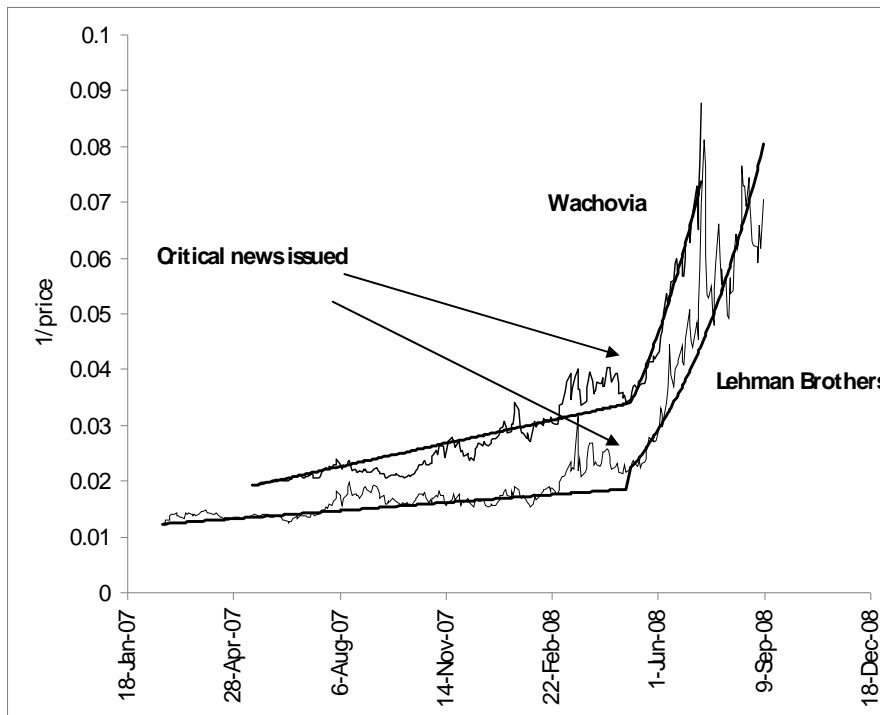


Figure 4. The dependence of inverse price on trading time for Wachovia and Lehman Brothers (Data source: Google Finance). The pattern of the linear and exponential dependence of the inverse stock price on time is observed. The exponential decay of the stock price is initiated by dramatic news.

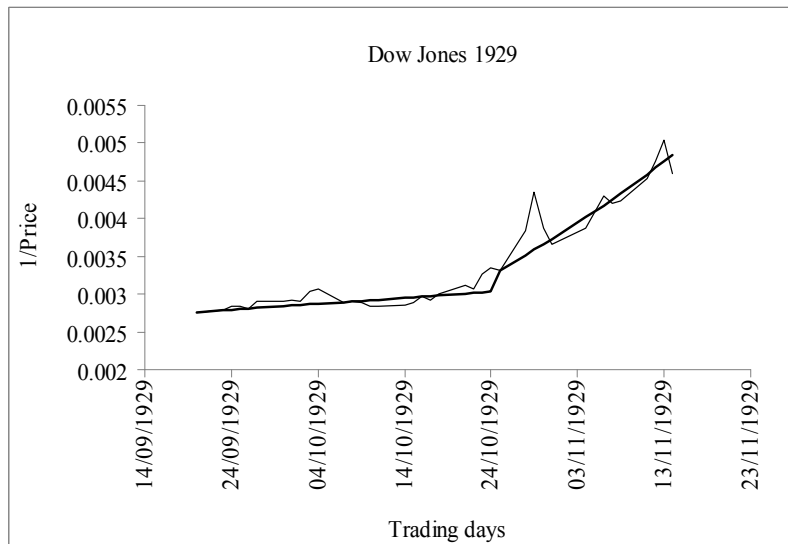


Figure 5. The dependence of inverse price on trading time for Dow Jones 1929 (Data source: Bloomberg). The linear and exponential dependence of the inverse stock price on time is observed.

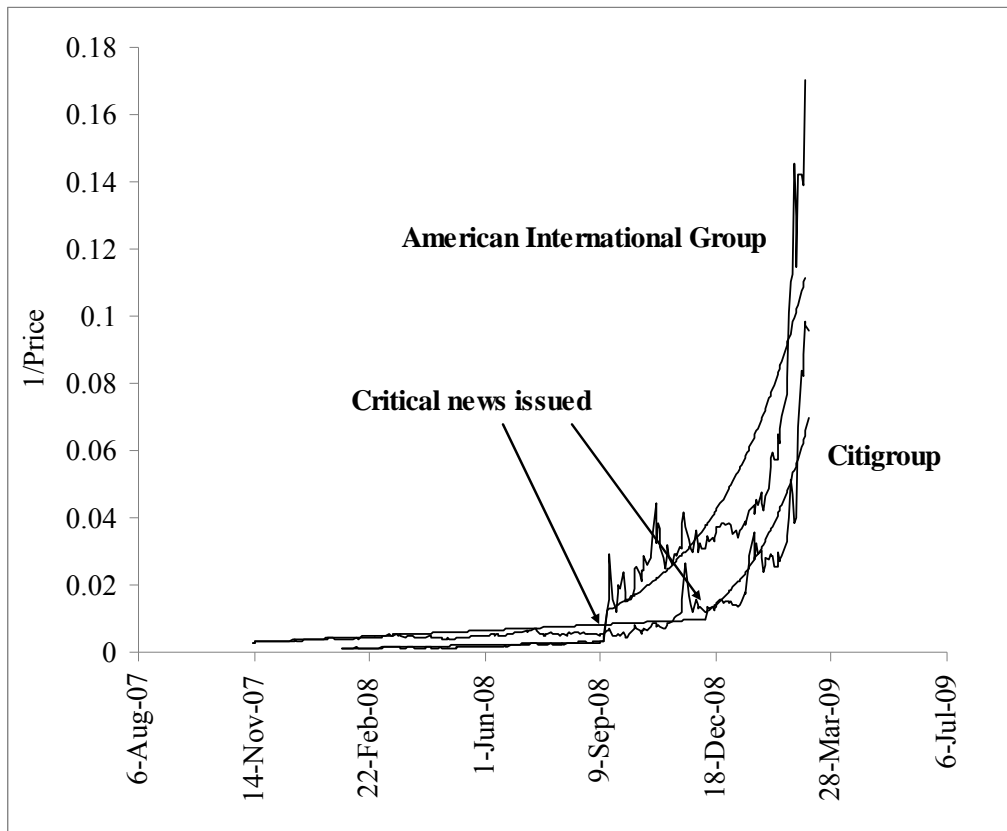


Figure 6. The dependence of inverse price on trading time for American International Group and Citigroup (Data source: Google Finance). The pattern of the linear and exponential dependence of the inverse stock price on time is observed.

3. Discussion

The stock price dynamics was investigated for three financial market crises: 1929, 2001, 2007-2008. The corporations with large capitalization were selected taking into account their credit events. As can be seen from Table 1, the fitting linear and exponential parameters, a and b , are in the short range for 10^{-5} - 10^{-4} (dollar day) $^{-1}$ and 0.01-0.012 day $^{-1}$, respectively. The linear slope parameter $a = \frac{k_i}{C}$ was statistically stable for each cases, therefore the stable linear coefficients confirmed hypothesis of the stable information-impact rates, k_i , of selling of the shares due to the negative public information impact on the investor's decision and does not

depend on the stock price decay information. The empirical result of the stable information-impact rates also supports the Caginalp and Balinovich [17] model of the stock price oscillations.

It is interesting to observe that the probabilistic parameters of the chain process, k_c , are around $\sim 1-2 \cdot 10^{-2} \text{ day}^{-1}$, although market data was taken for different periods: 1929, 2001, 2008. From the estimated rate, k_c , we can suggest that approximately 1-2% of the traded shares during the trading day can cause the snowfall effect, for which the new information of the stock price decline may cause the next initiation of new selling-off of the shares.

The two observed regimes of the stock dynamics empirically proves that the kinetic parameters critically depend on the market conditions. The similar time series dependences were observed for the large American and Canadian banks during financial crisis, such as Bank of Montreal and JP Morgan Chase. The extended results of the observations will be published in future.

Comparison with previous models

Barunik and Vosvrda [8] applied a cusp catastrophe model for the stock market with the focus on the stock market crashes. They observed the bimodality of the two-year return data in 1987 and 2001. In contrast to the cusp catastrophe model developed by Barunik and Vosvrda, we applied the daily traded shares as the model variable rather than the stock price return variable. By analogy with the Catastrophe Theory, the probabilistic parameter k_i is defined from the empirical potential $\Psi(I)$, Equation (3). From the analytical dependence of the stock price and trading period, Equation (9), the potential is linear function of the actively traded shares. For the second process, Equation (11), the potential depends on the square of the number of shares. Thus, we can conclude that the potential function critically depends on the actual market conditions and does not exhibit the stable equilibrium conditions in the case of the market crashes.

The proposed kinetic model significantly expands the two-state transition model developed by Caginalp. Obviously, the presented kinetic scheme may be simplified to the two-state transition model developed by Caginalp. However, the current model better explain the empirical dependence between the trading volume and stock price (Remorov [12]) and the stock price dependence on time. With respect to Econophysics, the proposed kinetic scheme is an analogue of the physical model of the interaction between two types of gases, which have two different energy levels.

The proposed model of the market crash can be used for the stock price modeling at the extreme market conditions. The calibration parameters can easily estimate from historical data as shown in the current article.

4. Conclusion

We presented the simple kinetic approach in the description of the market crashes. The model explains the bankrupt cases and market crashes in the US Market, including Enron (2001) and Dow Jones (1929). We found the characteristic parameters for the description of the stock price dynamics. We showed that the proposed kinetic approach better describes the sharp price decline, when market cannot be controlled by market-makers with respect to the application of different hedging strategies, and when the market-makers are followed by the crowd behaviour process.

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INVESTIGATION OF NONLINEARITY AND CHAOS IN PRIME INDIAN AND AMERICAN STOCK EXCHANGE INDICES

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Abstract. *Indian stock market has a long-term significant association with the behaviour of American stock exchange. The present work is an effort in this direction and the purpose of the present work is to search for any kind of nonlinearity and chaos present in the two prime Indian stock market indices viz. SENSEX and NIFTY and the prime American stock market index DOW-JONES. We have analyzed delay vector variance to identify nonlinearity in these indices. As considerable amount of nonlinearity is observed in the said stock exchange indices, there is a possibility that the time series may have chaotic nature. For that purpose, we have employed 0-1 test, largest Lyapunov exponent and recurrence plot to examine chaotic behaviour of these time series. For the present study we have considered SENSEX close data during the period from 1st January, 1990 to 31st December, 2013, NIFTY close data during the period from 3rd July, 1990 to 31st December, 2013 and DOW-JONES close data during the period from 8th May, 1969 to 31st December, 2013. Study reveals that the all these three stock market indices are nonlinear, stable, deterministic and non-chaotic in nature.*

Keywords: SENSEX; NIFTY; DOW-JONES; DVV analysis; 0-1 chaos test; largest Lyapunov exponent; RQA.

1. Introduction

Prediction in stock markets is a very hard task as the values of the stock exchange indices over time are highly uncertain and depend on heterogeneous parameters. There is no one or two main factors which control share market, various factors collectively control the fluctuation of

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the system. Scaling analysis on the SENSEX, NIFTY and DOW-JONES data suggests that the corresponding Hurst exponent values are 0.56, 0.47 & 0.43 respectively which indicates that SENSEX is persistent (long memory) and NIFTY & DOW-JONES are anti-persistent (short memory) in nature [1-5]. However, the interesting fact is that the present values of the Hurst exponent observed for these said stock exchange indices are not significantly away from 0.5, the mark of randomness. It may indicate a possible presence of hint of randomness and if this happens it certainly adds to the hardness of forecastability for the same. Study also reveals that both SENSEX and NIFTY data are multifractal [6-18] and periodic [19] in nature. These observations point out the possibility of presence of nonlinearity in these time series.

Simple nonlinear dynamical systems may sometimes exhibit a completely unpredictable behaviour, which might seem to be random, despite the fact that they are fundamentally deterministic. Tiny differences in the starting state of the system can lead to enormous differences in the final state of the system even over fairly small timescales. This gives the impression that the system is behaving randomly. This happens even though these systems are deterministic, meaning that their future dynamics are fully determined by their initial conditions with no random elements involved. This behaviour is known as deterministic chaos. A chaotic system designed with infinite degrees of freedom is coined as a stochastically chaotic system. Nonlinearity is necessary condition to chaos. Edward Lorenz and Henri Poincaré were early pioneers of chaos theory, and James Gleick's 1987 book *Chaos: Making a New Science* helped to popularize the field. More recently, computer scientist Christopher Langton in 1990 coined the phrase "edge of chaos" to refer to the behaviour of certain classes of cellular automata [20]. The phrase has since come to refer to a metaphor that some physical, biological, economic, and social systems operate in a region where complexity is maximal, balanced between order, on the one hand, and randomness or chaos, on the other. Chaotic behaviour is also observed in natural systems, such as weather [21]. This may be explained by analysis of a chaotic mathematical model which represents such a system. Quantum chaos investigates the relationship between chaos and quantum mechanics.

There exists a number of methods to analyze nonlinearity in a time series like the method of Kaplan [22], $\delta-\varepsilon$ method [23], the method of Kennel *et al.* [24], correlation exponents [25], deterministic versus stochastic method [26] etc. But all these methods have some serious statistical errors [27]. In our paper, we have applied delay vector variance

(DVV) [28-29] to detect linearity or nonlinearity of the SENSEX close data during the period from 1st January, 1990 to 31st December, 2013, NIFTY close data during the period from 3rd July, 1990 to 31st December, 2013 and DOW-JONES close data during the period from 8th May, 1969 to 31st December, 2013. Next, we have used 0-1 test [30] in the present three indices to examine chaos. We have verified the result calculating largest Lyapunov exponent based on the algorithm described by Rosenstein *et al.* [31]. We have also analyzed complexity of the three time series by studying recurrence plot (RP) and recurrence quantification analysis (RQA) [29, 32-34].

2. Theory

2.1. DVV Analysis

A time series $x(i)$ can be represented in “phase space” by the method of time delay embedding. When a time delay is embedded in it, it can be represented by a set of delay vectors (DVs) $x(k) = [x_{k-m\tau}, \dots, x_{k-\tau}]$ and $k = 1, 2, \dots, N$ where m = embedding dimension and τ = embedded time delay lag. Within a certain Euclidian distance τ_d to DV $x(k)$, DVs are grouped which is denoted by $\lambda_k(\tau_d)$. The mean target variance σ^{*2} is computed over all sets of λ_k : $k=1, 2, \dots, N$ to obtain optimal embedding dimension m . The embedding dimension which produce minimum σ^{*2} is the optimal one. The variation of the standardized distance enables the complete range of pair wise distances to be examined [28, 35-36].

In order to standardize the distance axis, τ_d is replaced by $(\tau_d - \mu_d) / \sigma_d$ where μ_d and σ_d are mean and standard deviation, respectively which are computed over all pair wise distances between DVs given by

$$d(i, j) = \|x(i) - x(j)\|, \quad i \neq j \quad (1)$$

The DVV plots are obtained by plotting target variance $\sigma^{*2}(\tau_d)$ versus $(\tau_d - \mu_d) / \sigma_d$. The measure of the noise present in time series is given by minimum value of target variance $\sigma_{\min}^{*2} = \min_{\tau_d} \{\sigma^{*2}(\tau_d)\}$. The presence of noise is dominant in case of stochastic components. So, stochastic components should have greater value of σ_{\min}^{*2} . In the other hand, smaller value of σ_{\min}^{*2} leads to the conclusion that the time series is deterministic.

As all the DVs are in the same Universal set and the variance of the targets is equal to the variance of the time series for maximum span, the DVV plots smoothly converge to unity at the extreme right.

We have used Iterative Amplitude Adjusted Fourier Transform (iAAFT)[37,38] to generate surrogate time series. The DVV plots of these surrogate time series are obtained using optimal embedding dimension of the original time series. A DVV Scatter diagram can be obtained by plotting target variance $\sigma^{*2}(\tau_d)$ of the original time series along horizontal axis and mean of $\sigma^{*2}(\tau_d)$ of surrogate time series along vertical axis. If the DVV plots of surrogate and original time series are similar, then DVV Scatter diagram coincide with the bisector line and the time series is said to be linear. Else if the DVV plots of surrogate and original time series are not similar, then DVV Scatter diagram deviates from the bisector line and the time series is said to be nonlinear. The nonlinearity can be quantified as the root mean square error (RMSE) between the $\sigma^{*2}(\tau_d)$ of the original time series and mean of the $\sigma^{*2}(\tau_d)$ of the surrogate time series.

$$\text{RMSE} = \sqrt{\text{mean} \left\{ \sigma^{*2}(\tau_d) - \frac{\sum_{k=1}^{N_s} \sigma_{s,k}^{*2}(\tau_d)}{N_s} \right\}^2} \quad (2)$$

where $\sigma_{s,k}^{*2}(\tau_d)$ is the target variance at span τ_d for the kth surrogate, and the mean is taken over all span of τ_d that is valid in all surrogate and DVV plots[35, 36].

2.2. 0-1 Test for Chaos

Gottwald and Mellbourne has introduced and modified this binary 0-1 Chaos test [39, 40]. In this method, time series vector is taken as input and “0” or “1” comes as output if the input time series vector is “non-chaotic” or “chaotic” respectively. This test is easy to implement, reliable [41] and robust for detection of deterministic chaos in a noisy time series [42] and experimental data [43].

A Fourier transformed series p_n is constructed for the time series $x(k)$ for $k=1,2,\dots,N$ as [44]

$$p_n = \sum_{k=1}^n x(k)e^{ikc} \quad \text{where } 1 \leq i \leq N \quad (3)$$

for different random values of c . In our study, 100 random values of c between $[\pi/5, 4\pi/5]$ are taken. The smoothed mean square displacement $D_c(n)$ is obtained as

$$D_c(n) = \frac{1}{N-m} \sum_{k=1}^{N-m} |p_{k+n} - p_k|^2 - \langle x \rangle^2 \frac{1 - \cos nc}{1 - \cos c} \quad (4)$$

where $\langle x \rangle = (1/N) \sum_{k=1}^N x(k)$ and $n \leq m \leq N/10 \ll N$. If $x(k)$ is chaotic in nature, then $D_c(n) \sim n$ and p_n will present a Brownian motion in the complex plane. Otherwise if $x(k)$ is non-chaotic or regular in nature, then $D_c(n)$ is a bounded function of n , i.e., $D_c(n)$ should not increase with n and p_n will present a bounded motion in the complex plane. To make the test more robust to the presence of noise $D_c(n)$ has been modified to $D_c^*(n)$ as

$$D_c^*(n) = D_c(n) + \alpha V_{damp}(n) \quad (5)$$

where $V_{damp}(n) = \langle x \rangle^2 \sin(\sqrt{2n})$

The amplitude α of the term $V_{damp}(n)$ controls the sensitivity of the test to weak noise and weak chaos. The asymptotic growth rate K_c is obtained to assess the strength of the linear growth.

$$K_c = \text{corr}(n, D_c^*(n)). \quad (6)$$

The binary output of the test is given by K which is expressed by

$$K = \text{median}(K_c). \quad (7)$$

If the value of K is close to 0, then the time series is non-chaotic or regular and if the value of K is close to 1, the time series is chaotic or non-regular [45].

2.3. Largest Lyapunov Exponent (λ_{\max}) Method

Lyapunov exponent in a dynamical system is a quantity that characterizes the rate of separation of infinitesimal close trajectories [46]. It is a measure of exponential separation of neighboring trajectories averaged over all points of a trajectory around an attractor. If x_0 and $x_0 + \Delta x_0$ are the two points in space, which depends on time and each of which generates an trajectory in that space using some dynamical

equations, then the separation between two trajectories $\Delta x(x_0, t)$ depends on initial value and time. If the time series is chaotic, then $\Delta x(x_0, t)$ varies randomly with time. Lyapunov exponent can be expressed as

$$\lambda = \lim_{t \rightarrow \infty} \frac{1}{t} \ln \frac{|\Delta x(x_0, t)|}{|\Delta x_0|} \quad (8)$$

As $\Delta x(x_0, t)$ depends on x_0 , there is a spectrum of Lyapunov exponents whose numbers are equal to the dimension of the phase space. The largest among them is denoted by λ_{\max} . It determines a measure of predictability. A positive value of λ_{\max} generally indicates that the trajectories are on a chaotic attractor, the negative value indicates that the trajectories converge to a common fixed point and a zero value indicates that the trajectories maintain their relative positions i.e., they are on a stable attractor. So a positive value of λ_{\max} implies that the system is chaotic.

There are various methods available to calculate the Lyapunov exponent. We have used the method described by Rosenstein *et al.* [31] as it is fast, easy to implement and robust to the changes in the embedding dimension, size of data set, embedding lag and noise level. This method finds the nearest neighbor of each point in phase space and tracks their separation over a certain time evolution.

2.4. RP and RQA

2.4.1. RP

A Recurrence Plot (RP) is a visual way to see the recurrence pattern of a dynamical system. Eckmann *et al.* [47] is pioneer of this method. A recurrence is defined as the return of the trajectory in its earlier state. A recurrence occurs when the system returns to the neighborhood of an earlier point in the phase space. If a point $\vec{x}_i \in R^m$ is in a trajectory $\vec{x}_1, \vec{x}_2, \dots, \vec{x}_N$, the recurrence matrix \mathbf{R} is expressed as:

$$R_{i,j}(\varepsilon) = \Theta(\varepsilon - \|\vec{x}_i - \vec{x}_j\|), \quad i, j = 1, 2, \dots, N \quad (9)$$

where N is the number of points in the trajectory, ε is the appropriate threshold distance, $\Theta(\cdot)$ is the Heaviside function (i.e., $\Theta(a) = 0$ if $a < 0$ and $\Theta(a) = 1$ if $a \geq 0$) and $\|\cdot\|$ is an appropriate norm. So, \mathbf{R} is a matrix with

elements 0 and 1 only and a Recurrence Plot is a graphical representation of \mathbf{R} obtained by marking a black dot for every 1 and white dot for every 0. Thus, the RPs have very long diagonal lines for periodic signal, very short diagonal lines for chaotic signal and almost no diagonal line for homogeneous distribution of stochastic signals.

2.4.2. RQA

The recurrence quantification analysis (RQA) [32, 48-50] is a method of nonlinear data analysis which quantifies the number and duration of recurrences of a dynamical system presented by its state space trajectory.

We have calculated mainly four recurrence variables. First one is %REC which quantifies the percentage of recurrent points falling within predefined threshold. It corresponds with the probability that a specific state will recur. %REC basically counts the black dots in the RP. The value of %REC falls between 0% (no recurrent point) to 100% (all recurrent points). REC is expressed as

$$REC(\varepsilon_i) = \frac{1}{N^2} \sum_{i,j=1}^N R_{i,j}(\varepsilon_i) \quad (10)$$

The next recurrence variable is %DET or predictability which quantifies the ratio of recurrent points forming diagonal lines to all recurrent points. Diagonal line segments must have a minimum length defined by the line parameter. The value of %DET falls between 0% (for stochastic time series) to 100% (for deterministic time series). Any value between them indicates that the time series is chaotic. DET is given by

$$DET = \frac{\sum_{i,j=1}^N D_{i,j}}{\sum_{i,j=1}^N R_{i,j}} \quad (11)$$

where

$$D_{i,j} = 1, \text{ if } (i, j) \text{ and } (i + 1, j + 1) \text{ or } (i - 1, j - 1) \text{ are recurrent} \quad (12)$$

0, otherwise

The third recurrence variable is %LMAX, i.e., linemax which is length of the longest diagonal line segment in the recurrence plot, excluding main diagonal line constructed by those points where $i=j$. It

inversely scales with Lyapunov exponent [47], i.e., shorter LMAX implies chaotic time series and longer LMAX implies non-chaotic time series.

If N_l is the number of diagonal lines and l_i is the length of i th diagonal line, then

$$LMAX = \max(l_i) \text{ where } i=1,2,\dots,N_l \quad (13)$$

The fourth recurrence variable is ENTR, i.e., entropy which is the Shannon information entropy of all diagonal line lengths distributed over integer bins in a histogram. It is the probability to find a diagonal line of exactly length l in RP. ENTR is given by

$$ENTR = -\sum_{i=1}^{N_l} p(l) \ln p(l) \quad (14)$$

where $p(l)$ is the distribution of diagonal line lengths. Entropy reflects the complexity of the deterministic structure in the system. High entropy indicates non-chaotic behaviour where as low entropy indicates chaotic behaviour.

3. Result

In the present paper, our study is limited on 2 prime Indian stock exchange indices, namely, SENSEX & NIFTY and one prime American stock exchange index, namely, DOW-JONES. We have taken daily closing value of SENSEX from 1st January, 1990 to 31st December, 2013 [52], NIFTY from 3rd July, 1990 to 31st December, 2013 [51] and DOW-JONES from 8th May, 1969 to 31st December, 2013 [51]. For SENSEX, NIFTY and DOW-JONES, we have 5739, 5657 and 10205 data points respectively.

First, we have calculated embedding dimension for the said time series and observed that the value of embedding dimension is 3 for all the time series. Then we have analyzed DVV plots and DVV scatter diagrams.

Fig. 1(a), (b) and (c) represents DVV plots for SENSEX, NIFTY and DOW-JONES respectively.

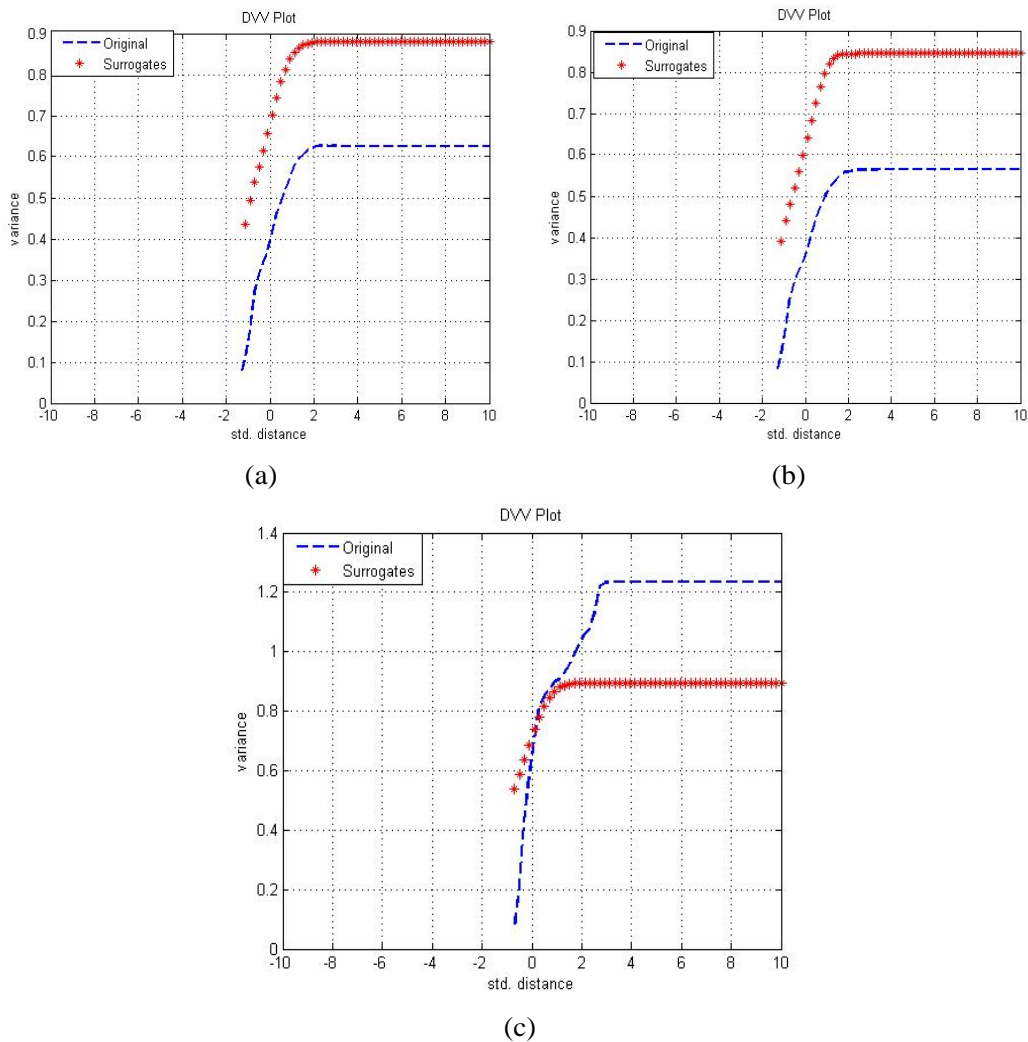


Figure 1. DVV plots of original and surrogate data with maximal embedding dimension=3 for (a) SENSEX; (b) NIFTY; (c) DOW-JONES.

In Figure 1(a), (b) and (c), minimum values of target variance σ_{\min}^{*2} for SENSEX, NIFTY and DOW-JONES obtained are 0.0701, 0.0734 and 0.0685 respectively.

Figure 2(a), (b) and (c) represents DVV scatter diagrams of SENSEX, NIFTY and DOW-JONES respectively.

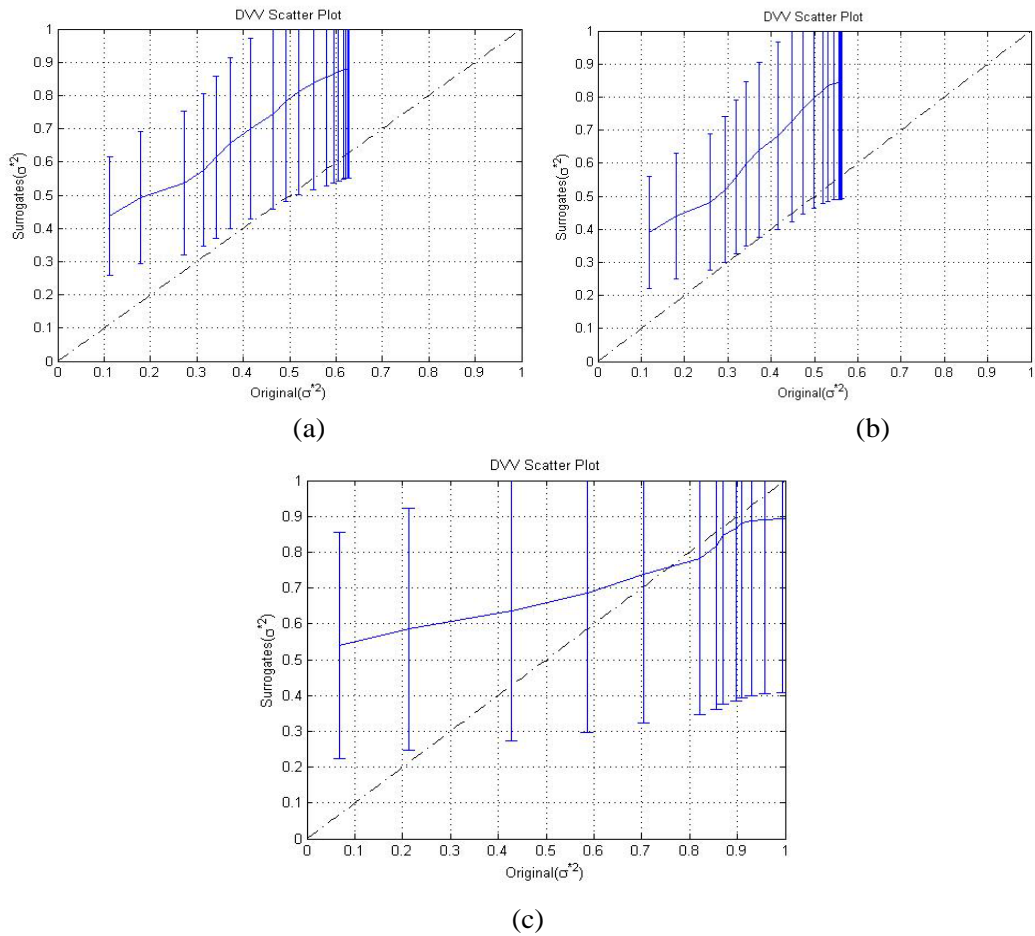


Figure 2. DVV scatter diagrams with standard deviation error bars for 99 surrogates for **(a)** SENSEX; **(b)** NIFTY; **(c)** DOW-JONES.

In Figure 2(a), (b) and (c), RMSE values for SENSEX, NIFTY and DOW-JONES obtained are 0.2618, 0.2791 and 0.2975 respectively.

Next, we have performed 0-1 test for chaos. Figure 3(a), (b) and (c) gives $D_c(n)$ versus n ; Figure 4(a), (b) and (c) plots p_n in complex plane; Figure 5(a), (b) and (c) gives $D_c^*(n)$ versus n ; Figure 6(a), (b) and (c) plots K_c versus c for SENSEX, NIFTY and DOW-JONES respectively.

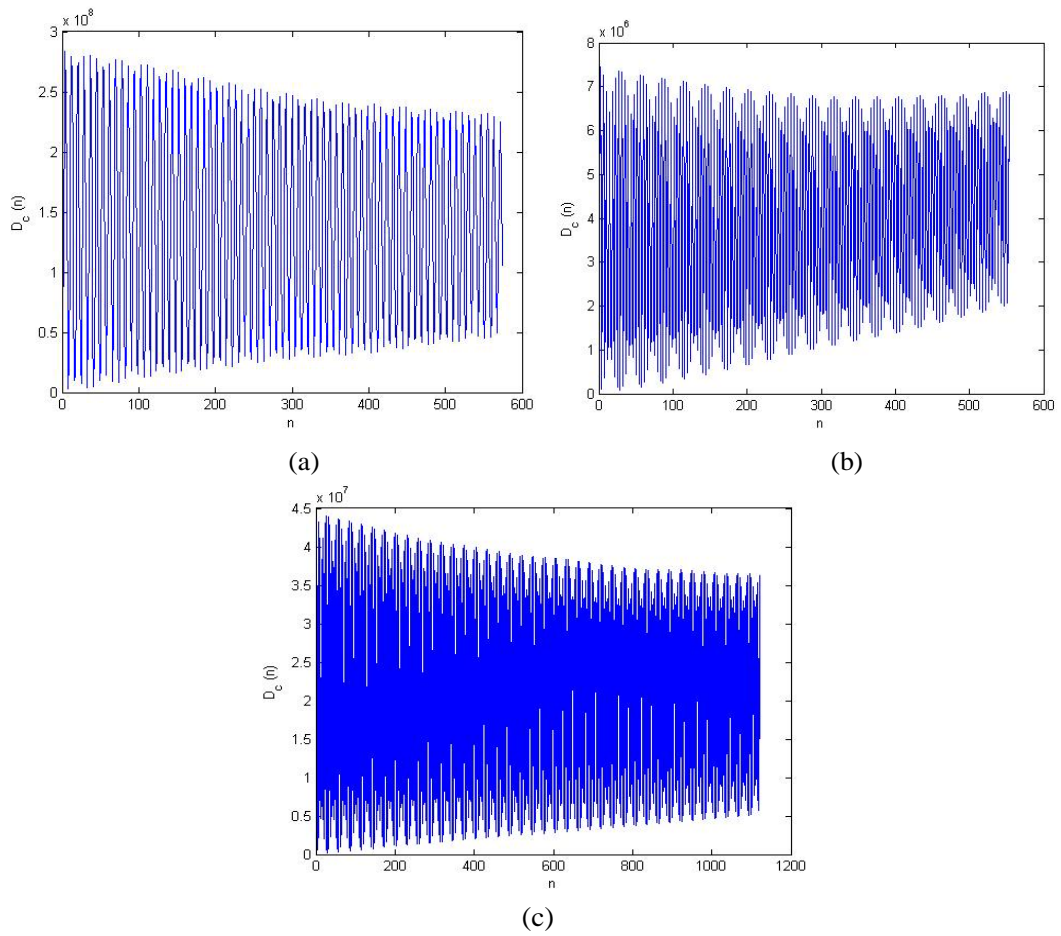
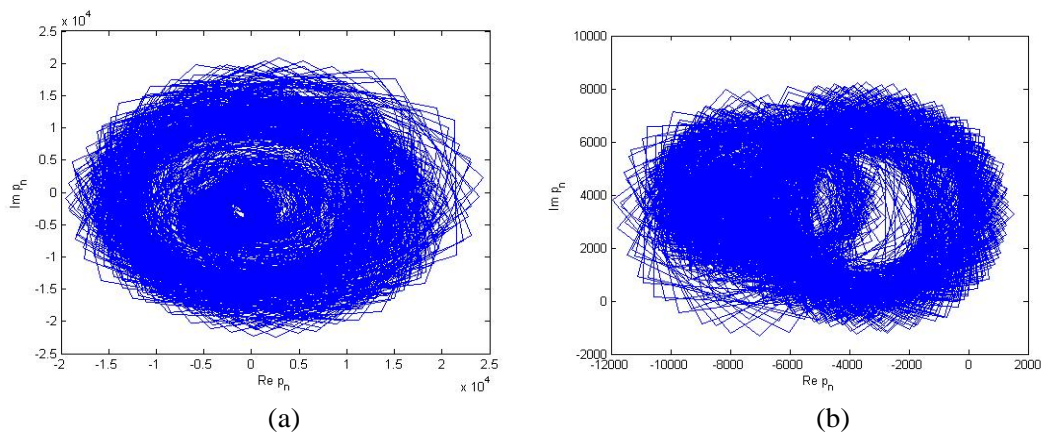


Figure 3. $D_c(n)$ versus n for (a) SENSEX; (b) NIFTY; (c) DOW-JONES.



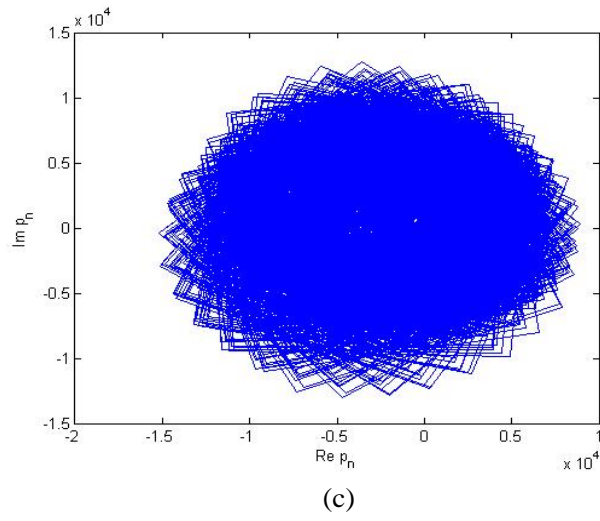


Figure 4. p_n in complex plane for (a) SENSEX; (b) NIFTY; (c) DOW-JONES.

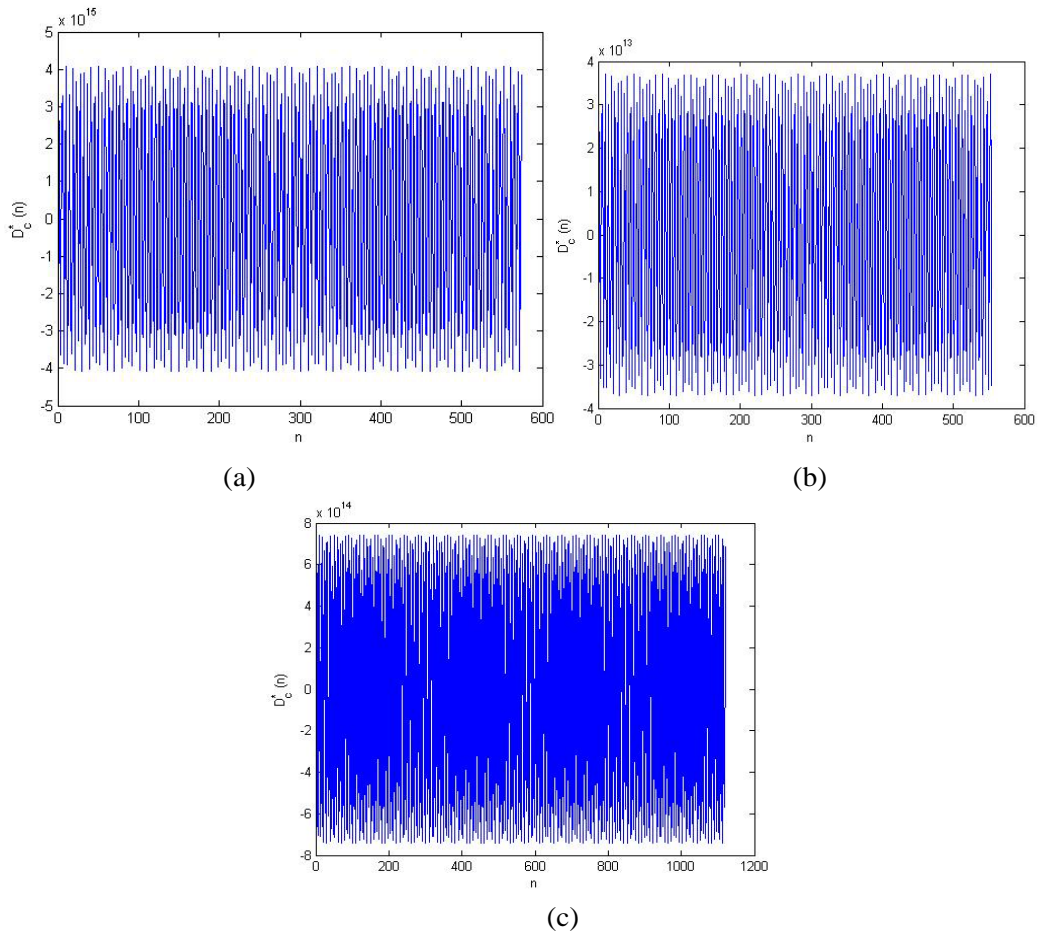


Figure 5. $D_c^*(n)$ versus n for (a) SENSEX; (b) NIFTY; (c) DOW-JONES.

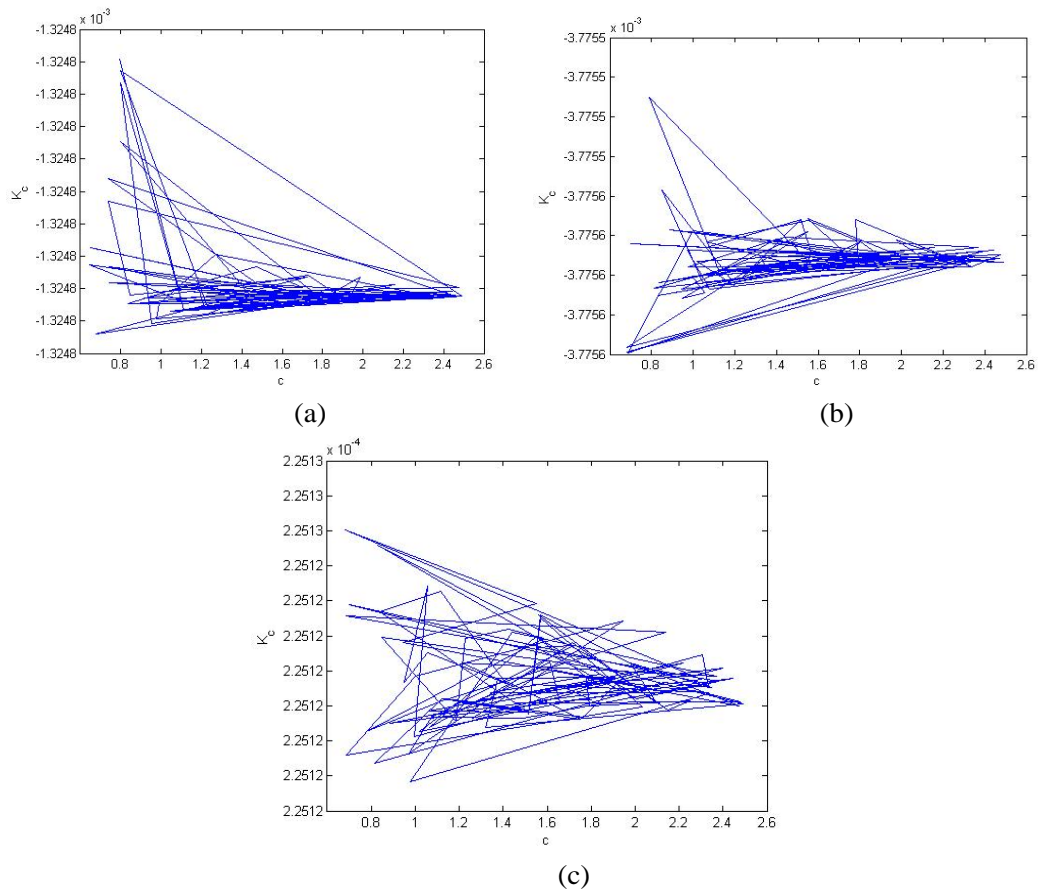


Figure 6. K_c versus c for (a) SENSEX; (b) NIFTY; (c) DOW-JONES.

The output of the 0-1 chaos test for SENSEX, NIFTY and DOW-JONES are 0.0013, 0.0038 and 0.0002 respectively which are very close to 0. This indicates a possible absence of chaos in all the three indices.

To verify the result obtained by 0-1 test, we have then checked Largest Lyapunov exponent λ_{\max} and observed that the value of λ_{\max} for SENSEX, NIFTY and DOW-JONES are 8.9071×10^{-5} , 7.2077×10^{-4} and 7.2077×10^{-4} and 5.4049×10^{-5} respectively which tend to 0.

Next, we have performed RP and RQA analysis. Fig. 7(a), (b) and (c) demonstrate RP plots for SENSEX, NIFTY and DOW-JONES respectively.

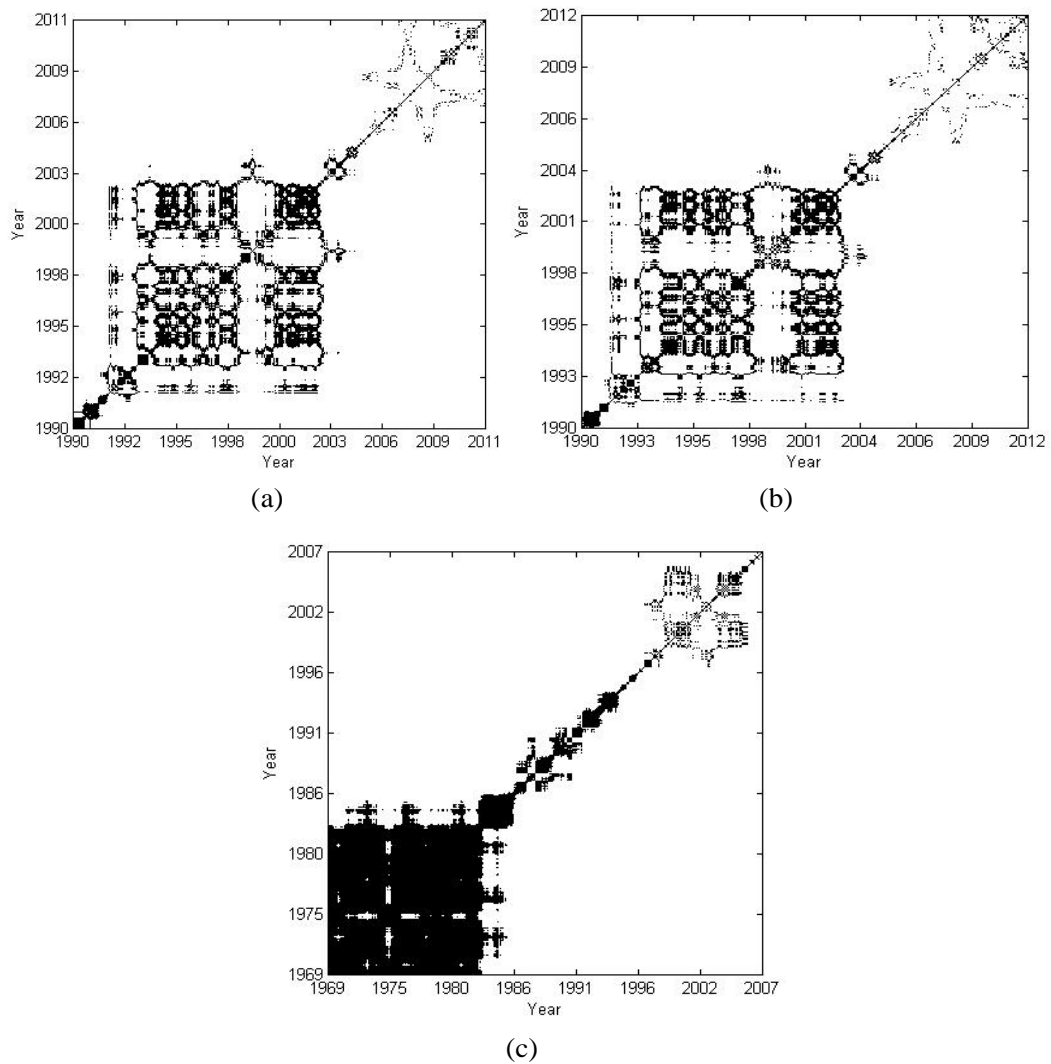


Figure 7. RP plots for (a) SENSEX; (b) NIFTY; (c) DOW-JONES.

We have taken $\varepsilon = 0.1$ for all RPs and normalize time series before any recurrence based calculation to reduce the recurrence threshold to around 2% of maximum distance and to get the clearer scenario of recurrence plot.

RQA analysis is done globally done to get an overall idea about complexity of the time series. Table 1 summarizes the RQA variables for global analysis.

Table 1. *RQA Analysis for SENSEX, NIFTY and DOW-JONES.*

	SENSEX	NIFTY	DOW-JONES
%REC	0.0868	0.0861	0.1235
%DET	0.9921	0.9922	0.9976
LMAX	17.1713	16.9070	57.3612
ENTR	3.3078	3.3047	3.3451

4. Discussion and conclusion

We have seen from the DVV plots of the time series that minimum values of target variance σ_{\min}^{*2} for SENSEX, NIFTY and DOW-JONES are very low which leads to the conclusion that the time series are possibly deterministic. The DVV scatter diagrams and the corresponding RMSEs clarify the fact that all the time series are nonlinear. Though the time series are nonlinear, there is not significant amount of chaos detected as binary output of 0-1 chaos test are very near to 0 for all the time series. This is confirmed by the values of the largest Lyapunov exponent which are again close to 0 indicating a non-chaotic system. A dynamical system with nearly zero exponent is conservative and stable in nature. We have observed in Figure 3 and Figure 5 that $D_c(n)$ and $D_c^*(n)$ do not linearly scale with n ; instead they exhibit a bounded oscillatory function of n . Figure 4 shows that p_n exhibit a bounded motion in complex plane. These two observations also support the fact that time series are non-chaotic. The RPs of the time series reveals that all the times series are not stochastic or chaotic. Table 1 explains the fact that the time series are deterministic and non-chaotic. High values of %REC indicate that the time series are regular. The values of %DET obtained are more than 99% which shows that the time series are deterministic. Again, high values of LMAX and ENTR recommends in favour of non-chaotic nature of all the three indices.

In fine, our study reveals that the all these three stock market indices are nonlinear, stable, deterministic and non-chaotic in nature. The absence of chaos strengthens the previously observed periodic nature of the present three time series [19]. The non-chaotic nature also boosts up the possibility of reliable forecasting of these time series both in short term and long term scale. Moreover as chaos is not viewed in the present case, there is no possibility of interplay between chaos and non-chaos [53]. Thus, we can consider the present three financial time series with less complexity. There have been long-standing debates on the issue whether there is any chaos in

financial market data or not. Vassilicos *et al.* [54] showed that no chaos can be observed in financial market data while Krawieckij *et al.* [55] argued in favour of the presence of chaos in this context. The presence of multifractality as observed in [6] combined with our present observation of absence of chaos for SENSEX and NIFTY data completely agrees with the view of Vassilicos *et al.* [54]. In this regard, Hsieh [56] argued on the presence of conditional heteroskedasticity instead of low dimensional deterministic chaos to explain the nonlinearity in financial market data in a better way. Future study may be incorporated in this direction to understand this conditional heteroskedasticity, if any.

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EXPLAINING FINANCIAL CRISIS BY FRACTAL MARKET HYPOTHESIS: EVIDENCES FROM INDIAN EQUITY MARKETS

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Abstract. *Fractal Market Hypothesis speaks about financial markets that consist of investors, each of them having different trading time horizon under which they operate. It states that a financial market can undergo a crisis when a particular trading time horizon gains prominence over others. We test this proposition using data from two major Indian capital market indices namely BSE SENSEX and NSE NIFTY and one bond market index NSE GSEC. Here, a wavelet based method is applied in order to capture the activities in different timescales. We take daily returns of all the indices from 04-01-1999 to 12-09-2013 for the purpose of the analysis. The time period includes the dot-com crash and the 2008 global financial crisis as well as two general elections in India. During the crisis period, the market behavior is marked by an increased activity among all timescales as proposed by the fractal market hypothesis. From the results, it is evident that Indian equity markets are influenced possibly by internal political turbulence, financial crisis in international capital markets and change in investor behavior during extreme events.*

Keywords: *Market Efficiency, Wavelets, Indian Equity Markets, Fractal Market Hypothesis.*

JEL CODES: F31, G01, G14, G15.

1. Introduction

Ever since its inception, Efficient market hypothesis (EMH henceforth), proposed by Fama (1965) has been the center of many academic debates. The hypothesis proposes certain assumptions about investor behavior. Investors are supposed to be rational in behavior, taking decisions alone and able to process all the information available to them instantly. In other words, all investors are homogenous in nature as far as their behavioral patterns are concerned and they operate under same time

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horizon. Another underlying assumption is that returns follow normal distribution. In such a scenario, getting abnormal returns from the markets is impossible.

If this hypothesis is to hold, there are no chances of extreme events such as an asset bubble or a financial crisis. The notion of efficient markets has been refuted by many empirical evidences over the years as well as the major financial crises occurred during the past years, financial crisis of 2008 being the most recent one. Still, EMH considered as one of the corner stone of main stream finance theory.

In reality, a financial market consists of different set of investors whose time horizons may vary from seconds to years. For each of them, same set of information may hold different value and they may treat it accordingly. Further, each set of investors may have its own different trading rules and strategies where particular information treated as a potential loss by one group might be treated as an opportunity for profit by another group. In such a situation, it will be of interest to look for another explanation for anomalies that result in extreme financial events.

Fractal Market Hypothesis (FMH henceforth), proposed by Peters (1994) gives an alternative notion of stable markets, as opposed to efficient markets. The major tenet of the FMH is the notion of liquidity, the ease with which an investor is able to buy/sell an asset without causing sufficient effect on the price of the asset.

For this to happen, either there should be an information asymmetry between the traders or they should operate under different time horizons, and therefore put different value on the same set of information. Intuitively, prices reflect short term (technical) information, mostly employed by short term traders and the fundamental information that is important to the long term investors. When short term traders experience a severe price movement, forcing them to sell, long term investors may step in and buy from them. They are able to do so because of their long investment horizon.

Here, the activity (selling) in one time horizon is balanced by another activity (buying) in a different time horizon. Therefore supply meets the demand and the market is smoothly cleared. As long as all the time horizons are equally active, the market remains stable.

A market crash or instability could occur when certain time horizons are more active compared to others and thus creating a supply and demand mismatch. Peters (1994) speaks about the possibility of an exogenous event that could create uncertainty about the long term prospects about the economy. An example will be like 2001 September 11 attacks in USA

.Such an event could make the long term investors lose faith in the fundamentals and force them either to stop participating in the market or act like short term traders and thus triggering an extreme financial event.

Haldane (2011) offers another explanation where long term investors stop taking part in the market activity, doubting the authenticity of the information on prices they receive because they watch the market less frequently compared to short term traders. Here the crisis can happen due to endogenous reasons.

There is a large volume of literature existing that deals with the notion of weak form market efficiency in equity markets. Here, few studies that of representative nature are mentioned briefly in the following paragraphs.

Lo and McKinley (1988), in their seminal work introduced the variance ratio test o test weak form market efficiency in the CRSP indices and found that they were not weak form efficient. Chan et.al (1992) employed unit roots and co-integration analysis to study the relationship between a number of Asian equity markets and the US. The study found an absence of co-integrating relationships and failed to reject weak form EMH for all the markets. Gu (2004) analyzed the NASDAQ index by employing variance ratio tests and found evidence that NASDAQ is not weak form market efficient. During the time of 2008 financial crisis, Grech and Pamula (2008) analyzed the Polish equity market (WIG) behavior using time dependent Hurst exponent and found relations between the local fractal properties and the market crashes. Borges (2010) studied the European equity markets using runs test and variance ratio tests and found that while the markets of Germany and Spain did not reject EMH, the equity markets of UK, France, Portugal and Greece reject EMH. Domino (2011) analyzed 126 stocks traded in Warsaw Stock Exchange using Hurst exponent to find relationships between and found evidences contradicting to market efficiency.

Kristofuek (2013) analyzed five leading equity index returns using a continuous wavelet transform based approach and found evidences contrary to the EMH. The possibility of the Asian equity markets being informationally efficient have been analyzed in detail by researchers such as Ayadi and Pyun (1994), Lima and Tabak(2004), Lim *et.al.* (2008a, 2008b), Kim and Shamsuddin(2008).The overall result of these studies indicates that the Asian forex markets are not informationally efficient.

Similarly, the notion of informational efficiency in Indian equity markets has been analyzed by a number of authors such as Sharma and Kennedy (1977), Barua (1981), Gupta(1995), Amanullah and Kamaiah

(1998), Mitra(2000), Poshakwale (2002), Chaudhuri and Wu (2004), Chawla *et al* (2006), Ahmed et al (2006), Hiremath and Kamaiah (2010a,2010b). If we analyze these studies, it provides a mixed picture related to the presence of weak form market efficiency in the Indian equity markets. The recent study carried out by Goud et al (2013) analyzed sectoral indices from two major stock exchanges namely BSE SENSEX and NSE NIFTY by employing variance ratio tests. The results found evidences contradicting to weak form market efficiency in majority of the indices tested. Here, the combined evidences points out that on the whole, Indian equity markets are not informationally efficient.

There are two points that is common among these studies. First, the methods employed do not distinguishes between time horizons under which investors operate. Second, while all these studies provide information about informational inefficiency of equity markets; none of them are able to provide an explanation about the actual market behavior that could lead to an asset bubble or a financial crisis. Considering the fact that the capital market movements can affect various segments of the economy, an understanding about actual market behavior warrant further investigation.

In this article, we try to explain the behavior of Indian equity markets with the help of FMH. We proceed based on the assumption that an increased volatility is an indication of increased trade activity. We apply the wavelet based methodology employed by Kristoufek (2013) in order to capture the activity at different timescales and to see whether we could find evidence supporting FMH. The following section gives a brief description about the data set and the methodology employed.

2. Data and Methodology

We take daily closing values of two major Indian equity indices namely BSE SENSEX and NSE NIFTY and one bond market index namely NSE G-SEC Index from 04/01/1999 to 12/09/2013. Daily percentage log returns were calculated using the formula

$$r_t = \log_{10}(P_t/P_{t-1}) * 100.$$

Next, we apply methodology employed by Kristoufek (2013) to verify the presence of FMH, where wavelet power spectrum was employed to test FMH. The idea behind application of wavelets on a financial time

series is based on its ability to decompose the given time series both in the time and frequency domain as compared to the commonly used models, for example GARCH family models (Engle, 1982; Bollerslev, 1986) where one analyze the data at the given frequency level. Here, wavelets possess a serious advantage over the Fourier analysis as one could study the evolution of power over specific time scales. Moreover, wavelets are not bound by the stationary criteria as in Fourier analysis. The wavelet power could be treated as a scale-specific variance.

Compared to the standard techniques to study variance such as GARCH family models, one could access information about evolution of variance over time as well as its distribution across different scales using wavelets. Let us consider variance as a proxy of market activity. If the argument of FMH is to hold, increased power at low scales (high frequencies) should be observed during the critical periods. Further during a crisis period, a change in the structure of variance across different frequencies due to the change in investors' activity may be observed. To capture such information across all timescales, a continuous wavelet transform based method will be ideal.

Here the methodology consists of extracting the wavelet power spectrum of the given time series using a continuous wavelet transform (CWT) in order to study the evolution of variance across different timescales.

A brief description about wavelets and wavelet power spectrum is given below.

A wavelet $\psi_{u,s}(t)$ could be defined as a real-valued square integrable function such that

$$\psi_{u,s}(t) = \psi \frac{(t-u)}{\sqrt{s}} \quad (1)$$

where u is the location, s is the scale and t is the time. A wavelet has zero mean, i.e.

$$\int_{-\infty}^{\infty} \psi(t) dt = 0 \quad \text{and it is usually normalized so that} \quad \int_0^{\infty} \psi^2(t) dt = 1.$$

A time series could be reconstructed from its wavelet transform if it satisfies the following admissibility condition.

$$C_{\psi} = \int_0^{\infty} \frac{|\psi(f)|^2}{f} df < +\infty. \quad (2)$$

Here, $\psi(f)$ is the Fourier transform of the given wavelet.

To obtain the CWT $W_x(u, s)$ of a given time series x_t , a wavelet $\psi(\cdot)$ is projected on to the time series so that

$$W_x(u, s) = \int_{-\infty}^{\infty} \frac{\psi^* \left(\frac{t - u}{s} \right) dt}{\sqrt{s}} \quad (3)$$

where $\psi^*(\cdot)$ is the complex conjugate of $\psi(\cdot)$. The CWT decomposes the series into different timescales. Here, there is no information loss in the reconstructed signal and also energy of the given series is maintained. i.e.

$$x(t) = \frac{\int_0^{\infty} \int_{-\infty}^{\infty} W_x(u, s) \psi(u, s(t) du ds}{s^z C \psi} \quad (4)$$

$$\|x\|^2 = \frac{\int_0^{\infty} \int_{-\infty}^{\infty} |W_x(u, s)|^z du ds}{s^z C \psi} \quad (5)$$

where $|W_x(u, s)|^2$ is the wavelet power at scale $s > 0$. Of the many wavelets available for the analysis, we choose Morlet wavelet as it is commonly used in economic and financial analysis. The Morlet wavelet is defined as

$$\psi(t) = e^{i\omega_0 t - t^2/2\pi^{1/4}} \quad (6)$$

where ω_0 is the central frequency.

An equity market does not operate in isolation. It normally interacts with other domestic markets, as well as with other foreign markets. It is perfectly possible that the market(s) under study could be influenced by other markets within or outside the country. Further, it is also possible that the nature of interaction may change during a crisis period. In order to capture such dynamics, we take the help of wavelet coherence.

We define the wavelet coherence of two time series X and Y as:

$$R_{XY} = \frac{S(C_{XY}(ab))}{\sqrt{S(|C_X(a, b)|^z) S(|C_Y(a, b)|^z)}} \quad (7)$$

where S is a smoothing operator, a is the location parameter, b is the scale parameter, C_{XY} is the wavelet cross spectrum between X and Y , C_X and C_Y are the wavelet transforms of X and Y respectively.

The statistical significance level of the wavelet coherence is estimated using Monte Carlo methods. We generate a large ensemble of surrogate

data set pairs with the same AR1 coefficients as the input data sets. For each pair we calculate the wavelet coherence. We then estimate the significance level for each scale using only values outside the COI.

2. Results and Discussion

The wavelet power spectra for BSE and NSE along with the time evolution of the returns are shown in figures 1 and 2. The top panel in each figure depicts the wavelet power spectrum of the corresponding series whereas the bottom panel shows the evolution of the return series. The significance of the wavelet power is analyzed by testing against the null of an AR(1) process. Significant areas of power are surrounded by a black line in the diagram.

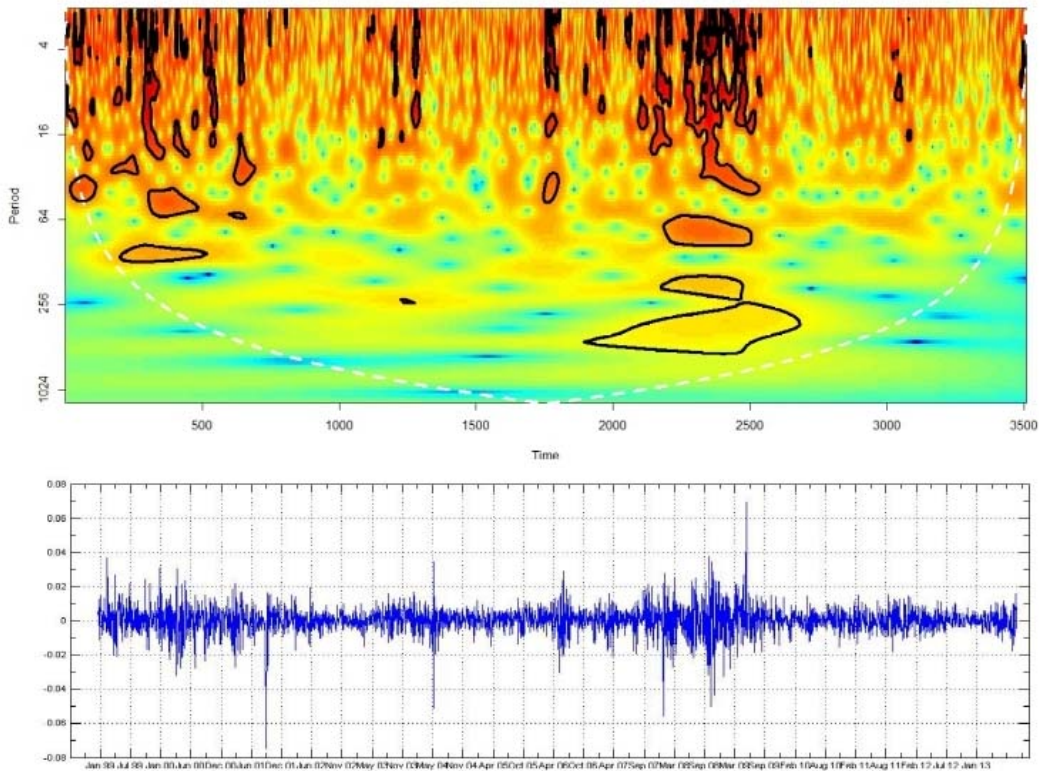


Figure 1. Wavelet Power Spectrum of BSE SENSEX.

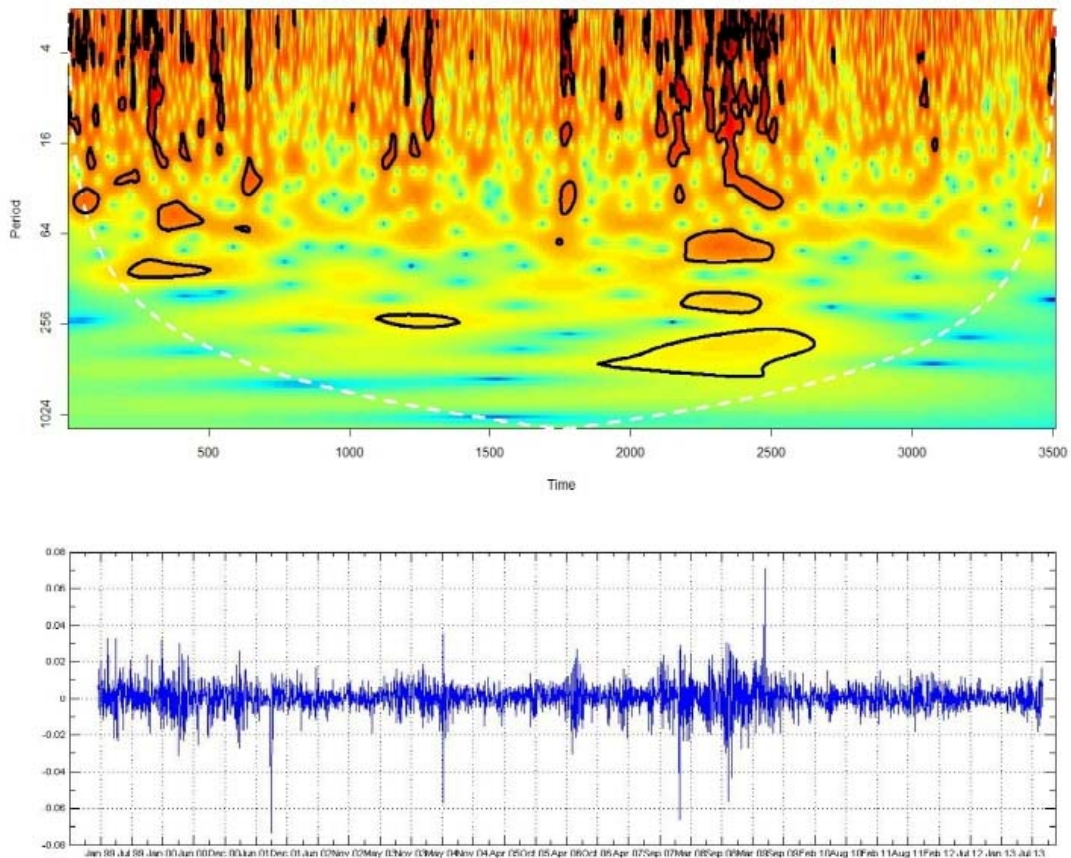


Figure 2. Wavelet Power Spectrum of NSE NIFTY.

After examining figures 1 and 2, we can see two major regions in both of them where there is increased activity over all timescales, signaling a crisis. The first one ranges from around Jan-1999 to June-2001. During this period, we could think of two major events that could affect the market dynamics. The first one is the ascension of National Democratic Alliance lead central government in India after a brief period of political uncertainty. During that time there was a wide spread uncertainty concerned with the economic policies that the newly government might follow. This uncertainty might have transferred into the market. The second possible reason is the dot-com crash in the US equity markets. As India had initiated financial liberalization program in 1991, Indian markets were integrated to international financial markets to some extent by the time of dot-com crash. Hence it is possible that the information about the

US market crash had channeled to Indian market and made the traders in the Indian market behave as explained by the FMH.

Next, we can see another major turbulence around may-2008 to December-2009. This period coincides with the 2008 global financial crisis. By this time, Indian market was integrated with world capital markets to a great extent and foreign institutional investors (FII) were playing a major role in market activities. It is possible that the information from other capital markets were transmitted into Indian markets instantly through this channel, being one possible cause of market crash. Effect of the 2008 crisis is found to be more severe in both the indices compared to the previous crisis period.

It is also to be noticed that the general elections in India happened during April-May 2009. The first half of 2009 was also a period of political uncertainty in India. During this time, the first UPA government that was nearing its end of term received lots of criticisms mainly due to the nuclear deal with the USA and allowing the IAEA (international atomic energy agency) access to its nuclear facilities as part of the deal. Hence there was a lot of confusion in the country about the election results and the subsequent government formation. It is possible that the uncertainty around that period had some impact on the market behavior along with the occurrence of the financial crisis in US.

To gain a better understanding about the dynamics of extreme events occurring in a financial market, it is important to see how the market(s) interact domestically as well as in an international context. The following section answers this concern with the help of wavelet coherence. First, the interaction between BSE and NSE is analyzed to understand the domestic dynamics. In order to see the possible external influence, pairwise wavelet coherence for BSE SENSEX and NSE Nifty is calculated against S&P 500. Figure 3 provides the coherence plot between BSE SENSEX and NSE Nifty, while figures 4 and 5 show the coherence plot between BSE SENSEX/SP500 and NSE Nifty/SandP500 respectively. The significance of coherence is analyzed by testing against the null of an AR(1) process as in the previous case. Significant areas are rounded by a black line in the diagram.

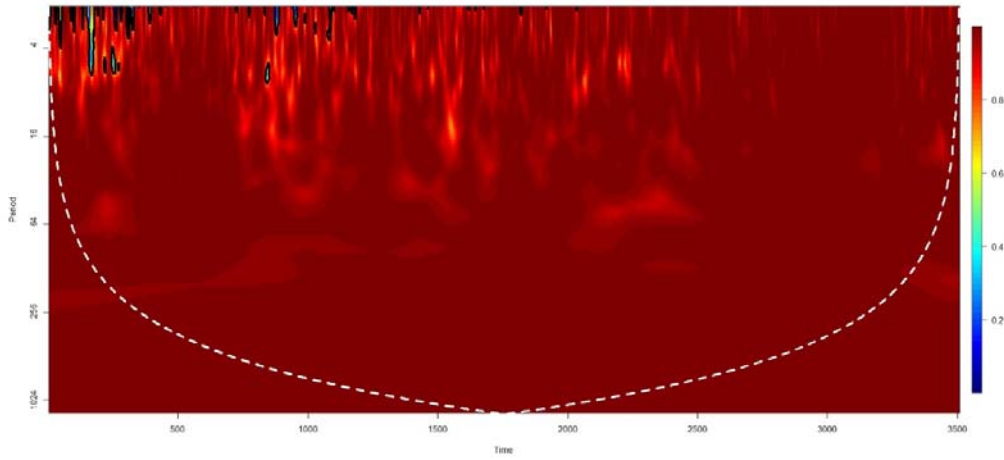


Figure 3. Wavelet Coherence: BSE SENSEX/ NSE NIFTY.

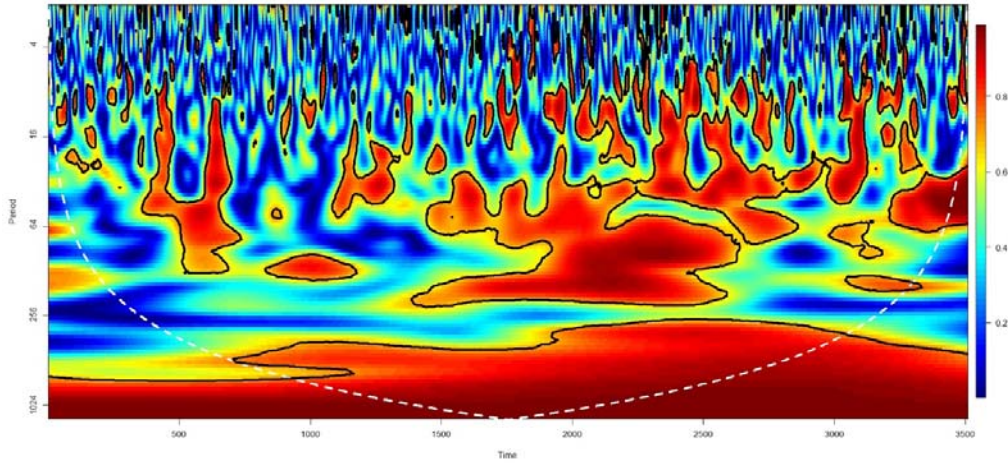


Figure 4. Wavelet Coherence: BSE SENSEX/S&P 500.

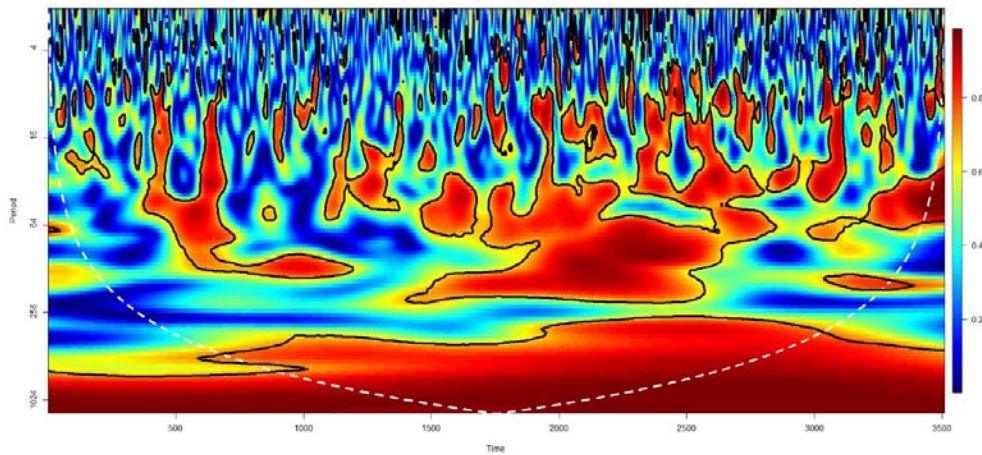


Figure 5. Wavelet Coherence: NSE NIFTY/S&P 500.

From analyzing the figure 3, we can find that BSE SENSEX and NSE Nifty are highly correlated with each other from the color of the coherence spectrum. Further, the spectrum is of homogenous nature for most of the analysis period. However, it is to be of interest that during periods of extreme events, there are not many fluctuations around. Around the time of Dot-com crisis, we can see some significant change in the correlation across the scales, upto 8 days. However, around the time of the 2008 crisis, the significant changes are confined to the daily scales.

Next, we take up the case of BSE SENSEX/S&P 500. Here we can see that both the markets are correlated to each other, but the strength is not uniform as in the previous case. Around the 2001 crisis, we can see some significant patterns up to the scale of 128 days. While considering the 2008 crisis period, the co-movement of the markets has increased both in size and duration. From the diagram, it is evident that SENSEX and S&P 500 were closely connected during the 2008 crisis up to the scale of 128 days. Further, the long run co-movements were found to be strong even after the 2008 crisis. When we compare this behavior with the pre-2008 crisis period market behavior, it could be stated that the markets become more integrated over the time.

If we consider the case of NSE Nifty/S&P 500, a similar trend as in the previous case could be observed. Both the markets became integrated over time, and around the time of the 2008 crisis, the strength of correlation between the markets across different timescales were high.

It could be said that Indian markets are affected by the activities occurring in a developed market such as S&P 500. The increasing presence of FII's in the Indian market over the past few years could be taken as one possible reason for the increased correlation around the time of a financial crisis. The investors could short-sell their assets in a developing market such as India so as to offset their losses in a developed market as S&P 500. However, this activity may create panic in the Indian financial market, resulting in a market crash as explained before. This is an example of occurrence of a crisis in a financial market through financial contagion.

Another aspect that we consider is the phenomenon known as flight-to-quality (FTQ), where investors shift their preference from risky assets to non-risky assets such as bonds to minimize the loss during an extreme financial event. Here it is attempted to analyze the interaction between the Indian stock markets with the Indian bond market to see if there are any such jumps. We take the help of wavelet coherence analysis to study the correlation between the stock and bond markets across different timescales. The outputs are shown in figures 7 and 8 respectively.

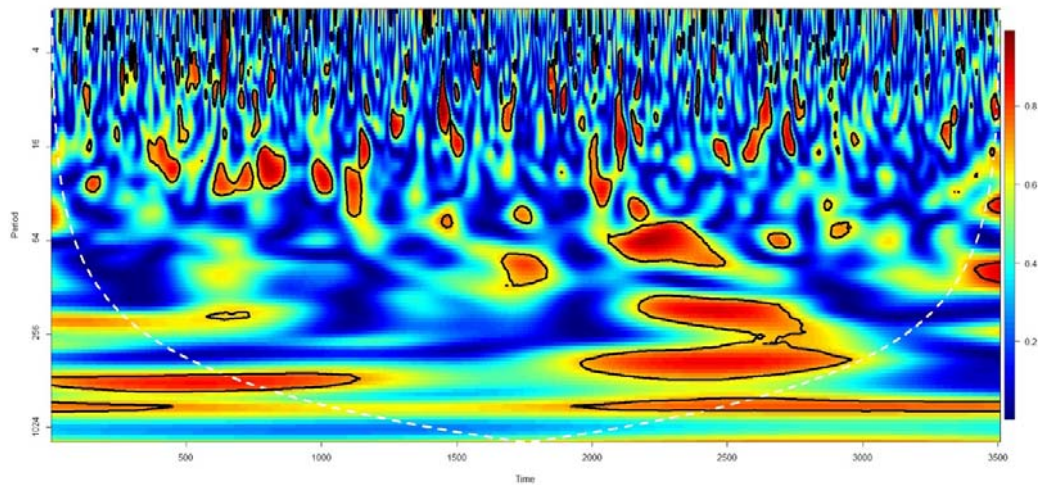


Figure 6. Wavelet Coherence: BSE SENSEX/NSE GSEC.

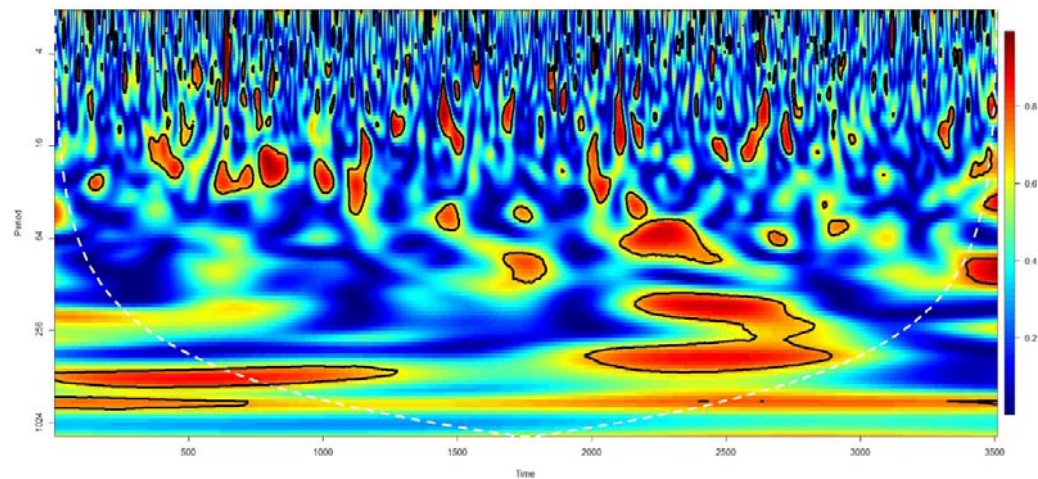


Figure 7. Wavelet Coherence: NSE NIFTY/NSE GSEC.

From analyzing the coherence plots of BSE SENSEX/NSE-GSEC and NSE Nifty/NSE-GSEC, it could be seen that the plots are not homogenous in nature. There are areas of significant activity. It implies that the investors shift between risky and non-risky assets intermittently in order to diversify and minimize risk. However, during the 2008 crisis period, there is a variation in activity between the scales of 32-64 days and 128-256 days. The latter part of the activity is more in duration. Here, it could be of the case that the long term investors might have shifted their preference to non-risky assets and thus withdrew from the equity markets. Such an absence of the long term traders could result in a market crash as per the postulates of the FMH.

Here, it could be stated that the reasons behind the Indian equity market crash particularly that of 2008, is due to multiple reasons. First, the presence of FII's, trying to short sell their assets in order to balance their loss in the developed markets. Second, the behavior of long term traders, either switching from risky to non-risky assets or acting like short term traders during the crisis period. Both actions would have resulted in a market crash. Lastly, the prevailing political uncertainty around the period also would have acted as a catalyst.

3. Conclusions

In this study, we have attempted to verify the Fractal Market Hypothesis in the Indian equity market using a wavelet based method. We have used daily returns of two major equity indices BSE SENSEX and NSE nifty and one bond market index NSE GSEC from 04/01/1999 to 12/09/2013 for this purpose. We have found conclusive evidence that validates the hypothesis for both the indices under analysis. That is, there was increased activity happening across all timescales in both of the indices when there was turbulence in international markets or during times of political uncertainty within the country. Further, the possible reasons of crisis such as contagion and flight to quality were also identified. Here, the notion of Indian equity market being informationally efficient is refuted.

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NEW ECONOMY Section

POST-CRISIS ECONOMIC MODEL: RETURN TO KEYNESIANISM?

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***Abstract.** Any major economic crisis causes significant changes in the mainstream macroeconomic models applied in most countries. After the oil crisis of the 70s and the imposition of monetarism, things have not changed significantly until the global financial and economic crisis that broke out a few years ago. In the aftermath, Keynesianism seems to be the most preferred economic current by the authorities, which is easily visible when looking at the change in their vision about regulation of the financial sector and the solutions to the crisis found, most often of interventionist nature. This paper aims to assess the appropriateness and possible implications of the adoption of Keynesianism, in a modern claimed embodiment.*

***Keywords:** macroeconomic theories; economic model; economic crisis; crisis strategy; Keynesianism.*

JEL codes: E44, Q54, E43.

1. Introduction

No doubt the economic crisis is a phenomenon that no one wants to encounter. A crisis generally involves a rebalancing of some economic equilibrium that was previously disturbed by external and internal factors. Economists have noticed quickly that economic crisis seems to recur from time to time, on a smaller or larger scale, in other words the existence of economic cycles was discovered. Since the Austrian school, all schools of economic thought have tried to explain why these crises occur and tried to find mechanisms that can be used to prevent or mitigate the possible negative effects.

The role of economics in a society is to indicate the best business model to follow. In other words, how we can properly organize the economic activity in order to avoid economic crises and to achieve a long-term sustainable growth. Very important in this issue is the role of the state (public authorities of any kind) in the economy. This is often where the

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schools of economic thought separate. Austrian school followers strongly oppose the state intervention in economic activity. According to them, the state can and must defend property rights and possibly provide a safe environment for private business to take place under normal conditions, but should abstain from interventionist policies of any kind. By contrast, advocates of interventionist theories claim that the State may have a positive and proactive role in an economy, if coherent measures are implemented to prevent market failures.

This paper is divided into five parts. After the introduction, the second part is dedicated to the “classic” Keynesian theory. This theory, although somewhat refined, is very popular today among many economists despite the fact that it was presented more than half a century ago. In addition to explaining the economic crisis, the great merit is that Keynesian school tried to develop a recipe that authorities should follow in order to prevent or to limit the negative effects of economic crisis. No doubt this means accepting the idea that the state may have a beneficial role in the economy and there are ways for it to intervene to support the work of private agents with a positive outcome. Chapter 3 presents the main causes of the recent economic crisis. Although the crisis originated in the US financial sector, it quickly spread in the entire world and transformed into a full scale economic crisis, affecting all economic sectors. Chapter 4 proposes a brief analysis of solutions found by authorities around the world, from a keynesist perspective, and the possible implications of the adoption of Keynesianism as a mainstream economic model, with all pros and cons. The conclusions of this paper are laid down in Chapter 5.

2. Keynesian vision

The ideas expressed by John Maynard Keynes in his famous work entitled "The General Theory of Employment, Interest and Money" (first published in 1936) are still of great interest in that they are used by economic policy makers as arguments for the measures proposed and implemented to counter the crisis. This is because the Keynesian school of thought is one of the few schools that support a strong state intervention in economy and provide a coherent recipe on how to do this. According to Keynes, the classical theory represents only a particular case of his own theory, when there is full employment. Hence it is intitled "general" theory.

There are some key differences between the theories of Keynes and the rest specifically related to wage rigidity differences and liquidity preference.

The British economist shows that wages have certain rigidity to the changing demand for labor, and this creates the prerequisite for the appearance of involuntary unemployment. Wage rigidity is given in principle by the terms of contracts and labor laws that can still be found today in most economies. From this perspective, Keynesian theorists always prefer a somewhat higher level of inflation at the expense of unemployment. Basically, in a reasonable and steady decline in the purchasing power (by 1-2 percent per year), employers are given a breathing space in which wages may increase with inflation, if labor productivity is constant, above inflation if labor productivity increase or maintain the nominal wages and hence lower the wages in real terms, if labor productivity is decrease. Otherwise, in the latter case, the company can begin to accumulate losses which may ultimately lead to bankruptcy and unemployment. This is the main reason why some central banks in major economies such as the US Federal Reserve, have full employment among their objectives, along with maintaining prices stability. Keynesian theorists use this as an argument for an interventionist monetary policy in an economic slowdown in order to stimulate consumption.

In contrast to the Austrian school idea where natural interest is defined only in relation with time preference, Keynes introduces the concept of liquidity preference. The British economist defines 3 types reasons why individuals choose to keep cash¹:

(I) transactional reasons – need of money for current transactions of personal and business exchanges;

(II) as a precaution – longing for security on current cash equivalent of a certain proportion of the total resources;

(III) speculative reasons – the objective of ensuring profit from a better knowledge of what the market will bring in the future.

For John Maynard Keynes interest rate is a phenomenon that involves a lot of psychology. Hence the phenomenon called the disciples of Keynes 'liquidity trap', or situation in which an increase in money supply will not change the real interest rates in the long term. It is a particular situation, investors believe that the price of securities is too high. Therefore they think that if they buy securities they will lose capital and, therefore, retains rather the money in various accounts or bank deposits. Under these conditions, the central bank can not use the standard tools of monetary policy to stimulate the economy, increase consumption and reduce unemployment. Keynes only exposes this problem but does not offer a

¹ Keynes, John Maynard (2009), *Teoria generală a ocupării forței de muncă, a dobânzii și a banilor* – prefață Paul Krugman, Editura Publica, București, pp. 234-235.

practical solution. It would be preferable not to come to this. However, contemporary economists, followers of Keynesian ideas seem to have found some solutions to this problem, solutions that are found in quantitative easing measures applied for the first time in Japan in the early 2000s and internationally in most developed economies after the financial crisis in 2007.

After defining its concepts Keynes presents his own vision of the theory of economic cycles. Austrian school hypothesis that interest rates can play an important role in producing crises is accepted, but Keynes considered as the main culprit a sudden collapse of the marginal productivity of capital. Towards the end of periods of prosperity, investors are increasingly optimistic about future earnings of invested capital surplus could bring. Without an external action to stop this unfounded optimism at some time disappointments will appear. This time corresponds to the beginning of crisis. Panic is quick and investors choose to withdraw increasingly more from the real economy and to put their money somewhere safe (bank deposits in high trusted currencies, gold etc.). This will greatly increase the liquidity preference on account of the precautionary reason. The phenomenon described by Keynes is quite topical nowadays. Abrupt withdrawal of these investments in the real economy produces financing problems for large companies, which will generate significant losses. Once the sharp drop in the marginal productivity of capital occurs, this in turn causes a decrease in the propensity to consume, which will supply a further decrease in capital productivity (determined by lower demand this time), thus entering into a vicious circle of economic decline and unemployment. It is when the financial crisis becomes an economic crisis. All interventionist policies proposed by Keynes and his followers promoted by authorities worldwide will be based on the above reasoning. We can safely Keynes's explanation is different than that of the classical theories or the Austrian school related to the economic calculation problem (in which the entrepreneurs are influenced by expansionist policies of governments).

Consumption should be stimulated by all means to get out of this vicious circle and revive the economy. In the absence of intervention by the authorities, the crisis could be much tougher than necessary. However, because governments can allways intervene, economies should not enter into the trap of excessive exuberance and should not confront with economic crisis ever. Governments should not, under any circumstances, act pro-cyclical. Keynes and his adepts argue for interventionist monetary policy, designed to revive lending and help consumption.

John Maynard Keynes proves to be an optimist, believing that the state has a duty and a responsibility to protect the economy from crisis. Not happy with the idea that authorities should remain passive once the crisis has started and suggests some concrete measures of recovery. After all, if the state is the only trader who by his actions caused an economic crisis (as argued by the Austrian school), all the state can and should do is to act towards the reversal of this.

3. Reasons for the economic crisis

The recent economic crisis started as a financial one prior to the year 2008 and originated in the US housing market, although it expanded so quickly worldwide. Most economists accept the idea that the main culprit for this negative situation was the financial sector. US and European banks leanded money too easily to subprime debtors, usually in the housing market, through various systems of ensuring the loans in case of default. As these insurances were chep, banks were eager to support them, as profits were growing more and more. In theory, once the first payments were not settled, banks should activate the insurance and the collateral should be put on sale. However, between the time of receiving the money (and buying the house) and the first principal rates, usually the house price would increase and a new mortgage could be accesed (some of the loans had a grace period of years in which only interest would be paid). Basically most of the financial intermediaries lost their function of sound economic resource allocation and created beautifull dreams of easily achivabile prosperity. This could only have lead to a disaster.

Causes for this situation can be found in the lack of proper regulation of key parts of the financial intermediation sector, in the new corporate governance model of the recent years, or even in the fiscal and monetary policies of the governments worldwide which made great efforts to postpone the bursting of the bubble.

It is to be noted that economic science was deeply dominated by monetarist ideas prior to the 2007 crisis. Still, concerning regulation, one major economic theory stand out that was layed down in the 80's and failed to be implemented by authorities around the world. This is the theory of financial instability hypothesis of the American economist Hyman Philip Minsky. The theory can be regard as being of keynesism nature due to the support of government intervention (or central bank) in financial markets. It is one of the first theories of this kind, which analyzes the economic cycles including through existing institutional regulations. Minsky shows

that financial markets are essentially unstable and that the state must intervene to correct this situation. For the purpose Minsky's road to instability goes through three phases²: Phase I – Stability, where funding is fully covered by income; Phase II – Speculative stage, where interest rates only are covered by revenues and the Phase III – Ponzi stage, where a company, in order to pay the interests owed, must use new funding that further increase its debt levels. The inherent instability of financial systems can lead to financial crisis and economic crisis. Minsky is committed to appropriate regulation of financial systems to prevent such slippage.

Even if Minsky's theory was not imposed in the 80s when it was exposed, it has taken a great interest among economists and politicians alike, after the 2007 financial crisis.

Regulation authorities often argued those days that corporate governance structure of major financial players is something private where no public/state authorities should intervene ever. Also, most of the regulation of the financial system consisted mainly in regulating deposit taking institutions, in order to ensure that those are fully safe. Instead, most of the other sectors of financial regulation was far less regulated, due to the investment component of them (it should generally involved a greater risk and greater possible profits). This made it possible to transfer the risk of default from one subsector to another. Authorities failed to involve in those situations were markets failed, specifically in correcting the moral hazard issues brought by the the new corporate governance systems of many shareholders with small percentages of equity that made possible CEO's to be more and more powerful. Instead governments added to this bubble by trying to avoid its imminent burst through various means of stimulating the economy. This behavior could be described by Keynesist adepts as procyclical.

The housing market was a major problem especially in U.S., however the European financial system became in turn vulnerable to it due to various financial instruments derived from those mortgages. Also, many European governments engaged in unsustainable debt in the periods prior to the financial crisis. This added to the negative effects of it. In periods of economic growth the Keynesian theory strongly recomands governments to abstain from stimulating the economy even more by increasing the governmental consum. Instead authorities should slowly make reserves in order to access them once the crisis starts. In Europe, prior to the financial crisis, most of the member states didn't observe at all the Maastricht

² Minsky P. Hyman (2011), *Cum să stabilizăm o economie instabilă*, Ed. Publica, p. 420

criteria of sound public debt and public spending (public debt of no more than 60% of GDP and public deficit of no more than 3% of GDP). This is also a procyclical behavior in Keynesian theory.

Also, the crisis overlaid to some historic economic problems in the EU, that could in turn have led to individual, small scale, economic crisis of their own, but instead have led to aggravating the negative effects and to hinder the responses of authorities.

4. The crisis nowadays

Once the crisis erupted, the first responses of public authorities were of technical nature, consisting of ensuring enough liquidity for the financial systems and economies to survive. Of course some authorities, especially in Europe, found this to be very challenging due to their actions prior to the financial crisis. For many, the financial crisis changed into a public debt crisis. This, together with the fact that agreeing with a common response to the financial issues in Europe prove to be very challenging, are the main reasons that US recovered more quickly from the crisis.

In US, measures that could be described as Keynesian in nature, such as TARP programs, have been quickly implemented in order to save what's left from the financial system. Some believe that the crisis could very well have been avoided if similar measures would have been implemented prior to the bankruptcy of Lehman Brothers in 2008. However, TARP and similar programs prove to be very hard to explain to the general public even after the financial crisis, as it involved using public money to help large and private financial corporations. Also, it is these authors' opinion, that if these measures are not implemented together with others that would address the main causes that lead to this crisis, their impact would be insignificant on a long run. This would have also been hard to explain to the general public prior to the crisis. Similar measures have been adopted in Europe, specifically in the Eurozone by ECB.

Saving the financial systems was one thing, but reviving the economies and gaining investor trust in its future was a different issue. Authorities around the world undertaken major efforts, financial and nonfinancial, to address this. In the field of monetary policy, the rates were dropped systematically by central banks around the world. However, this didn't produce much positive effects due to a phenomenon described by Keynes in its 1936 book and later named by its disciples as liquidity trap. This is the case when long term interest rates remain high despite the short term interest rate being close to 0. In this case the classical monetary

policy measures no longer work to support economic growth and to limit unemployment. A solution to this problem, well supported by contemporary Keynesian adepts is quantitative easing. This involves the intervention of central banks in some segments of the financial markets crisis not acting earlier. Specifically, the central bank buys bonds with long maturities in these markets to influence their yields and create fiscal space to stimulate the economy. Thus, central banks can continue to implement monetary policies, despite policy rates reached levels close to zero. This definitely creates additional monetary base, but not necessary inflation, if central banks use money that would otherwise be locked by untrusting investors in the future potential on economies. Such measures were applied for the first time in Japan in the early 2000s, and with the outbreak of the financial crisis have been adopted in some of the most developed economies in the world, namely the US, Eurozone (especially in the very recent period) and UK. In the short term at least, the measures appear to be successful.

After doing what they can to save the financial systems and to limit the other negative effects of the financial crisis, governments worldwide began to analyze the causes that have led to it and, slowly, some measures appear in the field of regulation and of public debt management.

5. Conclusions

Like all previous crises, the economic-financial crisis of 2007-2008 will undoubtedly cause changes in the mainstream economics. Today changes have already begun to be implemented by authorities around the world. They seem to embrace rather on principles outlined by Keynes and cyclical interventionist economic policies and those of Minsky on deregulation, in slightly refined theories. The main exponents of the current post new Keynesian economists are Joseph Stiglitz and Paul Krugman.

Stiglitz is a strong proponent of the legislation and therefore the instability of Minsky's theory of financial systems. The author has studied the situations where markets fail and considers there is always an issue of incentives and motivations. Support also taken from Keynes interventionist policies opposing solutions involving balancing budgets through austerity measures.

Paul Krugman, also a supporter of the ideas proposed by Keynes, says interventionism to stop the financial crisis including monetary policy. Liquidity trap described by Keynes in 1936 seems to have been solved by a

new type called quantitative easing measures. This involves the intervention of central banks in some segments of the financial markets crisis not acting earlier. Specifically, the central bank buys bonds with long maturities in these markets to influence their yields and create fiscal space to stimulate the economy. Thus, central banks can continue to implement monetary policies, despite policy rates reached levels akin to zero. Such measures were applied for the first time in Japan in the early 2000s, and with the outbreak of the financial crisis have been adopted in some of the most developed economies in the world, namely the US, Eurozone and UK. In the short term at least, the measures appear to be successful.

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THE SYSTEM OF PUBLIC FINANCES IN POLAND

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***Abstract.** The aim of the article is an attempt to present the rules of collecting and spending budgetary income in Poland. An attention will also be paid to the level of public debt, its structure and debt management.*

***Keywords:** public finances, globalisation processes, financial decisions, budget income.*

1. Introduction

The sector of public finances has a very significant influence on the competitiveness of contemporary economies. It is reflected in criteria, and as a consequence in results, of international comparisons and of the evaluation of competitiveness of countries, which result in clear relation – the better functioning of the public sector is, the higher level of economic well-being. The role of the sector of public finances in the creation of well-being may be analysed taking into account various aspects from the creation of valuable ideas and exercising leaderships in social and political life by shaping politics and appropriate institutional solutions to the effectiveness of fulfilling current tasks set to various entities of the sector. This wide scope of problems connected with the functioning of the public sector has one aspect in common, namely it is thinking and acting taking into consideration the common good.

In literature, the public sector is often associated with public finances. According to the binding laws concerning public finances in Poland, they involve collecting income and public revenues, expenditure of the funds, financing loan needs of the state budget and the budgets of the units of local government, incurring liabilities concerning public means, managing public funds and managing debts.

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2. The term and tasks of public finances

The term *public finances* is most often explained as an abstracted subdiscipline of the science of finance, being a part of economic sciences, as well as a state public activity as a determined complex of phenomena in social and economic life. The superior notion of finance is considered as a general phenomena connected with collecting and spending of financial means along with the whole institutional surrounding [Kosikowski, Ruśkowski, 2003, p. 19, Wernik 2007, p. 11, Kożuch A, 2014, p. 11]. The difference between the terms concerns subjects that raise and spend financial means. These are public entities conducting tasks of the state. Public finances as an area of the state activity concern widely understood financing of public tasks of units included in the sector of public finances [Lubińska, 2010, p. 13]. As mentioned above, according to act 3 of the Public Finance Law, they include processes connected with collecting and spending of public funds.

According to P. M. Gaudemet [Gaudemet, Molinier, 2000, pp. 17-19] „public finance examines mechanisms of particular financial phenomena, looks for rules for setting taxes, specifies ways of appeal available for the taxpayer and determines techniques of control concerning spendings”. In Polish literature of the subject, finances are defined as a multi-paradigmatic economic science that aims at the description, analysis and evaluation of globalisation processes, choices and financial decisions made in conditions of uncertainty and risk by households, institutions, financial and non-financial enterprises, units of local government as well as international and supranational organizations, including integrative groupings [Flejterski, 2007, pp. 71-72]. S. Owsiak points out that the science of public finance is not limited only to the study of economy using public funds, but it also explains economic and social content of public finance, attempts to determine cause and effect relationships between pooling public finance and the management, social and political processes. [Owsiak, 2004, p. 21]

The subject of public finance is managing public funds, i.e. the means available to public authorities and their subordinate units to conduct public tasks.[Malinowska-Misiąg, Misiąg, 2007, p. 11]. Whereas J. Osiatyński [Osiatyński 2006, p. 15] defines public finance as " phenomena, processes and public and legal institutions connected with arising and managing public funds."

On the basis of the above mentioned analyses, it can be stated that public finance constitute a combination of financial phenomena connected with income and expenditure conducted by public bodies including the state and units of local government.

3. Budget income according to Polish legal system

The superior and most general legislative act which regulates the issues of budgetary income is the Constitution of the Republic of Poland of 2nd April, 1997. According to art. 216, financial resources devoted to public purposes will be collected and disposed of in the manner specified by the statute. It results in an obligation to adopt the budget annually in accordance with what it specified in a budgetary statute. Detailed issues concerning budgetary income are described by the act regulating public finances and acts in which ways of acquiring income from specific sources are defined, i.e. acts regulating the issues of specific taxes.

According to the Polish Finance Act of 27th August 2009 [the Polish Finance Act of 27th August 2009], public funds include:

1. public income;
2. funds derived from the budget of the EU and non-returnable funds coming from the financial aid of member countries of the European Free Trade Association (EFTA);
3. funds derived from foreign sources, not returnable, other than listed in 2;
4. revenues of the state budget and of budgets of local government units and other units of the public finance sector derived from :
 - a. sale of securities,
 - b. privatization of assets of the State Treasury and assets of local government units,
 - c. repayment of loans granted from public funds,
 - d. obtained loans and credits,
 - e. other financial transactions;
5. revenues of organizational units and legal persons classified under the public finance sector, derived from activity and other sources.

Public income consists of:

- 1) public levies which include taxes, contributions and other cash payments incurred for the state, territorial government units, special purpose funds and other units of the public finance sector under separate laws;
- 2) other income of the state budget, units of territorial government and other units of the public finance sector obtained under separate regulations and international contracts;
- 3) income from the sale of things as well as from performing services by the units of the public finance sector;

- 4) income from property of units of the public finance sector, especially from:
 - a) income from lease or tenancy and other agreements of a similar character,
 - b) revenue from bank deposits and bank accounts,
 - c) interest on loans provided and on owned securities,
 - d) dividend due to acquired property rights;
- 5) inheritances, bequests and gifts in cash to the benefit of units of the public finance sector;
- 6) compensation to units of the public finance sector;
- 7) income of units of the public finance sector on account of provided sureties and guarantees;

The most important factor influencing the level of income of the state budget in 2013 was economic slowdown of development in Poland due to the stagnation of GDP growth in the countries of the European Union. It was particularly noticeable at the beginning of 2013.

According to Central Statistical Office of Poland (GUS), the real GDP growth amounted only to 0,4% in the first quarter of 2013 year-on-year. The result of the big economic slowdown and pro-cyclicity of tax elasticity was the fact that budgetary income was nominally lower in the first months than in the same months of 2012.

The most important macro-economic factors influencing budgetary income in 2013 were:

- GDP growth at 1,6% , i.e. 0,1 percentage point (pp)
- the rate of the increase of individual consumption in total by 0,8% (real),
- the decrease of average employment in national economy by 1,1%,
- the increase of average pay by 3,4% (nominally),
- the dynamics of investment of the sector of governmental and local institutions at 86,4% (nominally) to 85,0% as predicted.

While analysing the execution of budget income in 2013, cyclical conditions should be taken into account. In 2013, the same as a year before, the decrease in the rate of economic growth was observed. The real dynamics of GDP was admittedly positive, however, significantly lower than it was expected looking at the rate of growth of Polish economy estimated at approximately 3,2%. Additionally, the consequence of a slower rate of economic growth in 2012-2013 was a fast closure and the occurrence of a negative number of output gap, which in 2011 was at relatively high level plus 2,0% of potential GDP. It is estimated that in

2013, the level of actual GDP dropped below the potential level, which resulted in a negative number of output gap at minus 1,2% of potential GDP. In total between 2012 and 2013, output gap increased by 3,2 pp, i.e. it was significantly bigger than at times of financial crisis of 2009-2010 when the output gap change amounted to 2,5 pp. The situation was connected with a significant worsening of cyclical conditions and as a consequence, due to high pro-cyclicality of tax elasticity, significant worsening of the conditions to collect tax income. The share of total income of the budget of countries in GDP is presented in Figure 1.

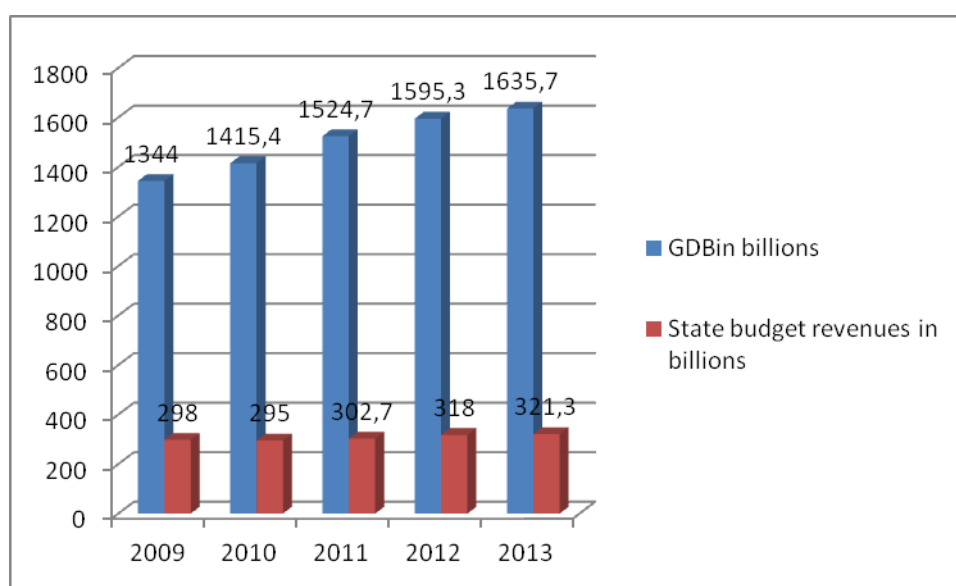


Figure 1. The share of total income of the budget of countries in GDP in 2009-2013.

Source: Own study on the basis of statements on budget execution in 2009-2013, www.mf.gov.pl

The highest share in the income of the national budget in GDP took place in 2009 (22%). Between 2009 and 2013, the share decreased gradually and it amounted to 19,6% in 2013. While analysing the data included in Table 1, it can be stated that the budget income amounted to 279,2 billion Polish zloty. It was higher than in 2009 by 1,8%, but lower than in 2012 by 2,9%. It was caused mainly by the decrease of dividend yield by 13,4% and deposits from NBP (National Bank) profit by 35,4%. Among all tax income, only personal income tax (PIT) increased by 3,8%

and excise duty remained at almost unchanged level. Other types of tax income were recorded at a lower level.

The increase of revenue from the personal income tax paid in accordance with tax scale was connected with the growth of total payroll fund in national economy, old-age and disability pensions. The increase amounted to 3,1% in 2013. The analysed period also experienced the increase of tax income from individuals conducting business activity and from flat tax by 3,8%. Analysing Value Added Tax, 5,5% decrease could be noticed in comparison to 2012 and 14% growth in relation to 2009. While comparing budget income from VAT, it should be noted that there was a change in regulations concerning the way of recording VAT reimbursement in Poland. In 2012, cash accounting was introduced while dealing with VAT reimbursement. It led to a one-time positive effect of the increase of budget income on this ground in 2012.

The decrease of income on this account in 2013 was caused by particularly unprofitable general conditions of conducting business activities. According to the estimation of the European Commission concerning the output gap in the analysed year, the deviation of GDP cyclical component from the potential of economic growth reached a minimum level, the lowest since Poland joined the European Union. It meant that cyclical conditions for collecting income were the worst since 2004. Deterioration of economic fluctuations in Poland between 2012 and 2013 was one of the biggest in the EU, similar to Cyprus, Greece, the Czech Republic and Italy. The increase in tax arrears, which were connected with the situation of enterprises due to the stagnation in economic growth in 2013, also influenced budget income from VAT in 2013. The arrears from VAT increased in 2013 by 4,6 bn ,i.e. by 27,8%, in total in relation to 2012.

Changes in the way of settling VAT for taxpayers, introduced in previous years and aiming at making tax system easier, also had a negative influence on income from VAT in 2013. The most important factors which had a negative effect on budget income from VAT were: the increase of import value of goods settled in income statement at the expense of the import settled according to general laws in customs, the increase of settlement amounts determined in quarter declarations. It was particularly significant in the last quarter of 2013 and it caused reallocations in the flow of income from tax to January of 2014, which had a negative effect on revenues in 2013.

Table 1*The level and dynamics of the budget income between 2009 and 2013.*

Lp	Specification	Level [in billion zloty]					Dynamics [%]	
		2009	2010	2011	2012	2013	2013/2009	2013/2012
A.	Tax income	214,9	222,6	243,2	248,3	241,7	112,5	97,3
I.	Indirect tax	155	165,2	180,3	181,9	175,4	113,2	96,4
1	Value Added Tax	99,5	107,9	120,8	120	113,4	114,0	94,5
2	Excise duty	53,9	55,7	58	60,4	60,7	112,6	100,5
3	Gambling and lottery tax	1,6	1,6	1,5	1,4	1,3	81,3	92,9
4	Corporate Income Tax (CIT)	24,2	21,8	24,9	25,1	23,1	95,5	92,0
5	Personal Income Tax (PIT)	35,8	35,6	38,1	39,8	41,3	115,4	103,8
6	Other	0,0008	0,0005	0,001	1,4	1,9	237500,0	135,7
II.	Tax-free income	27,4	24,5	32,3	37,1	36	131,4	97,0
1	Dividends	8,3	5	6,1	8,2	7,1	85,5	86,6
2	Duty	1,6	1,7	1,9	2	2	125,0	100,0
3	Other tax-free income	24,9	11,2	15,6	16,3	19,4	77,9	119,0
4	Payments of units of territorial government	2,7	2,7	2,4	2,4	2,2	81,5	91,7
5	Deposits from NBP (National Bank) profit	0	4	6,2	8,2	5,3	112,5	64,6
III.	Funds from the EU and other not returnable sources	31,9	3,2	2,1	2,2	1,5	4,7	68,2
	Income in total	274,2	250,3	277,6	287,6	279,2	101,8	97,1

Source: Own study on the basis of statements on budget execution in 2009-2013, www.mf.gov.pl

Additionally, it can be assumed that during the economic slowdown in 2013, the share of gray zone increased. Such a situation also took place, for example, in 2009.

Another tax, whose level was observed to drop in the national budget in 2013 in comparison to both 2009 and 2012, was Corporate Income Tax (CIT).

The decrease amounted to 4,5% and 8%, respectively. It was caused mainly by:

- a worse macroeconomic situation. The real GDP growth was lower than in 2012 by 0,4 pp. Income from tax was also influenced by nominal GDP level, which amounted to 4,5% in 2012.
- unfavourable result of tax settlements for 2012. According to the data of the Ministry of Finance, balance of settlements, i.e. the difference in the amount of money to be paid and overpayment, amounted to 0,4 billion zloty, and it was lower by 3,0 billion zloty in comparison to the balance of settlements for 2011.

While analysing budget income on account of CIT in 2013, it should be noted that some taxpayers settled their tax during the year in a simplified way – on the basis of the results from two years ago. It meant that a part of the income was not dependent on the current economic situation. The taxpayers settled their annual tax by the end of March of the next year.

Taking into account the structure of national budget income, Value Added Tax was the most important. On average, it constituted 41% of all budget income in the analysed period of time. In 2013, its share increased by 4,3 pp in comparison to 2009.

Another tax which played an important role in contributing to the budget was the excise tax. Its share increased steadily in the analysed years. In 2013, it grew by 2,7 pp in relation to 2009.

Funds from the EU were most significant in 2009. They shaped the national budget in 11%. In other analysed years, their share decreased gradually. In 2013, the deterioration amounted to 11,1 pp.

Budget revenues may be devoted to strictly determined purposes. According to the Public Finance Law, it can be spent on:

1. public expenses;
2. outlays of the state budget and the budgets of local government units.

4. The National Budget expenses

Public expenditures may be spent for the purposes and in the amount established in:

- 1) the Budgetary Act;
- 2) a budgetary resolution of a local government unit;
- 3) the financial plan of a unit of the public finance sector.

Units of the public finance sector effect expenditures in accordance with regulations concerning the individual types of expenditures.

Public expenditures should be effected:

1) in an expedient and economizing manner, taking into account the principles of:

- a) acquiring the best returns from given outlays,
 - b) optimal choice of methods and means to achieve goals determined earlier;
- 2) in a manner making possible punctual execution of tasks;
- 3) in the amount and time resulting from commitments drawn earlier.

The Public Finance Law determines six groups of expenditure:

- subsidies and subventions which to addressed to various entities (especially general subventions for local government units) and are the source of financing tasks commissioned to local government units,
- performances for natural persons consisting of state budget expenditures addressed to natural persons directly (pensions) or indirectly (prescription co-payments),
- current expenditures of budgetary units connected with the operation of public institutions, subject to special rules of settlement (including remuneration and salaries and contributions assessed on these, paid to budgetary workers, Members of Parliament, control and security agencies, courts, tribunals as well as paid for the purchase of goods and services necessary for the operation of governmental administration, courts, tribunals and other public institutions),
- expenditures connected with the share of the State Treasury in companies and commercial (law) partnerships (for example, the purchase of stocks) as well as investment expenditures (costs connected with building new objects constituting municipal infrastructure),
- expenditures for servicing the State Treasury debt, consisting of interest and discount on treasury securities, interest on drawn credits and loans as well as payments related to guarantees granted by the State Treasury,
- contributions to the budget of the European Union, referred to as "own resources of the European Union" consisting of shares in income from customs duties, agricultural duties and sugar duties as well as funds calculated on the basis of Value Added Tax (VAT) and the value of Gross Domestic Product (GDP).

The state budget expenditures include co-financing of projects with the participation of the EU funds (they consist of state budget expenditures devoted to co-financing of projects with the use of European funds, financing of technical help projects and projects with the participation of funds received from the member countries of the European Free Trade Agreement as well as expenditures on projects with the participation of

other funds from the EU budget that are not determined in the the budget of the European funds).

Table 2

The level and dynamics of the budget expenditure between 2009 and 2013.

Lp	Specification	Level [in billion zloty]					Dynamics [%]	
		2009	2010	2011	2012	2013	2013/2009	2013/2012
1	Grants and subsidies	133,9	145,2	148,5	155,4	155,2	115,9	99,9
2	Benefits to individuals	20,1	20,9	21,9	23	24	119,4	104,3
3	current expenditure of budgetary units	51,3	53,9	55,3	57,2	58,4	113,8	102,1
4	property expenditures	14,7	15,4	14,9	13,6	12,9	87,8	94,9
5	the expenditures on the debt service of the Treasury	32,2	34,1	36	42,1	42,5	132,0	101,0
6	own resources of the European Union	13,4	14,3	14,7	15,9	18,1	135,1	113,8
7	Co-financing projects with participation of the EU funds	32,4	10,9	11,4	10,8	10,3	31,8	95,4
x	Total expenditures	298	295	302,7	318	321,3	107,8	101,0

Source: Own study on the basis of statements on budget execution in 2009-2013, www.mf.gov.pl

On the basis of the data included in Table 2, it can be stated that budget expenditure in 2013 increased by 1 % in comparison to the previous year, whereas the growth amounted to 7% in relation to 2009.

The biggest growth concerned expenditure in the group of own resources of the European Union. The increase of the contribution was the consequence of a significant increase of the level of the EU budget (including contributions of the particular member countries) by adopting a few amending budgets during the year in order to provide enough funds to cover all liabilities of the EU in the last year of financial perspective 2007-2013.

Another group of expenditures which was observed to increase in 2013 was current expenditure of budgetary units. The increase amounted to

13% in relation to 2009 and 2,1% to 2012. It was caused by legislative rise of enumeration in particular social groups.

Performances for natural persons also increased in the studied period of time mainly due to adjustment of old-age and disability pensions for inflation by indexation rate of 104% and due to the increase in the number of people entitled to receive these benefits.

The share of the settled expenditure of the state budget in 2013 both in estimated GDP (i.e. PLN 1.642,9 bn) and real GDP (PLN 1.635,7 bn) amounted to 19,6%.

Between 2009 and 2013, the share of settled expenditure of the state budget in real GDP in total amounted to 22,2% in 2009, 20,8% in 2010, 19,8% in 2011, 19,9% in 2012 and 19,6% in 2013.

While analysing the share of expenditure of the state budget settled in 2013 in particular sectors, it could be stated that the biggest part constitute expenditure included in the following sectors:

- compulsory National Insurance (23,3%), in which the highest outlays were allocated to grants to Social Security Funds and Pension Fund ,
- various settlements (22,1%), in which the biggest share constituted general subventions for local government units as well as contributions to the EU budget, servicing of the public debt (13,2%),
- national defence (6,3%).

The figure below presents the share of expenditure in particular sectors in the expenditure of the total state budget.

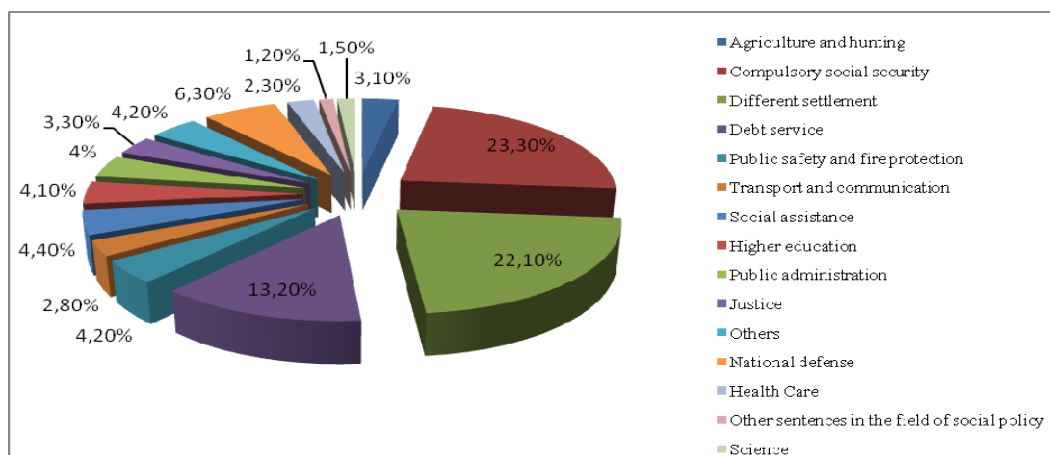


Figure 2. The structure of the budget expenditure according to the sectors of budget classification in 2013.

Source: Own study on the basis of statements on budget execution in 2013, www.mf.gov.pl

5. Deficit and public debt

Recent economic slowdown had a significant influence on the decisions of public organs. The state faced new challenges which required bigger public expenditures. It led to the creation of budget deficit which is defined as a negative relation between budget income and budget expenditure. Therefore, it is the part of expenditure that is unable to be covered by the budget income. The size of the budget deficit in a given budgetary year is determined by an annual budget act, including limitations imposed by article 220 of the Constitution of the Republic of Poland. They concern the prohibition of: the adoption by the Sejm of a budget deficit exceeding the level provided in the draft Budget by the increase in spending or the reduction in revenues from those planned by the Council of Ministers and covering a budget deficit by way of contracting credit obligations to the State's central bank. The budget act also determines ways of covering the budget deficit.

The budget deficit, as far as the state budget is concerned, can be covered only by revenue sources determined by the budget act in an enumerative way. The budget act determines a limited catalogue of sources of financing of budget deficit, including:

- Issuing treasury securities (treasury bills and bonds) purchased by non-bank entities, i.e. households, enterprises and commercial banks.
- taking loans in commercial banks,
- taking credits from international financial institutions,
- taking credits in the central bank or issuing securities taken by the bank. In Poland and many other countries, these ways are statutorily forbidden as the most inflationary.
- Budget surpluses from the previous years or income from privatisation of the assets of the State Treasury
- Loans.

The level of the public deficit is presented in Table 3.

The highest public deficit in Poland was observed in 2010. Expenditure was higher than the income by PLN 44,7 bn. In 2011, the negative balance of the state budget decreased by 44%.

Table 3*Public deficit in Poland between 2009 and 2013 (in billion zloty).*

Specification	2009	2010	2011	2012	2013
Total income	274,2	250,3	277,6	287,6	279,2
Total expenditure	298	295	302,7	318	321,3
Deficit	-23,8	-44,7	-25,1	-30,4	-42,1

Source: Own study on the basis of statements on budget execution in 2009-2013, www.mf.gov.pl

The state public debt is often explained as a nominal value of debt of units of the public sector of finance determined after eliminating mutual commitments of the entities of the sector of public finances. Thus, the state public debt consists of all the commitments drawn by the State Treasury and other institutions of the public finance sectors representing the State Treasury, including budgets of local governments. The limitations of the state debts are defined in legal acts, which determine maximum limitations of debt in relation to the value of Gross Domestic Product. The limitations valid in Poland result from the Constitution of the Republic of Poland, the Public Finance Act and, as a member of the European Community, regulations of the Maastricht Treaty. The Constitution of the Republic of Poland of 2nd April 1997 contains the most important limitation to the debt, art. 216 sec. 5, saying: 'It shall be neither permissible to contract loans nor provide guarantees and financial sureties which would engender a national public debt exceeding three-fifths of the value of the annual gross domestic product.' That is a constitutional limitation to the state public debt stating clearly that the debt cannot exceed 60% of the GDP value. The constitutional record is strictly connected with art. 104 (104c) of the Treaty on the European Union (the Maastricht Treaty of 7th February 1992), and in particular art.1 of the Protocol on the excessive deficit procedure (an annexe to the Maastricht Treaty), where limits are determined at 3 % for the ratio of the planned or actual government deficit to gross domestic product at market prices and 60 % for the ratio of government debt to gross domestic product at market prices. The limits included in the Treaty constitute a macroeconomic commitment of the EU countries and they are referred to as Euro convergence criteria. The public finance law on 27th August 2009 determines tasks of the Minister of Finance concerning the constitutional debt limit by controlling the sector of public finances as well as concerning the control of the State Treasury debt. It also contains three

limitations to the public debts. Exceeding of these limitations is connected with applying Prudential and Rehabilitation Procedures.

1) The first limitation presents the value of the ratio of the total amount of the state public debt to the gross domestic product greater than 50%, but not greater than 55%.

2) The second group consists of the ratio greater than 55%, and smaller than 60%.

3) The third and last limitation concerns the relation of the debt to GDP which is equal to or greater than 60%.

The public debt includes commitments from:

- drawn and outstanding loans and credits by the State,
- issued debt securities,
- compensation for compulsory purchase and payments for lost or damaged property,
- guarantees,
- compensatory and other damages
- term deposits

The public debt classification includes: government debt, debt of a local government or debt of the social insurance sector.

Table 4

The level of the public debt in Poland in 2009-2013.

Specification	Level				
	2009	2010	2011	2012	2013
The state public debt in bn zloty	669,9	747,9	815,3	840,5	882,3
The relation of debt to GPD in %/	49,9	52,8	53,5	52,7	53,9

Source: Own study on the basis of statements on budget execution in 2009-2013, www.mf.gov.pl

On the basis of the data presented in Table 4, it can be stated that the highest level of the public debt occurred in 2013. It increased by 31,1% in comparison to 2009 and by 5% in relation to 2012. The biggest dynamics in 2013 was observed in the social insurance sector in relation to the previous year. It increased by 53,6%. The debt of local government doubled in the analysed period of time in comparison to 2009. The rate of the increase of the debt of local government was higher than that of the government debt. It should be noted that the debt of the government sector grows at the same rate as total debt. The situation results from the share of

the sector in the level of total debt. In the studied years, the share amounted to 93,1% of the total debt on average. The debt of local government had 6,5% influence on the public debt. The lowest share in the debt structure had the debt of the social insurance sector. It amounted to 0,4% of the total debt.

While analysing the share of the public debt in GDP, it can be stated that between 2010 and 2013, debt limitations resulting from the Public Finance Act were exceeded.

In 2013, the basic market for raising funds was , similar to previous years, the national market where Treasury securities with a nominal value of 131,2 bn zloty were issued. In total, in 2013 twenty-four government tenders of securities were organised, including 21 tenders of government bonds and 3 tenders of Treasury bills. Throughout the years, funds to finance the loan needs were achieved by credits from international financial institutions – the World Bank and European Investment Bank. In 2013, funds equivalent to 11,6 bn zloty (€ 2,8 bn) were raised.

While analysing the structure of debt, it can be stated that the share of debt in foreign currencies dropped from 31,6% in 2012 to 30,3% in 2013. Average debt maturity, as a way of measuring the risk of refinancing, attenuated slightly from 5,49 in 2012 to 5,33. However, the state debt indicator increased from 4,47 in 2012 to 4,49. The level of debt of maturity shorter than one year dropped significantly from 11,4% in 2012 to 9,3%, whereas the debt in Treasury bills, due to lack of necessity to emit the instruments, has been at 0 level since last August.

6. Summary

To fulfil the needs of the citizens, the state has to collect funds which should be intended for specific purposes. In 2013, there was a decrease in the budget income in Poland. It was mainly caused by the attenuation of the tax revenue. It was connected with a worse economic situation of the entities partly resulting from an economic slowdown of the state. The main group to which the state directs the income is the social insurance, the service of the public debt and national defence. In the studied years, the level of the budget expenditure was higher than the income. The highest deficit was observed in 2010. The result of the state budget deficit was gradually increasing public debt. The debt of the government sector had the highest share in the total debt.

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INFORMATION STRATEGY OF SMALL ENTERPRISE – NEED OR TREND

Paula PYPLACZ^{*}, Katarzyna MIZERA^{**}

***Abstract.** The present study deals with topics concerning the operation of small businesses in the market. Considerations concern the information needs of this group of companies, known as companies aspiring to the role of being effective, competitive – the so called. enterprises of the future. The need for implementation of information strategy by small enterprises as part of the company's overall strategy was analyzed.*

***Keywords:** small enterprise, information strategy, information.*

1. Introduction

The organization, according to the Porter's theory of resources, has the financial, physical, human resources and increasingly significant resource – information, which has an impact on all areas of the company and is an essential element of the decision-making process. Information is now an integral part of the work of each organization, it becomes a significant factor in creating a competitive strategy, and it determines success. Information strategy is created from a series of decisions taken by management based on the information being received from the environment. The amount and form of the information flow increases with the technological advances in the field of communication. However, one cannot modernize the organization without the evolution of the information system, which supports the activities of the organization and determines the quality of management processes.

The aim of the study is to analyze the situation of enterprises in the aspect of the effective use of information and exploitation of it to create an information strategy. Due to the specific approach to information management in small firms and the activities in the formulation of an overall strategy, the analysis will be limited to small businesses group.

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Businesses that despite many limitations and aspire to the role of the so-called businesses of the future.

2. Information as resource of enterprises of the future

The information revolution that we are witnessing has the impact on competition in the market which occurs in three main ways [8 p. 92]:

- changes the structure of the sector, and at the same time changes the rules of competition;
- creates a competitive advantage by enabling companies to achieve better results than their rivals;
- leads to a completely new areas of activity often on the basis of the current operations of the company.

Thus, the activities of strategic analysis are not only the domain of large organizations. Every small business has to think strategically, although turbulent and dynamic market changes often long-term "plans" of entrepreneur.

Aspects of strategic management are in fact derived from ongoing transformation of the economic model which in Poland is associated with the past political transformation, while on a global scale with changes in the economic structures, in which entrepreneurship manifests itself and the emergence of a its new forms known as a company of the future and new entrepreneurship [2 p. 114], [3 pp. 93-103]. Simultaneously in the new economy no company operates in isolation from other economic operators. Economic activity of enterprise of the future is based on a powerful network of interrelationships between various levels and functional structures. The basis of its operation is unlimited access to suppliers, strategic partners, competitors and customers, readiness and ease of changing relations between the teams and a wide possibility to outsource operations or tasks to be performed by potential subcontractors [5 p. 25]. These relationships also allow access to information resources held by business partners.

Previous traditional organizations have focused their attention on the product, service, sales, innovation and increase of efficiency. However, in the companies of the future, information resources are becoming increasingly important part. They should allocate more funds for the appropriate acquisition, processing, evaluation, storage and transmission of information needed for the proper functioning in conditions of strong competition. The basic kind of information related to the activities of small businesses are market information, which can be defined as "any content in

a specific form, passed from the market or to the market which are reports, descriptions, orders, decisions of a market participants concerning the market and the general economic phenomena related to it" [4 p. 102]. Under certain circumstances, the information may become management information, which allows for the implementation of the basic functions of management (planning, organizing, motivating and controlling). It is a wide range of information about activities of the company, from which you can extract a specific subset useful for a decision-making on different levels of governance. Management information helps in decision-making both strategic and current and indicates areas of activity, to which company should pay special attention [9 pp. 124-125]. Management information, by making decisions and implementing actions, allows the organization to learn and to continuous adjust to the turbulent market.

With the increasing amount of information flowing in from the outside as well as those occurring inside of the organization, appropriate management is necessary. The first element is to examine and determine the information needs [10 pp. 856-862]. The comprehensive approaches, which contribute to a new quality information system, have decisive importance. The most frequently used methods are derived from the analysis and design of information systems i.e. [13 pp. 96-97]. Examination by the product, total study, critical success factors, key indicator system, business information characterization study, business process model, enterprise activity matrix, and information control net model.

Information that comes to decision-makers originates from different sources Sometimes these sources are difficult to verify. Reliability in the analysis of information needs is a necessary condition to obtain high quality information that will be used successfully in decision-making. Therefore, in addition to appropriate methods of collecting information the role of person using the information is crucial. Skills are required to detect the essence of phenomena occurring in the distal and proximal environment_verification of available resources_combining and interpreting the information using the concept of information management and knowledge [6 pp. 168-169].

The main obstacles in the effective use of information in organizations include [12 p. 74]:

- too much information, which makes difficult in the further processing and use,

- no link between obtained information and the actual needs of decision-makers
- excessive dispersion of information across the enterprise
- difficulty in locating needed information
- too long to waiting time for information
- cases in which relevant information is lost
- concealment of certain information in contacts between employees
- difficulty in determining the reliability and accuracy of collected information.

Satisfying information needs of the enterprise is a part of the process of achieving goals, vision and overall strategy of the organization, including information strategy.

3. Information needs of small business

Until recently, the main area of activity of Polish small business market was local, regional or national. Globalization, decentralization, Polish entry to the European Union force changes in all areas of the organization. Formulated in 2004 by Strużyński thesis that small businesses are the engine of sectoral and regional development [11 p. 119] seems to be still valid.

The share of the SME sector in the economies of most countries is significant. However, their limited barriers of expansion usually arise from a small size and too cautious and even preventive actions.

Although the share of Polish small and medium-sized enterprises in Poland in GDP is lower than in the EU. The activity of this group of companies has an important role in the development of the Polish economy and the fact that still generates new businesses allows predicting, that the key role in building economy by these companies remains long unwavering.

Nowadays, the information needs are rapidly changing. Despite the "bombing" of the organizations of all kinds of information, good search and retrieval of data is difficult, expensive and time consuming task. There is a frequent situation in which there is a shortage or excess of information. Deficiency leads to a situation in which decision-makers cannot quickly take the appropriate decision based on facts. In the other hand, an excess of unnecessary information is associated with difficulties in the analysis, which is using the activities and incurring unnecessary costs. The most preferred is a situation in which a company achieves information balance, which is optimum information. Unfortunately, this is difficult to achieve

and requires constant monitoring information needs. Effective information management requires a real advisability ratings of extending the scope of the information received. This is done by [1 p. 14]:

- comparison of the cost of obtaining information with the benefits , which we can derive benefits from it;
- maximization of utility, i.e. Actual function, representing the valuation effects of individual decisions.

Proper management of information resources is a complex and unsteady process. Due to the rapid changes in this area, large amount of collected information is needed for analysis, distribution and archiving. Managers need to work on the basis of their own information resources, as well as use external services, specialized companies. Although the process is costly, small business owners recognize the legitimacy of having complete information. In addition, data and information acquisition is an ongoing process that must be adapted to the changing market or decision-making situations. It would be a great help to have special departments or secondment of suitable persons who will address this issue at the same time creating a formalized information systems, including information resources. [9 pp. 251-268]

4. Information strategy in the organization

The necessary condition for the effective operation of the company is adequate quality of the information. It should therefore strive to create the conditions that allow the acquisition, analysis, processing, and transfer of information within the organization as well as at the level of the organization – environment. Organizing appropriate conditions allows building in the company efficient working information system, which aim is to monitor incoming and outgoing information, verify, update, and distribute to various levels of management and store them for later backtesting. The information system can be defined as purposely organized structure of people, equipment and procedures for collecting, processing and distributing information on the use of various decision-making centers in the company. The information system as to be used effectively with its range should cover the entire enterprise, all of organizational units. The purpose of any information system should be [7 pp. 232-233]:

- providing the information necessary for decision-making and implementation of shaping the situation of the company;
- ensuring cooperation of the management and the executive system;

- enabling efficient communication between members of the organization;
- a rapid response to changes in the functioning of the company and the environment and taking corrective actions;
- the improvement of the research and development;
- contributing to the perpetuation of organizational knowledge resources as a key company resource

The information system is the nervous system of the organization and includes all acquired resources and activities in the field of information management. It thus becomes the foundation of information strategy. It is therefore necessary to determine the strategic directions of development of AI functionality as an integral part of the strategy of competitive struggle. As useful tool can be a model of competitive use of information, developed by the International Institute for Management Development, indicating the four directions of attention in the information system [13 pp. 114-116], as shown in Figure 1.

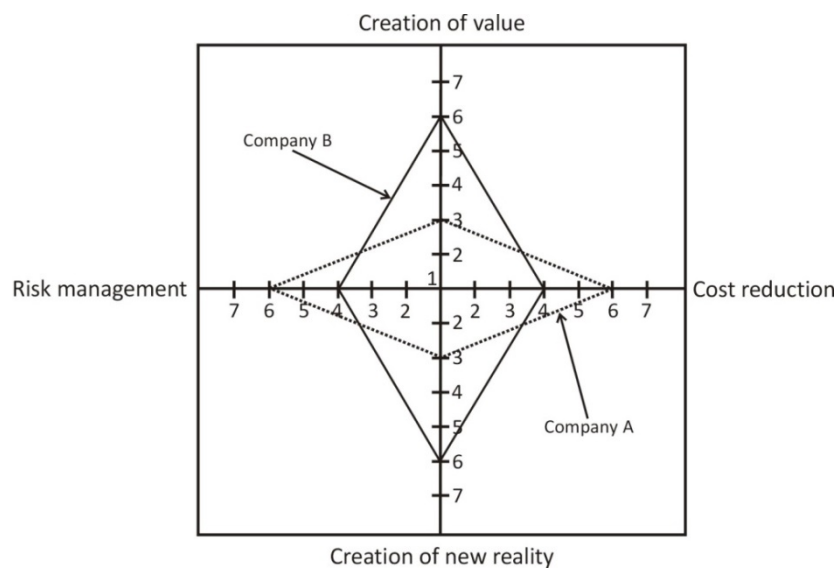


Figure 1. Model of competitive use of information.

Source: [13 p. 115]

The first direction is risk minimization, such optimization which is to relevant market information derived from the client about processes of service in this market by the company, and the market competition and internal threats hit in an appropriate form at the right time for managers, to minimize the risk of making the wrong one decision. In this way, the risk

of operational, financial and outgoing outside the company is minimized. The second dimension is the reduction of costs. Process-oriented, constantly being improved cost system. This is the basis for the generation of information affecting the efficiency of the organization. Inefficient business processes should be identified by the AI, and information about the cost of the organization should be the everyday work tool for operational managers.

Because the client "stands in the center of interest" of the company, all employees must provide relevant information, that will be used by them to create market value. Thus, the third dimension is to create value for customers and served markets.

The fourth dimension is the creation of a new reality. Unfortunately, actions on the wider innovation are rather weak point of small businesses.

An appropriate information system can be used as supplement, which supplies the company's employees with the information relating to what is significant happening in the market. This is the information about all the latest products, process, technology, marketing and organizational skills. In this way, innovation becomes a daily practice of every employee in the organization.

According to T. Davenport building enterprise's information strategy is based on the following factors [13 p. 108]:

- In most of the companies the information environment is poorly organized;
- information resources can always be better allocated;
- information strategies helps businesses adapt to changes;
- information strategies give greater importance of information;
- information resources are insufficient to understand, interpret and create positive value with use of these resources;'
- when external enterprise environment is changing, then usually such a change also needs the information environment of the company.

Leading representative of the school of information management – M. Earl – suggested the perception of information strategy as a resultant of three strategies [13 p. 105]:

- strategy for information system – it consists of components that bind with the overall strategy of the company and the components of creating new opportunities. At this level there is need to identify requirements for new applications and supporting technologies and developing activities of the company.

- strategy for information technology – is mainly determination of the extent and architecture technology, which represents the technological

frameworks for infrastructure management company. Moreover, the approach of combining technology with the organization was in the 1990s to define the basis for the information strategy. So speaking of the information system often focuses attention on technological solutions. This is undoubtedly an important element, but in small organizations without broad general organizational aspects, there is no chance to expect high-quality information.

- strategy for Information Management – components of this strategy are the roles and relationships between them, it is necessary to define them in the management of processes in the field of computer science, and especially for the information system. Roles determine who has the authority and is responsible for what in terms of policy information resources and activities both inside and outside of the information system functions, at different levels of the organization

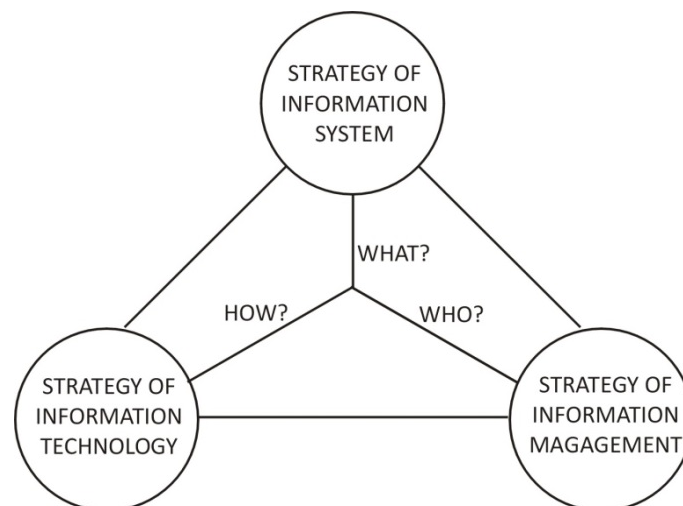


Figure 2. Components information strategy.

Developed on the basis of [13 p. 106]

Information strategy of the enterprise should primarily provide support for the basic strategy of the company in providing information about the optimal quality parameters. It is important to reach out to specific information to ordinary workers, as well as various recipients from outside of the company (customers, suppliers). Therefore, the primary objective of an information strategy can be considered as an environment shaping enterprise information that meets the information needs in the future [13 p. 107].

5. Activities of small companies in respect of information strategy

Small businesses need to adapt both its mode of operation and business strategy for overall trends also in the broad sense of information management. Effective management can be achieved, inter alia, by optimal utilization of methods, techniques and generally available instruments that are tailored to the individual nature of the business, so that there was no information gap, and do not multiply unnecessary information. Information gap hinders proper and full analysis of the efficiency of the business process. Its proper analysis and interpretation is capable of achieving competitive advantage and conducting business in a conscious way.

Appropriate actions are resulting from the nature of the organization. Every small business has characteristics that distinguish them from other companies (medium or large).

Specific management of the company. The owner is usually both the manager and the only person who makes all the important decisions, which makes that there is one center of decision-making. It's his personality traits have a direct impact on the way of company. They lead to interactions with staff and relations with the environment.

In small companies, there is the possibility of close contacts with suppliers, business partners or customers by meeting their individual needs and the ability to flexibly adapting to changes in the market. Relations small business with customers and suppliers are often personal. Cooperation is often private and business connections, which often go beyond the formal business contacts.

Small business is characterized by independent economic and legal owner. This seemingly favorable situation is often associated with the phenomenon of financing activities primarily from its entrepreneur resources. Small businesses have also limited resources: human skills, physical, financial and informational deficiencies that occur or its lack of reliability. This situation has undoubtedly impact on the reduction of investment, thus limiting the ability to compete in the market.

Taking advantage of its strengths, small businesses have the opportunity to act in market niches which are not attractive for the big companies. In addition, the fact of business in the field predominantly on the local market involves less financial resources through simplified monitoring.

The organizational structure is not usually extended, has informal character, and at the same time is flexible, usually singular and flat. The main strength of strategic decisions making falls within the competence of

the owner. It is difficult to observe bureaucratic procedures or formal organizational standards. All tasks, functions, roles and positions are often contractual and may change with changes in the company.

Management positions are often involving relatives of the founder, a strategic management and procedures are used to a limited extent. Experience and intuition is mainly used. This approach, unfortunately, affects governance, where premonition often replaces the tools used to assess the market.

Communication takes place on the basis of informal contacts between the owner and the employees, due to the previously described uncomplicated organizational structure and the closeness in relations supervisor – subordinate. Small businesses have difficulties in obtaining external financing. In combination with limited equity capital, which may cause limitation of the product offer, is following a significant decrease in competitiveness. Fortunately, in recent years the situation in terms of obtaining funds from special sources for small businesses and non-returnable funds has improved. Various types of assistance programs, i.e. from the EU, particularly contributed.

Features of small businesses cause that they must use their strengths to improve their competitiveness and efficiency. Also, strategic actions must be tailored to their specific business. Often the duration of several years is too long for a small business perspective. The information strategy can be one of the elements to enhance their competitiveness. According to Davenport and Prusak companies formulate information strategies should pay particular attention to the tasks resulting from: information content, common information, information processes, and new information markets. [13 pp. 109-110]

Accenture consultants have proposed five groups of actions in the implementation of company information strategy: [13 p. 109]

- action-oriented value chain – in the most types of business the competition revolves around a small number of similar to each other business models, resulting in creation of similar to each other sets of strategic information. The challenge for the information strategy is to find parts of their own value chain, whose support can bring real competitive advantage;

- the improvement actions of business analysis tools – through the development of tools and analytical methods, management of the company may be able to improve decision-making processes;

- integrating activities in the area of the company – an increasingly common practice of companies is to combine the cooperating entities within the development of new products or as part of the logistic supply chain;

- measures aimed at receiving signals from the environment – by creating information channels beyond the enterprise, companies can be more quickly informed about new opportunities and threats. Can thus obtain the most inspiring and valuable information from percipient people, who know what is happening in the environment of the company.

- actions to develop a new strategic information resources – finding new unique information assets can strengthen the competitive position of the company.

6. Conclusion

Small businesses are considered to be one of the most important and most common models of doing business. Unfortunately, the involvement of these entities in information is often limited. The most favorable situation occurs when a firm has an optimal amount of information with a sufficiently high degree of its usefulness. Meeting the needs of enterprise information is a key component of information. Implementation of the communication strategy is a difficult task, in which it is difficult to expect that the intended expenditures will be lower or at least equal to the expected effects. Therefore, the role of a manager involved in information management is the key to the implementation of the communication strategy. He must be convinced to adopt and implement a long-term action in this area.

Measurable benefits for entrepreneurs of small organizations are: the possibility of obtaining higher sales, improvement of the customer service through better understanding of the market and customer requirements. Also in the field of human capital motivation is increased the work teams is being improved, staff fluctuation is reduced. Information resources can become part of the platform connecting small organizations in clusters or industrial group. In order for such situation occurred companies should reasonable invest in such information, which are important for the company and result from the strategy information. Small companies that claim to be the so called “enterprises of the future” must adapt to the prevailing requirements and standards and even try to overtake them. Source of competitive advantage is the ability and speed of creating new products, flexibility, effectiveness, including the speed and the use in the operation of modern management methods. The company of the future must also adjust the internal organizations to the new requirements. Organizations are characterized by flattened structures based on units and leadership related to the concept of the so called “Modern manager”.

Widely understood intellectual capital is the main resource of the enterprise of the future.

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THE IMPLICATIONS OF INDEBTEDNESS FOR FINANCIAL STABILITY

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***Abstract.** Economic growth, one of the main objectives of every economy has been recently affected by the global economic and financial instability. This led to the increase of the indebtedness which soon became a problem for both the developed and developing countries. The article examines the indebtedness indicators highlighting their implications for financial stability. Although indispensable in an economy because of its role in supporting economic growth, debt can have serious implications for stability when its values are very high.*

***Keywords:** financial stability, loans, indebtedness.*

JEL classification: F34, G21

1. Introduction

A system enjoys financial stability when it is able to attract and place monetary fund effectively and to withstand shocks without damaging the real economy (Isărescu, 2006). Ensuring financial stability implies to monitor the ability of a system to absorb shocks. The importance of this type of analysis stems from the fact that the stability of the real economy largely depends on the stability of the financial system. In the current context the influence of the banking sector on the real economy can be best exemplified as follows: due to some shocks manifested in the real economy, bank losses will increase significantly and their impending reaction will be to reduce the supply of credit, which could deepen even more the recession by reducing consumption and investment expenditure. Therefore, there is a strong link between economic and financial stability. The stability of a financial system cannot exist without economic stability and vice versa.

Financial stability can be compromised by a number of factors, including the accumulation of debt, private or public. The economic and financial imbalances manifested in the recent years have changed the

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perception on debt. Many of the existing studies in the literature show that in a recession the deterioration of bank's balance sheets compromises future loans, which in turn cause a reduction in investment, income and employment. However, we can't eliminate debt but, we must rethink the levels for acceptable debts and its structure. The debts accumulated particularly in Europe have shown that they are not only capable of supporting the economy but also of creating major imbalance.

Achieving financial stability and strengthening the capacity to manage debt either by reducing current debt levels and improving debt structure or by developing the capacity to sustain debt levels or more likely, a combination of these represents a major concern of the regulation authorities around the world.

The article analyzes the relationship between debt and financial stability for countries in Eastern Europe. The paper presents in the first section some of the theoretical approaches in the economic literature regarding the concept of financial stability, followed by an analysis of some of the key indicators that highlight the relationship between the indebtedness of a state and its financial stability, in the second section.

2. The concept of financial stability in the economic theory

The analysis of financial stability is one of the issues most discussed in the literature. The financial stability theories have emerged primarily during the international financial crisis and were amplified recently, following the financial crisis of 2008.

The classical economic theories do not put a great accent on the analysis of the instability phenomena, on the nature and the causes of it. In essence, these theories admit that occasionally the economy will face destabilization but, the analysis focuses more on the forces that create equilibrium in the market and not on those that lead to destabilization.

Similarly, the Keynesians argue that in an imbalanced economy fiscal policy can be used to return to steady state. The limits of this theory consisted in the fact that it did not explain how these deviations occurred, such as for example, the unemployment. The focus it was put on the interactions that brought the system back to equilibrium rather than on the processes that lead to destabilization.

From the monetarist perspective financial instability cannot occur or may not have serious repercussions in the absence of changes in the money supply. Monetarists believe that the main determinant of financial imbalances can be found in monetary policy. The problem arising from this

theory is that it does not take into account the possibility of imbalances caused by factors other than the monetary ones (Crockett, 1997). However, the monetarist theory goes beyond the previous theories and analyzes the causes of the imbalances.

The shortcomings of these neoclassical approaches consist in the fact that they claim that the economic cycles can be eliminated through fiscal and monetary policy without taking into account the internal factors that can lead to instability; they attributed this phenomenon only to the forces located outside the functional dynamics of the economy (Minsky, 2011, p. 229).

In contrast to the previous analyzes, Minsky argues that the failure to understand the causes of the economic and financial instability and the ignorance of internal causes limits the ability to prescribe government policies to end the imbalance. He also states that a new theory, that can explain the instability as a normal phenomenon faced by an economy and that can provide tools to control it, it is needed.

The analyzes carried out in the recent years have led to some results that can explain the behavior of the economic agents that can cause financial instability. Among these causes are the information asymmetry, moral hazard, contagion and non-bank financial intermediaries (Crockett, 1997). Even though previously the economic theory analyzed differently the financial intermediaries because it was believed that the difficulties faced by these institutions could not generate the same systemic problems a bank generates, now, it appears that the analysis of the banking sector stability should consider not only banks but also non-banking financial institutions. These include investment funds, brokerage firms, insurance companies and others. Consequently, a stable banking sector means in very simple terms, the ability of all these institutions to withstand shocks.

A more complex definition is given by Garry Schinasi (2004), which argues that financial stability can be defined as a sum of three benchmarks:

- a) The ability of the financial system to facilitate efficient allocation of economic resources and the effectiveness of other business processes such as growth and social prosperity;
- b) The ability to manage and assess financial risks;
- c) The ability of the system to fulfill these functions even in periods of external shocks mainly, through self-correcting mechanisms.

If one or a combination of these features is not met, it is likely that over time the financial system will become less stable. Therefore, maintaining system stability involves identifying the main sources of risk and vulnerability such as inefficiencies in the allocation of financial resources from savers to investors and the mismanagement of financial

risks. Monitoring financial stability should be forward looking and, inefficiencies in the allocation of capital and the mismanagement of financial risks could compromise future financial system stability and therefore economic stability (European Central Bank, 2014).

Defining financial stability throughout risks and vulnerabilities takes into account the fact that they are easier to understand and quantify. The problem that arises from this approach is that states are faced with different types of crises, so the indicators used to measure financial stability depend on the type of crisis a state faces¹. An example of crisis is the banking crises manifested in 2008. A state facing this kind of crisis notes that much of its banking system became insolvent due to massive losses from investments or after a panic among depositors or both². Given the fact that a bank operates with the profits generated by the use of the money deposited by consumers, when a large number of customers withdraw the amounts deposited, the bank will face financial problems that can eventually lead to bankruptcy. When these withdraw occur at a large number of banks, the banking crisis spreads and may reach global dimensions. In general, a banking crisis turns into a financial crisis when it becomes a widespread problem. Another category of crises are those of the foreign exchange rate system, in which, the value of a country's currency collapses. An example of a currency crash is the one that took place in Argentina in 2002. The government has fixed the Argentina peso to the US dollar, believing that this will lead to a monetary stability and will ensure economic growth. Once the dollar strengthened against the euro and Brazil devalued the real, the rigidity of the currency system proved harmful for the economy. These events have decreased the competitiveness of Argentinian products in the two areas, the European Union and Brazil, its main trading partners. At the same time, the foreign investor's loss of confidence caused an outflow of capital leading Argentina into recession (Krugman, 2009, p. 113).

The sovereign debt crisis is another type of crisis that economies may face. This occurs when a national government is incapable of honoring its obligations arising from external and/or domestic debt. The problems

¹ Blaise Gadanecz and Kaushik Jayaram presented in "Measures of financial stability - a review" the most common variables in the literature to measure financial stability, the data frequency for these variables (annual, quarterly, monthly, daily) and their significance. The analysis focuses on six main areas namely, the real sector, the corporate sector, households, external sector, financial (banking) sector and financial markets.

² One of the banking institutions that faced in the recent economic and financial crisis a massive wave of withdrawals was Northern Rock, the fifth British mortgage lender.

concerning default on domestic debt occurred primarily during banking crises or periods of hyperinflation. The occurrence of such difficulties is based on economic conditions much harsher than those existing in the case of default of external debt. Such events were most common in Latin America (Reinhart and Rogoff, 2012, p. 14).

3. Debt and Financial Stability

Although indispensable in an economy because of their role in facilitating economic activity and welfare growth, high and very high debts can create vulnerabilities which in turn can enhance and contribute to the transmission of shocks in the economy.

The studies in the literature show that there is a strong link between debt levels and the volatilities manifested in an economy. However, empirical evidences show the strong relationship that exists between debt and the characteristics of business cycles, including the likelihood of a recession. Moreover, recessions accompanied by high debt are characterized by a great loss in output and employment.

In a study on the impact of debt on growth conducted on a sample of 18 countries for the period 1980-2010, Cecchetti, Mohanty and Zampolli (2011) show that debt above a certain level has a negative impact on economic growth. The study results also provide the debt levels which would not be indicated to cross. Thus, the government debt limit is 85% of GDP, for the corporate debt the limit is about 90% and about 85% of GDP for households' debt.

The economic crisis has forced many European countries particularly the advanced economies to support the banking sector, this fact led to a significant increase in debt and deficits. An example in this regard is Ireland, which has faced a banking crisis after the bursting of the housing bubble. The increased demand for housing fueled by the credit granted by the banks, did not only lead to the increase of housing prices but also to a massive construction of new buildings. The economic imbalances caused a large loss on the loans granted by the banks to the developers. To stabilize the situation, the Irish government injected 64 billion euros in the banking system, which represents about 40 percent of GDP (Schoenmaker, 2015, p. 2). Thus, the Irish government gross debt registered 116% of GDP in 2014.

To analyze debt indicators we have restricted the analysis to the European Union Member States from Eastern Europe, namely Bulgaria, Poland, Czech Republic, Romania, Slovak Republic and Hungary. The level of indebtedness of a country can affect economic performance on the

one hand causing itself the appearance or the amplification of shocks and, on the other hand undermining the ability of households and firms to adapt to new market conditions. According to a research by Schlarek (2004) in the case of developing countries there is a significant inverse relationship between external debt and economic growth, low levels of external debt are associated with higher rates of economic growth. The study also shows that there is a negative relationship between external debt and economic growth and that there is no significant link between external private debt and economic growth. The research was based on a sample of 59 developing countries and 24 advanced economies for the period 1970-2002. Consequently, a high degree of indebtedness can make an economy vulnerable to asset price movements that can amplify shocks and macroeconomic instability affecting therefore the economic growth. Of course, the likelihood of imbalances arising from debt depends significantly on the source of funding. If bank financing is based more on deposits and not on securities or other instruments, the assumed risks are significantly reduced.

The data on Eastern European countries show that in four of the six countries, loans exceed the deposits. Therefore, in case of unexpected withdrawals, the banking system in these countries might face a lack of liquidity (Figure 1).

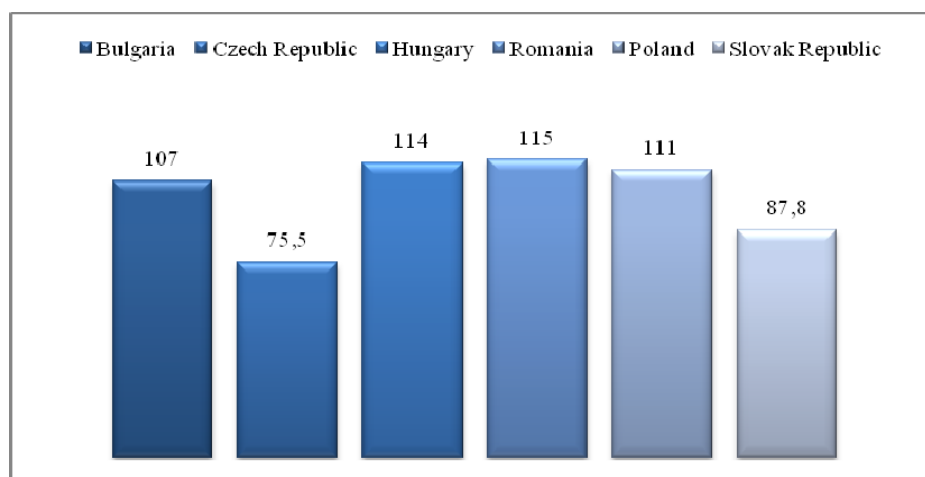


Figure 1. Bank loans (as % of bank deposits), 2012.

Source: OECD, National Banks, Helgilibrary.

The total degree of indebtedness of the analyzed economies differs significantly from country to country, mainly reflecting the importance of the banking sector (Figure 2 and Figure 3). The data show that the debt

threshold of 60% of GDP set by the Maastricht criteria is exceeded only by Hungary, which recorded in the last years a debt level of almost 80% of GDP. The data recorded for the countries in the sample indicate that in contrast to the advanced economies that are forced to face a compromise between financing investment projects and reducing their debt, the Eastern European ones can focus their resources on strategic sectors such as infrastructure.

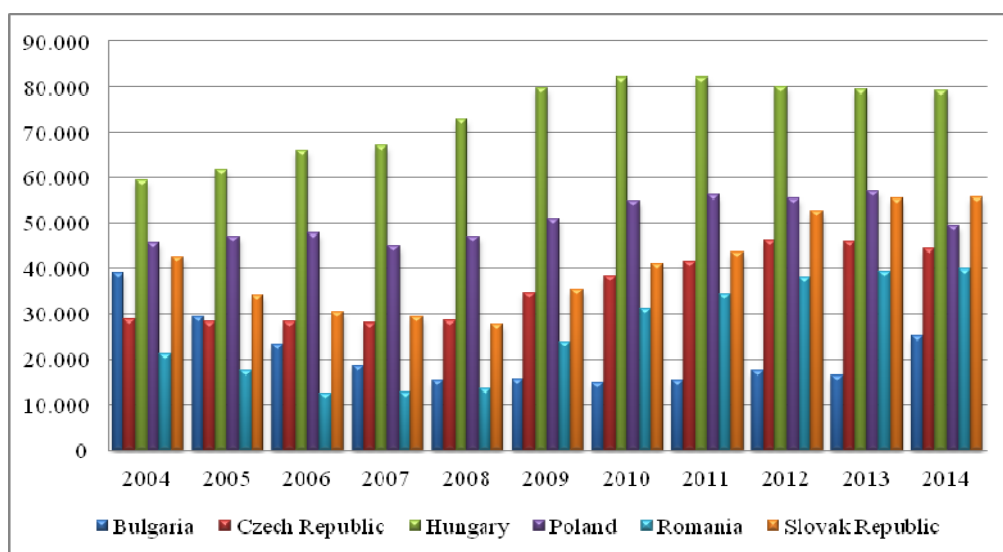


Figure 2. General government gross debt (as % of GDP).

Source: FMI, World Economic Outlook.

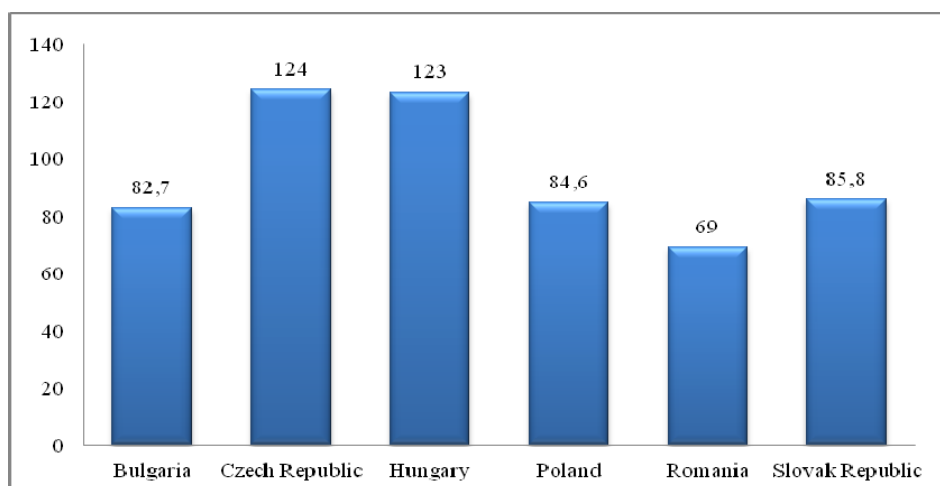


Figure 3. Bank assets (as % of GDP), 2012

Source: OECD, FMI, World Economic Outlook, Helgilibrary.

The risk arising from a country's high level of debt is entering in a recession. When a country's debt increases above the overall trend, the likelihood of a recession increases significantly. For example, if household's debt levels follow the general trend, there is a 10% probability that the economy will go into recession next year. If the household's debt increases by 10% of GDP over the general trend, the probability that the respective country will go into recession next year will also increase to 40% (OECD, 2012, p. 5).

Some studies consider non-performing loans as a measure of the risks assumed by the banks and of financial stability. Although non-performing loans at their current levels are not considered a destabilizing factor with an immediate effect, they compromise the sustained economic recovery and may create significant vulnerabilities in the future (Klein, 2013).

When a country's banking sector is facing a significant increase in non-performing loans, financial stability is threatened. Specifically, a large volume of bad loans in the bank's balance sheet can lead to a lack of confidence from the investors. The bank's solvency is questioned and, therefore, the access to finance becomes difficult. An economy, in which a large bank or several banks in its banking sector are confronted with such a situation, will become vulnerable in terms of financial stability. Highly indebted households and non-financial firms are less able to withstand shocks. They will react by reducing sudden expenses, which will enhance the effects of shocks.

The data on non-performing loans show that in three of the six countries analyzed the share of nonperforming loans in total gross loans increased significantly since 2008. The largest increase was registered in Romania, where this indicator increased ten times between 2008 and 2014. Significant increases were recorded in Bulgaria and Hungary as well. In the other three countries the share of non-performing loans in total gross loans increased on average by 3 percentage points compared to 2008, remaining relatively constant around 5% (Figure 4).

The relationship between debt and stability can also be highlighted by analyzing the role that the first plays in ensuring the implementation of effects of the economic policies in the real economy. When financial stability is at risk and markets are in crisis, the behavior of economic and financial variables may present some nonlinearity that can affect the effectiveness of monetary policy. This means not only that the monetary policy could become less effective in achieving price stability but also that it could have undesirable effects on financial stability itself.

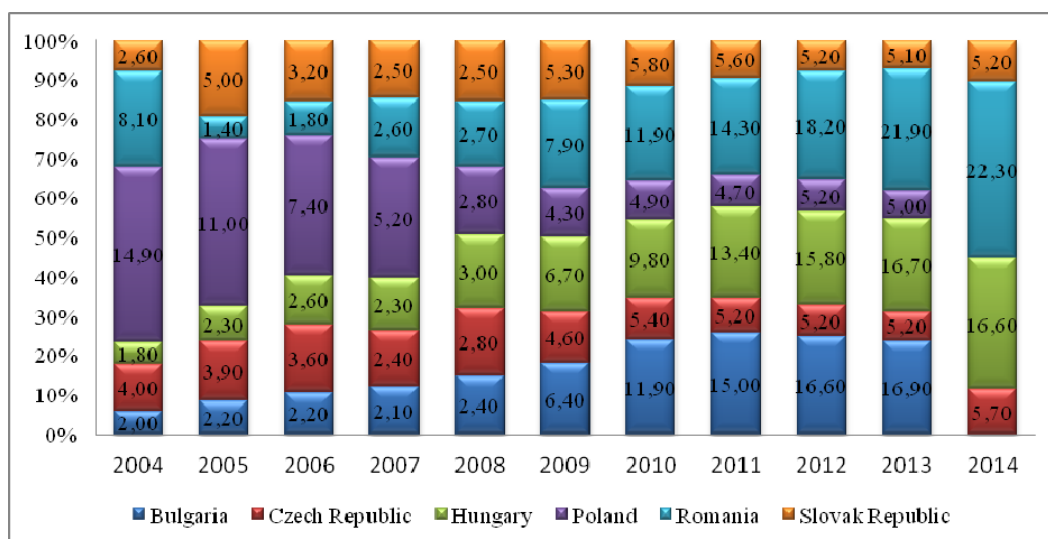


Figure 4. Bank non-performing loans to total gross loans (%).

*the data for Bulgaria and Poland for 2014 are not available

Source: World Bank

This relationship is best explained by Smaghi. He argues that in case of turbulence caused by excessive debt accumulation as a result of very low interest rates over a long period of time, when the bubble bursts and businesses are over indebted, interest rate tends to lose its effectiveness as a tool of facilitating the consumption. Therefore in a debt crisis, a reduction in interest rates is unlikely to be effective because the businesses and financial markets have already accumulated an excessive amount of debt and are no longer willing to absorb more. Thus, the interest rate reduction will not lead to an increase in consumption and investment. Consequently, when the debt becomes unsustainable and agents are forced to reduce consumption in order to repay their debt, monetary and fiscal policies tend to lose their effectiveness in supporting consumption and income growth. In a debt crisis the role that monetary and fiscal policy can fulfill is one of redistribution of the debt burden rather than a stabilization one (Smaghi, 2008).

4. Conclusions

Although the role of debt in facilitating the economic activities has never been questioned, the recent economic developments have raised a lot of questions regarding the volume of these debts and the levels from which

they lead to results opposite to those expected. As described by Cecchetti, Mohanty, and Zampolli (2011), the debt is a double-edged sword. Used wisely and in moderation, it clearly improves welfare. But when it is used imprudently and in excess, the result can be disastrous. Therefore, the maintenance of financial stability requires constant monitoring and sustainability of the debt.

The analysis of the data for the Eastern Europe countries respectively, Bulgaria, Czech Republic, Poland, Romania, Slovak Republic and Hungary show that these countries do not have a debt level so high that it will present an imminent danger to financial stability. This may be, partially, due to the lower level of financial development in these countries which did not create a high dependence between the real economy and the funding coming from the banks.

At the same time, the low degree of interconnection between the Eastern European banks and the ones in the advanced economies helped to maintain system stability without massive injection and the massive rise of the debt.

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POLISH PENSION SYSTEM AS A RESPONSE TO THE PROBLEMS OF AN AGING SOCIETY

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Abstract. *The pension system is an important element of social security. Its main objective is to provide citizens with a beyond retirement age standard of living. The realization of this purpose in the modern world faces increasingly difficulties, because on the whole world is observed adverse events, which may include, inter alia, an aging population and a decline in fertility. These developments, combined with permanently lengthening the life expectancy, caused a number of problems affecting the socio-economic and forced the governing changes in retirement systems. The aim of the paper is to show how authorities in Poland, trying to respond to the problem of an aging population, submit modifications to this area of social policy. In addition, in the study, primarily using descriptive and comparative method, there tried to rate the Polish pension system and there tried to show the directions and possibilities of its improvement. The conclusions and recommendations of this article can be also helpful for those responsible for the operation of pension systems in different countries.*

Keywords: *pension system, public authority, aging society.*

1. Introduction

One of the significant challenges facing us in the social sphere faced by both individual countries, as well as transnational and global groups is the phenomenon of an aging population. This process, showing some variation in relation to specific regions of the world, is universal, inevitable and irreversible for at least three or four generations. The increase in the proportion of older people in society on the one hand associated with lengthening of human life, which – as a result of the development of broadly understood civilization and progress – can be evaluated very positively. On the other hand, it is also the result of significantly reducing

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the level of fertility, which due to the consequences of (among other things on the functioning of the labor market and social security systems) is an important problem. From the point of view of the proper functioning of the state, within the meaning of the socio-economic efficiency, the key issue seems to be an implementation of the wider policy towards aging, generally understood as "actions intended to solve or reduce the problems associated with an increase in the proportion of old people society" [2]. To these activities we can include, among other things modifications currently functioning pension systems as key elements to security systems in the event of old age. As a result of demographic change and economic crises, most of these systems, especially of a public nature, were in fact on the path to financial collapse.

Therefore, the aim is to look at how authorities in specific countries cope with the problems of aging populations and how they adapt to the current conditions of pension systems. The purpose of this study is to analyze Polish solutions in this field, their assessment and make recommendations for improvement of the pension system, the functioning of which is after all one of the most important elements maintained by the state social policy [10]. Pension systems are in fact usually guaranteed by law and entered into a tradition and mentality of a society. So among other things, is in Poland, where the art. 67 of the Constitution guarantees citizens the right to social security "in the event of inability to work due to illness or disability, and after reaching retirement age". This means that the state takes over responsibility for social security of citizens (which is implemented on a rule) and creating mechanisms to protect them, inter alia, a significant drop in income and impoverishment in old age.

One of the rules, which is the basis of pension systems (PAYG), is the principle of social solidarity – which applies to both the creation of the financial resources of the system, as well as redistribution. Such a mechanism can function only if the number of people in the labor market functioning and which are also parties financially system power supply is greater than the number of people using the services financed by the system. In the event of an aging population, the system loses stability as the number of recipients of benefits exceeds the number of contributors. Due to the long-term nature of the phenomenon action becomes necessary by modifying previously developed solutions. This is due to the fact that the financial insufficiency of the pension system is felt both part of the society, which are the elderly, due to the significant deterioration in their financial situation and the whole of society in connection with the acquisition of funding at each of these people. The consequences of the

financial collapse of the system also affects the public finance sector (funding the pension system leads to an increase in public debt), as well as the economy as a whole due to the fact that increasing pension contribution increases the cost of business operation [15].

Attempts to optimize the pension schemes undertaken in different countries were related, inter alia, to actions such as: increasing the amount of pension contributions, reducing the amount of benefits paid, raising the age of eligibility to receive full and partial services, alterations in risk sharing in the field of social security, as and encouraging the public to take responsibility for their own security in old age – for example, through various forms of saving [1]. It should be remembered that changes to certain rules, especially if they involve additional expenditure or elimination of all kinds of privileges, are politically very difficult to implement, because usually encounter strong resistance in society. Cited above solutions are used in various countries, including the European Union. This is due to the fact that social policy (Treaty of Rome) is treated as an area of competence appropriate to individual Member States and not subject to harmonization. However, it is possible to identify some guidance in this area that have both normative (Directives and Regulations), as well as forming the so-called "soft law" (Open Method of Coordination). In this place should also mention of the request on the functioning of the labor market, especially the increase in the employment rate, which has been included, inter alia, the Europe 2020 Strategy and the European Commission's White Paper (2012) concerning the adequate and sustainable pensions.

Referring to the Polish solutions that will be presented hereafter study, it should be emphasized that in the case of Polish discussions and work on changing the shape of the social security system – which is one of the main elements of social policy – practically began after World War II, and proper gained momentum after the political transformation of 1989. As part of the undertaken actions there were regulations on state policy towards the unemployed (1989) [12], welfare (1990) [13], health care (1991) [14] and the pension system.

2. Polish pension system and the challenges of the present

In recent decades, the aging of the population was observed primarily in Western Europe. The continuing trend was a warning signal to the countries of Central and Eastern Europe, who could expect the emergence of similar problems. In Poland, however, matters relating to the

improvement of the demographic situation were not a priority but rather progressive, demographic structure of not having to provide immediate and strong interference of the state in population policy.

Modifications introduced in the Polish pension system since the Second World War was rather the result of financial difficulties the state, and not fear the demographic crisis. In Poland after 1945, economic and social situation basically forced modifications and yet functioning capital system changed to PAYG – pay as you go. Lack of financial resources did not allow for the capital was individually collected. It was necessary to permanently transfer the contributions of people working on the benefits payable to pensioners in the so-called intergenerational contract. In this system, followed by a flow of current between the generation of children and their parents' generation, and so people economically active part of the earned money were paid by to the common cash, which were paid on a regular basis benefits. In addition, the Polish political system in which private property was limited, did not allow even a partial capitalization of the pension system. In addition, the Polish political system in which private property was limited, did not allow even a partial capitalization of the pension system.

Introduced in the postwar period change in the Polish pension system would not solve the problem of the budget deficit. Therefore it was necessary to introduce other solutions that would help deal with the functioning of financial troubles during the Polish People's Republic system. And so, for example, in the 50s of the twentieth century, the social security system included in the state budget, which meant that the Social Security revenues were revenues of the state budget and the state budget secreted social security spending. In 60-70 years of the twentieth century there were created and pooled funds. Then failure of the system and the continuing lack of funds to pay pensions, forcing authorities to raise additional funds, which resulted in that from the beginning of the 80's have permanently raised pension contributions. It is worth noting that since 1981 until 1998 the premium paid by the employer for its employee increased from 15.5% to 45%. Employers therefore incur huge costs associated with employment, because the premium was paid in full only by them. Apart from the fact that the system has a high-tax wages, which resulted in the transfer of employment to the gray area, he still had other disadvantages.

First of all, the system did not stimulate economic growth. The pension system freed the size of benefits from the contributions and encouraged their non-payment, and also characterized by a low level of domestic savings, a low level of investment efficiency and inefficient allocation of public resources. On the other hand, it was more resistant to the economic recession and inflation, to a greater extent, provides a sense of social security, it has a relatively low cost of operation and checked in difficult situations, for example, after the war.

Despite the above mentioned advantages, the Polish authorities, taking into account not only the growing shortage of financial resources in the system, which created the need for supplementation of the state budget, but was already noticeable aging of the population, in 1998, introduced a pension reform. In Poland, on 1 January 1999 were introduced a new pension system, which after some fairly significant changes already operates in principle to the present [16]. The result of the reform was the transition from the advantage of the supply system to the dominance of the insurance system, so changing the PAYG system to a mixed system – partially funded. One of the objectives of the reform was to reduce the risk of insolvency of the system over a long period of time through the diversification of sources, which will finance benefits, and thus enhance the financial security of citizens and their awareness of the need to save for the future. Implemented the reform had resulted in responsibility for retirement has been partially passed on the citizens themselves, and indirectly to private institutions operating in the second and third pillar pension system [5].

In addition, new solutions have to eliminate disadvantages characteristic of PAYG. In particular, by introducing a dominant part of the insurance model, seeks to motivate people to work and pay contributions on the entire salary, and not, as often was the case before, only on the parts. Previous solutions in which the amount of premiums paid did not reflected directly on the amount of the non-payment encouraged, thus expanding the underground economy. Such solutions from an economic point of view were beneficial both for employers who paid lower premiums, and employees, as thus saved funds in whole or in part, were transferred to them directly. In addition, the new system, by abolishing the privileges for specific professional groups, had to fight inequalities. Abolition of the

possibility of early retirement, including the incomplete seniority pension at an earlier age had a positive impact on the extending the period of productive [6].

The pension reform in Poland was modeled on the changes that have been successfully carried out in other countries, especially in Latin America. Country that provided the inspiration, it was Chile, where the whole capital solutions applied. It should be emphasized that the growing population on the need to save for their future retirement capital in the system completely Chileans took over a quarter of century. In view of the fact that this solution was not entirely appropriate, in many European countries, and also in Poland, it was decided to establish a system partially capitalized – mixed, the possible adverse effects would be less noticeable. To this day in most countries were introduced mixed systems, from a structural point of view, are very similar. The differences are, in principle, a number of issues. The first pillar differences relate mostly to the amount of the premium paid by the employer and the employee, the need to develop a certain number of years of service, or have adequate seniority pension or obtaining the appropriate retirement age – in recent years, often of increased inter alia, in Scandinavia, Great Britain, France, and Poland. In the second pillar of the differences in the various countries concerned, first, compulsory affiliation to the second pillar, on the other hand, to privatize the institutions responsible for the reproduction of capital from the second pillar, the third of the contribution and its distribution in the payment of the employer and the employee, and finally the fourth regulations on investment opportunities in the institution of the second pillar. However, in the third pillar, where participation is usually completely voluntary, the differences appear most frequently in countries incentives to save (e.g. deduction and tax) and investment limits. The third pillar usually is formed of private institutions, for which membership is largely dependent on the confidence of citizens, the level of savings and of course the financial performance of these companies. Another important factor is the benefits introduced for employers to support employees in savings.

Introduced in Poland in the late 90s of the twentieth century the system, as in many other countries in Europe and even the world, consists of three pillars. The first pillar is mandatory is a PAYG – benefits from it are financed mainly from current contributions and the budget and

managed by the Social Insurance Institution (ZUS). The right to a pension from the first pillar is every citizen, after completion of the relevant age or after completion of the required age and a specified number of years, which paid contributions. After the 1999 pension reform from the pillar, as a whole, are paid to a person:

- born before 1949, covered by the old rules – before the reform. It is therefore necessary to achieve their desired retirement age – 60 years for women and 65 for men, and to show the appropriate experience, which included the contributory and non-contributory years, limited to 1/3 of contribution – it is 20 years for women and 25 years for men. It should be emphasized that in the "old system" forced many rules that allowed for earlier retirement.
- born between 1949-1969, which, despite the possibility of accession to the second pillar, decided to remain only in the PAYG system – that is, only in the first pillar.

The second pillar, which was introduced in 1999 and by 2014, was mandatory for people who were born after 1969 and for those born between 1949 to 1969, but who decided to retire draining capital contributions. This pillar is a capital and financial resources are transferred to the Open Pension Funds (OFE). Every citizen has the right to choose freely which, from competing in the free market OFE will place their money. OFE are private entities obligated to multiply capital, which in the future should be the second part of the pension. OFE are supervised by the state and the law imposes a number of obligations on them.

Initially, since 1999 to pension funds were directed 7.3% of the remuneration base. In 2011, it was decided to reduce this percentage – to 2.3%, while announcing its gradual increase. As a result, in 2014, another reform was carried out and the end of July 2014, all citizens (regardless of date of birth), drain pension contributions have to decide whether they want to remain in the OFE and further drain where the amount of the premium in a revised amount 2.93%, or move their capital to Social Security Institution (ZUS) – in fact decide to go PAYG scheme. It was announced, however, that under the Social Security System it will be created an account where will be discharged – 12.22% of the remuneration base, and it will be created an sub-account where 7.3% of the remuneration base will be invested.

People who in 2014 decided to choose the second pillar pay contributions in the amount of: 12.22% for Social Security System, Social Security System- sub-account 4.38% and 2.92% of the base salary for the account funds OFE. It should be emphasized that, in any case, contributions are indexed, and every four years (from 2016) will be opened “transfer window”, through which it will be possible to move funds from ZUS on OFE and vice versa. In 2014 in order to protect future retirees, it was decided that the 10 years prior to retirement contributions of all efferent contributions to pension funds will be gradually transferred to the Social Insurance Institution (ZUS). It is worth noting that the gradual transfer of the money to Social Security Institution will also be beneficial from the point of view of the state, because the cash will continue to shape, how needed to secure pensions. In addition, in 2014 in the second pillar there have been many other modifications: OFE investment limits were changed, they were forbidden to invest in government bonds (previously OFE had to invest there) and ordered to investing in stocks. In order not to interfere with securities exchanges was ordered to open pension funds invest in stocks in 2014. 75% and the limit will be reduced in 2017 to 15%. The preliminary analysis conducted that in 2013 showed that about half of the insured choose draining contributions in the second pillar. As a result, it turned out that the decision was taken every sixth insured¹ [17]. Thus, in 2014 the majority of Poles returned to the PAYG system with a number of modifications.

The third pillar of the reform is voluntary, and is the source of the optional retirement benefits. This is an additional savings under the Occupational Pensions Authority (PPE), Individual Retirement Accounts (IKE) or Individual Retirement Account Security (IKZE). In order to encourage the savings the state provides additional policyholder certain privileges of a fiscal nature, eg.: in the case of the IKE – no need to pay the taxes on profits after the completion of a certain age and fulfilling other specific terms of the contract, and in cases IKZE – the ability to write off a certain amount of income in the year tax returns. Participation of Poles in the third pillar is negligible, and people with accounts do not pay regularly measures. The data for 2014 shows that in the third pillar of the Poles invested about 14 mld. PLN, and the total savings of Poles are more than 1 billion PLN [3;18]. There is a lot of causes the reluctance of savings. In

¹ ZUS data show that in 2014 the OFE has remained 2 564 072 Poles.

particular, they can be classified as: lack of financial resources among the insured² [19], the relatively low limits on contributions to the third pillar, which discourages saving wealthy, because they have to look for other options – (IKE to 300% of the average wage in the year, IKZE – 1.2 an average of remuneration in the year), small incentives (tax exemption, but only after the age of retirement – IKE; whether the annual impairment on tax returns, with the need to levy a tax of 10% on the disbursement – IKZE), the uncertainty of return of capital, investment uncertainty.

Successive governments operating in Poland introduced a number of changes in the Polish pension system, moving from a system of capital, through PAYG, mixed to back most of the fees collected by a public body. Reforms after 1999 and the accompanying political disputes, including: OFE creation, reducing contributions to pension funds, changes in OFE investment limits, raising the retirement age to 67 years (for men until 2020, for women by 2040), the choice of ZUS and OFE, were aimed at improving the situation of future pensioners, but equally important was improvement in public finances.

The demographic crisis caused that the mixed system did not work in Poland. It turned out that after 14 years of operation of OFE Polish society has chosen pair PAYG system. It is therefore appropriate to ask, why OFE did not convinced a large group of employees, and why in other countries, such a system work? The answer to this is not clear, but certainly on the recent decisions of Poles influenced by several factors, among others:

- medium OFE financial results, which had to invest in state treasury bonds and were strongly reduced investments in stocks or foreign investment, which in other countries are unlikely to occur,
- lack of knowledge about business and pension fund,
- the relatively high costs of operating in the OFE,
- incorrect belief that it was not me as a citizen, not the amount of my contributions, not my investments, not the private sector and the state, as a whole should secure retirement,
- lack of knowledge and motivation to declare choose OFE-ZUS – the lack of a written notice of intent to join the OFE or stay in it, resulting in staying in ZUS,

² Every second Pole has savings and this is the third lowest, next to Romania and Turkey, the result obtained in the study, which was conducted in October and November 2014, 13 European countries on a representative sample of 12,743 people.

- knowledge that for 10 years before retirement funds, and so will go back to ZUS,
- lack of confidence, that the amount of premiums paid by the insured have a significant impact on the amount of the pension.

3. Conclusion

In response to the problems of an aging population, within a few decades, Poland has introduced many changes. On the one hand were the solutions to support the family as such – the introduction of free (years of the 60th of the twentieth century), and then paid parental leave (1981), gradually extended maternity leave, and most recently the introduction of parental leave (2013). On the other hand, the modifications related to the pension system.

Assessing successive reforms introduced in the Polish pension system should be stated that their main reason was closely linked to the difficulty, or rather the desire to overcome them, due to a decrease in revenues to fund the PAYG. Shortfall of funds in Social Insurance Institution had to cover the state budget, has increased the burden on the public finance system. It should be noted, however, that in a similar situation – in times of demographic crisis – there are many countries, not only with the EU, but also around the world. In such a situation, it is worth to learn from the experience of others, respectively adopting relevant and proven solutions and avoiding the mistakes that were made.

In conclusion, the Polish reform of 1999 was correct and necessary. However, not quite ingeniously OFE regulations, their excessive investment restriction resulted that they could not properly developed. Perhaps in the coming years, using the power of "transfer window" Polish society will give them more opportunities for development.

Increase the retirement age in Poland, as in other countries in Europe and the world, it was also inevitable, although at the moment it is difficult to assess whether it was necessary and effective. Surely, it was and it is a rather difficult socially area of social policy because of the conviction of a significant portion of the citizens of reducing social benefits due to them. Raising the retirement age should be – for example, the Canadian model – introduce some flexibility, through e.g. a decrease and an increase in benefits after going early and later retirement. Certainly, such a solution would avoid the situation that took place in Poland in 2011. At that time –

today already considered to be inconsistent with the Constitution of the Republic of Poland – the rules practically forced the persons entitled to a pension to terminate the contract of employment. Otherwise, the pension was suspended. It was negatively assumed that the exemption of older workers will improve the situation in the labor market, and in place of older people will come the young unemployed. It turned out, however, that such a simple relationship has not occurred. As a result, at present ZUS has to pay suspended retirement, while those who do not declared compensation get the contract. Introduced solution clearly showed that it is necessary to reward a job after graduating from retirement age, not discourage to it.

In addition, in the pension systems is necessary to clear the binding amount of the pension to the number of years of service, which somehow did reform introduced in Poland in 1999. Today, from the accumulated capital and the subsequent average life expectancy depends on the amount of benefit. In Poland, there is no need to demonstrate an appropriate internship pension scheme. It is required in the case of applying for a minimum pension.

No need to prove a certain number of years of work is the first step to take ongoing not only in Poland, the discussion on pensions for all citizens – "citizens pension", which could, in the same height, belong to all citizens after reaching retirement age. Such solutions exist, inter alia, in Denmark, Sweden, the Netherlands, the UK and Australia. With the introduction of civil pensions would certainly reduced poverty and the measures so far spent on social assistance. They are born, however, two basic questions. Firstly, do ensure of receiving benefits are not discouraged to work thereby threatening the stability of the pension system and the state budget. Secondly, how to raise funds for "citizens pension", and whether their introduction would not closely related to the significant increase in taxes, which is located in Denmark, where taxes are progressive, and very powerful. Data from Eurostat show that it is in Denmark, the ratio of the tax burden in relation to GDP is high and amounts to 48.1%. In this respect the following places in Europe occupied Belgium – 45.4%, France – 45.0%, Sweden – 44.2%, Finland – 44.1%, Italy – 44.0%, and Austria – 43.1%. The lowest taxes in 2012 were in Lithuania – 27.2%, Bulgaria and Latvia – by 27.9%, Romania and Slovakia – for 28.3% and Ireland – 28.7%. In Poland, in 2012, they amounted to 32.5% of GDP [11].

Strengthening the pension systems in all countries should be based also on strengthening the importance of the third pillar. Countries should strive to make the greatest possible incentives to accumulate savings, which is associated with changes in the law. These incentives should apply to both employees and employers. It is also appropriate to conduct educational policy and strengthen the awareness of citizens in this area. In 2014 Poland also changed the regulations concerning the operation of the third pillar, in particular IKZE. There has been modified investment limits and introduced a fixed tax (10%) that the insured pays before withdraw. Until now the tax depended on the tax threshold, and therefore income, which was located insured person.

In Poland, despite the introduction of a number of modifications to the pension system pensioners contemporary situation is not good, the benefits are low³ [22], and the system does not respond well to the end of the problem of an aging population. On the conducted forecasts indicate that in the future the situation will not look better, but on the contrary. Unfavorable situation will be registered aftermath of high unemployment (12%)⁴ [20], a large number of people working on civil contracts (13%)⁵ [21] and a high percentage of people employed under a contract of employment, and earning the minimum wage (in 2013, 12%)⁶ [21]. The challenge that stands in the area in front of the public authorities is primarily to support the labor market, as well as the inclusion of insurance as many people as economically active contributors.

Today's retirees are forced somehow to fundraising, allowing them a decent life. New instruments, which are designed to help pensioners, are reverse mortgages and lifetime annuity [4; 9]. These new financial services to allow the holders of real estate to obtain additional cash that can be used for any purpose. The mechanism of both products is relatively simple, but different. In the case of an annuity (sales model) the borrower includes a transaction in which a waiver of ownership of an apartment or house gets to the end of the cyclic life annuity under this head. It is important that the buyer entity locale, which may be a bank, fund, or insurance company, becomes the owner of the property at the time of signing the contract. A

³ Since 1 March 2015 minimum pension in Poland is 880, 45 PLN.

⁴ February 2015.

⁵ Data for 2013, National Labour Inspectorate (PIP).

⁶ Data for 2013, National Labour Inspectorate (PIP).

person who uses a reverse mortgage, to the end of life remains the owner of the property, and the heirs, if they are willing to stop and repay its liabilities arising from the loan, keep it right. If they do not express such a will, they will be required to transfer ownership of the property to the bank, which will return the difference by which the value of the property exceeds the amount due under the contract of the bank's mortgage inverted, if such excess will be [7; 8]. Although the above presented solutions have been regulated in Poland, there are not very popular. Unfortunately still a shortage of funds is temporarily eliminated by the high interest credits, loan.

At the moment it is difficult to clearly assess the changes that have been introduced in the Polish pension system. This is mainly due to the fact that they will be felt only after a long time. They cannot also be considered as terminated due to the continued lack of stability of the system. This stability in the long term can be achieved, inter alia, by reversing the trends, which are the best, because the natural way to protect the system against failures, or at least mitigate their effects. However, this requires comprehensive actions not only in the area of pension security, but in the context of the broader social policy, with particular emphasis on family policy.

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ENDO- AND EXOGENOUS DETERMINANTS OF THE PROVISION OF WATER AND SEWAGE SERVICES IN POLAND

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***Abstract.** Water and sewage services as a public service of technical nature are provided in natural, local monopoly. It is related to the specificity of provided services, complicated technical infrastructure and high capital intensity. The main aim of this article is to present ongoing changes in the approach to the water and sewage services and the main determinant of running water and sewage business in Poland. The article discusses the basic legal, organizational, and economical determinants in this scope. The attention was also paid to the most common abnormalities which occur in the market of water and sewage services, concerning the protection of competition and consumers. The analysis was based on publications concerning the water and sewage sector and data from the Central Statistical Office and the judicature the President of the Office for Competition and Consumer Protection.*

***Keywords:** water and sewage services, municipal services, natural monopoly.*

Code JEL: 112

1. Introduction

The period of political transformation and accession of Poland into the European Union contributed to the changes in the sector of municipal services linked to fulfill collective needs of society. Those changes are clearly noticeable in the field of water and sewage services.

Before 1980 in Poland there were 50 large single – line, state water and sewage enterprises, 80% of which had voivodeship or regional range. At that time organizational and legal determinants allowed the bodies of state administration the freedom with decisions related to fees for water and discharge of wastewater. Greater investments were planned at the central level and financed from the state budget [1, p.723]. The trade was dominated by the “engineering” approach, which was focused more on technical

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solutions and growth of production than on economic rationality and the level of provided services. After 1990 the water supply and wastewater discharge were considered as tasks owned by the borough. The process of decentralization and communalization of large voivodeship enterprises has begun. Boroughs and newly formed units deal with water and sewage services did not have enough resources to introduce essential organizational changes. Currently, the major challenge for the trade is to adjust Polish water and wastewater management to European Union standards.

The article presents the most important determinants of endogenous and exogenous implementations of water and sewage services in Poland. The attention mainly focuses on legal, organizational and economic determinants. General characterization of the economy of the water and sewage management in Poland was based on the data from statistical year books of the Central Statistical Office. Data concerning basic sources of financing for the development of water and wastewater management as a part of the National Program for Municipal Wastewater Treatment comes from National Water Management (NWM). Basic irregularities were also presented which appeared on the market of water and sewage services, which were the basis for the intervention of the Office for Competition and Consumers Protection.

2. General characterization of the sector of water and sewage services in Poland

Polish territory is 322 575 km². The area has 38,5 million inhabitants. The average population density in Poland is around 123 inhabitants /km². 99.7% of Poland is in the drainage basin of the Baltic Sea, 0.2% in the drainage basin of the Black Sea and in 0.1% in the drainage basin of the North Sea. The main rivers which drain waters from Poland to the Baltic Sea are Vistula and Oder. The basins of these rivers comprise 87.9% of Poland.

In the last couple of years in Poland undoubted progress occurred in the field of water and sewage management and water and wastewater management. According to the year book of the Central Statistical Office “Environmental Protection” 2012, 2013 [11] collective water supply systems – waterworks systems – in 2011 services 95.4% of the population and collective wastewater discharge systems – sewerage systems – 63.5% of the population and 87.0% of the urban population and 27.8% of the rural population. Basic data concerning water and wastewater management in Poland are presented in Table 1.

Table 1.

*Basic data concerning collective water supply
and collective wastewater discharge in Poland*

Specification		Years					
		1995	2000	2005	2010	2011	2012
Total population of Poland	in thous.	38284	38254	38157	38529	38538	38533
Total number of cities	-	860	880	887	903	908	908
The rural population	thous.	23675	23670	23424	23416	23386	23336
Water consumption for needs of the national economy and population for the purposes of operating the waterworks	hm ³	*	*	2105,2	2062,4	2033,0	2030,8
Domestic water consumption in households during the year	hm ³	*	*	1219,4	1197,9	1202,0	1200,5
Domestic water consumption in households during the year per 1 inhabitant in the cities	m ³	*	*	37,2	35,0	34,8	34,5
Industrial and municipal wastewater discharged into water or into soil discharged by sewerage network	hm ³	*	*	1273,6	1287,8	1258,8	1248,8
The length of waterpipe network in the cities	thous.. km	*	*	54,9	61,0	62,0	63,1
The length of waterpipe network in the countryside	thous. km	*	*	190,7	211,9	216,3	220

The length of sewerage network in the cities	thous. km	*	*	43,3	51,9	54,2	55,8
The length of sewerage network in the countryside	thous. km	*	*	36,8	55,6	63,5	69,8
Waterpipe connections to residential buildings in the cities	thous.	*	*	1757,1	1910,7	1952,3	1990,6
Waterpipe connections to residential buildings in the countryside	thous.	*	*	2752,1	3036,7	3110,7	3186,6
Sewerage connections to residential buildings in the cities	thous.	*	*	1156,5	1412,7	1478,4	1529,5
Sewerage connections to residential buildings in the countryside	thous.	*	*	598,0	906,3	1015,5	1102,9
Number of cities equipped with waterpipe network	-	854	877	886	901	906	906
Number of cities equipped with sewerage network	-	793	845	881	898	905	906
Number of cities served by wastewater treatment plants	-	643	801	857	873	901	903
Population in cities served by waterpipe network	%	91,1	91,7	94,9	95,3	95,4	95,4
The urban population which uses sewerage services	%	81,9	83,0	84,5	86,1	86,7	87,0

Source: Yearbook CSO 2012, 2013; Yearbook of the Central Statistical Office “*Environmental Protection*” 2012, 2013 [10], [11].

In the cities the development of sewerage systems generally follows with the development of the public water supply systems, however in rural areas observed essential differences in this aspect. These differences are due to the considerable dispersion of rural buildings: 15.1 million of the rural population lives in more than 40,000 villages. Due to technical and economic prejudice about the need for individual solutions to wastewater discharge and treatment to the extent that ensures adequate protection of the environment.

Reducing the amount of pollutants entering the water saw a noticeable improvement of water quality in rivers and lakes.

3. Basic regulations and rules for the provision of water and sewage services in Poland

The basic legal act which is establishing a framework for Community actions in the field of water policy of European Union is called Directive of the European Parliament and of the Council 200/60/EC of 22 December 2000, commonly known as the Water Framework Directive (WFD) [7]. It introduces an integrated water policy which is aimed at inter alia, to provide people, access to clean drinking water which will enable economic and social development at respecting the needs of environment.

Transposition records of WPD to Polish legislation occurred through the Act of June 7, 2001 for collective water supply and collective sewerage discharge [9], [10]. It specifies:

- the terms and conditions of collective supply of water intended for human consumption and for collective wastewater discharge;
- business practices of water and sewage enterprises;
- the rules for creating the conditions to ensure continuity of supply and proper quality of water; reliable wastewater discharge and treatment and also protecting the interest of recipients of services with taking into account the requirements of environmental protection and optimization of costs.

The Act also includes conditions that must be practiced by water and sewage enterprise and by the recipients of water and wastewater services. The Act regulates the rules for determining the tariffs for collective water supply and wastewater discharge. It assumes, among others: the annual period during which the tariffs are valid and calculation of tariffs based on the essential amount of income after (their) the allocation to individual recipients groups of services taking into account the costs associated with

the provision of services in the previous financial year, changes of economic conditions, conditions of providing conditions and costs resulting from the planned capital investments.

4. The specificity of the market of water and sewage services

The needs expressed by the society are implemented by goods and services. The natural features of certain needs can be fulfilled only in collective manner. An example of these types of needs may be: public safety, national defense, the use of public needs, sanitation, water supply and wastewater discharge and others. The greatest importance in meeting the collective needs has public services which are very broadly defined [6, p. 71]. Provision of public goods and services can be fulfilled by both the public sector as well as the private sector. The funding of public services occurs in total or partial with the use of public funds.

Collective water supply and wastewater discharge – services provided by water and sewage units in Poland are considered as an example of a natural monopoly network. This kind of monopoly is local because actions connected with waterworks, water supply, sewerage and wastewater discharge in Poland are the tasks of borough. Boroughs can delegate its tasks in the field of water supply and wastewater discharge to specialized units, namely water and sewage enterprises.

The provision of services in terms of network monopoly is characterized by [5, p. 17]:

- continuity and universality of the provision,
- universality of access, satisfaction of the public needs,
- indivisibility of technical infrastructure solutions and high capital intensity of the investment cycle,
- contemporaneity of production, delivery and consumption,
- significant differences at the time of demand for services,
- low elasticity of demand with respect to price.

Furthermore, about specific features of monopoly – considering the specific nature of the goods found in the sphere of services related to the water supply – decide, among others: the lack of any substitute of water used mainly for household as well as manufacturing processes and a highly limited ability, to use one common network for transferring products by different manufacturers.

5. Changes in management of units that provide water and sewage services

Although the operation of the units which deals with water and sewage services is done in conditions of a natural monopoly, like any organization they have their various “external shareholders” who feel the consequences of actions and are really interested in the results. The influence of various interest groups on the organization which deals with water and sewage business is shown in Figure 1.

People who run public organizations and those whom belong municipal utilities, must cope with the implementation of multiple objectives – often political, to satisfy various stakeholder groups (especially external). Without their support the public organizations cannot exist.

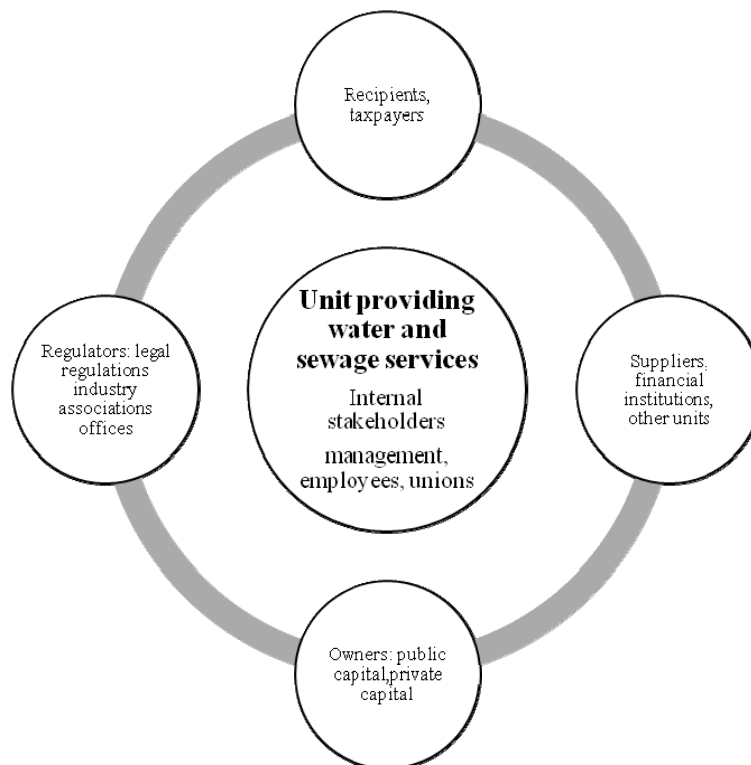


Figure 1. The influence of various interest groups on the organization which deals with water and sewage business.

Source: Own elaboration based on Kozuch B., Public management theory and practice of Polish organizations, Publisher Placet, Warsaw (2004), pp. 96-104.

The interaction between the unit deals with the activities of water and sewage sector and the various interest groups can be seen in several aspects [4]:

- economic and financial aspect of the business units of water and water and sewage sector which should be effective , profitable and the funds saved as its result should serve the development of the unit, modernization of the network and investments in water and sewage equipment and modern technologies;
- aspect of ownership conditions, management and control of local government units;
- the social and economical aspect concerning the final client.

Polish adaptation of water and sewage utilities to European standards is not only associated with the expansion and modernization of the network or the introduction of modern equipment and technology. It is also important to modernize and improve the activities in the sphere of unit management.

In recent years there has been a positive return in current, fairly conservative and not very dynamic engineering system which runs waterworks utilities. We can notice the tendency to look for more efficient and more modern ways of management. Partly it is due to the requirements of legal norms, the need of preparation appropriate analysis, planning renovation and modernization activities according to the expected level of revenues and costs as well as the need to search external funds for investments.

Great importance has also been placed on the growth of the quality, awareness and knowledge of company's management and contacts with utilities and consultants both national and international. A direct consequence of better management is the increase of interest in raising the qualifications of employees which decide about the level, quality, efficiency and culture of the organization, which is the company.

Moving away from the typical monopolistic position towards customers is another important element of the changes in the culture of the organization of water and sewage utilities. Creation of customer service offices not only increases the efficiency and the quality of the service, but primarily it creates a positive image of changes and attitude of the natural monopolist to the surrounding reality and builds public trust to waterworks enterprises.

Modern computer software and information systems allow for the collection and processing of data about the state of operating systems, parameters of devices which characterise the level of provided services, costs incurred within the business and the revenues from activities of the units. They can be a great tool for supporting the process of management and implement the supervisory functions by the owners.

6. Level of the prices and the rules for determining the tariffs for the water supply and the collective wastewater discharge

In accordance with the regulations of the Act concerning collective water supply and collective wastewater discharge, which were previously discussed, the amount and types of charges levied by the water and sewage utility for the service rendered to customers indicates the tariff. According to the statutory definition it is a publicly announced statement of prices and changes for collective water supply and collective wastewater discharge, with the conditions of use.

Water and sewage utility determines the tariff for one year on the basis of the necessary revenue. To determine the necessary revenue, what must be taken into account is: the costs associated with the provision of services incurred in the previous financial year, which were determined on the basis of the accounting records including planned changes in those costs in the year during which the tariff is in force. Next to be taken into account is: changes of economic terms, the size of services and terms of provisions, costs resulting from the planned capital expenditures based on the plan of development and modernization of waterworks equipment and sewage treatment.

Provision of waterworks and sewerage service is characterized by a high ratio of fixed assets of the individual water and sewage unit to the annual operating costs, so called capital intensity. Capital intensity is closely linked with the ability to conduct own development policy and modernization of the infrastructure by water and sewage unit. Prices for water must take into account the necessary investments in this sector. Improvement of water quality requires, at least partial repair or replacement of old water supply networks and the rising costs of the expansion and modernization of wastewater treatment plants, water treatment plants and water and sewage networks have influence on

increase of the amount of tariffs for water supply and wastewater treatment services.

Prices and rates specified in the tariff are differential for individual tariff groups of recipients of the services, are documented on the basis of documented differences in the costs of collective water supply and collective wastewater discharge. The fee for water supply and wastewater discharge shall be determined by multiplying tariff prices and rates as well as correlating them with the quantity of provided services. The price, mentioned earlier in the regulation, is defined as the amount expressed in monetary units, which the recipient of service is liable to pay to water and sewage utility for 1m³ of discharged wastewater.

Table 2.

The prices of water and wastewater in Poland. Selected statistical results based on data obtained in the survey on 1-30 March 2013 (in PLN).

Description/ recipient of services	Households		Industry (production)		Services including trade		Public investments	
	for water	for wastewater	for water	for wastewater	for water	for wastewater	for water	for wastewater
Numerical amount of the test	241	243	221	227	207	207	241	243
The average value	3,91	6,28	3,88	6,60	3,90	6,16	3,91	6,28
The maximum value	15,64	34,27	8,21	18,40	8,21	18,40	15,64	34,27
The minimum value	1,85	1,78	1,85	2,33	1,85	1,78	1,85	1,78
Price range	13,79	32,49	6,36	16,07	6,36	16,62	13,79	32,49
Median	3,60	5,49	3,70	6,03	3,73	5,78	3,60	5,49

Source: Chamber of Commerce “Polish Waterworks” (<http://www.igwp.org.pl/informacje-ekonomiczne>).

According to data published by the Chamber of Commerce “Polish Waterworks” (CCPW), the average price for water supplied to households in Poland in March 2013 was amounted to 3.91 zł, while the average price for discharged wastewater from household developed at the same period at 6.28 zł. Data concerning the average price for water and wastewater in households, in industry and services are presented in Table 2.

7. The major sources of financing development of water and sewage infrastructure

Construction, expansion and modernization of water and wastewater management is the responsibility of municipalities, financed from their budgets with the possibility of assistance from European Union and national environmental funds. Municipalities are responsible for the amenities of the agglomeration in the collective sewerage system and wastewater treatment plants with a suitable degree of purification. When agglomeration is located in an area of several municipalities, the municipality may conclude inter – municipal agreements relating to, among others, entrust one of their duties to other municipalities.

In Poland, the National Program for Municipal Wastewater Treatment (NPMWT) is a program aimed at coordinating the activities of municipalities and water and sewage utility in the construction, expansion and modernization of sewer and wastewater treatment plants.

In order to obtain funding by municipalities for investment concerning wastewater management from environmental funds and EU funds is their inclusion in NPMWT. It should be emphasised that the implementation of NPMWT is the most expensive task among all the tasks arising from EU directives in the field of environmental protection. Particularly important in its implementation is the financial support from EU funds.

Comparing actual costs incurred during the realization of NPMWT in period of 7 years (2003-2010) in the amount of 33 782 670 thous. zł, with the projected cost of the project IV updates NPMWT till year 2015 i.e. 37 530 863,6 thous. zł, we see that the financial challenge facing Poland for the years 2011- 2015 is huge.

Funding of investments related to water and wastewater management in Poland since year 2004 is carried out with significant share of EU funds. To 30 December 2011 a total investment worth 32.9 billion zł was made, involving 19.3 billion zł funds from the EU, including:

- from 2004-2006 – projects worth 15.6 billion zł, involved 10.2 billion zł of EU funds;
- from 2007-2011 – projects worth 17.3 billion zł, involved 9.1 billion zł of EU funds [project IV NPMWT].

The programming period 2004-2006 – pre-accession funds were derived from the following funds: the European Regional Development Fund – Integrated Regional Development Programme, the Cohesion Fund (ISPA), the European Agriculture Guidance and Guarantee Funds – funds for private farming.

The programming period 2007-2013 includes funds from: the European Regional Development Fund – Regional Operational Programmes of individual voivodeship, the Cohesion Fund – Infrastructure and Environment Programme. Only with these two major sources were subsidized projects worth 31.9 billion zł in the amount of 18.9 billion zł.

Presented value of projects and refinancing does not include funds from: the EEA Financial Mechanism, The Norwegian Financial Mechanism and the Rural Development Programme.

National measures including those from the National Funds for Environmental Protection and Water Management to implementation of tasks in the field of water and wastewater management in Poland between years 2004-2011, stood at 18.5 billion zł and were only preferential loans.

8. The most common anomalies in the water and sewage market

Analysis of the case – law of the President of the Office for Competition and Consumer Protection (OCCP) concerning the functioning of water and sewage utilities and international comparisons which were made, show that the functioning of water and sewage sector, both in Poland and in many other EU countries, generic problems and is the object of various government interventions.

In the water and sewage sector, in the field of the protection of competition, the most important thing is the prohibition of abuse of dominant position. If water and sewage utility do not have any competition, they can fracture above prohibition by using their economic advantage over contractors to enforce them to unfavorable contract term, as well as to block competition in the markets related to the collective water supply and collective wastewater discharge markets [5, p.73]. Another frequently observed abnormality is unlawful charging of customers by costs of buildings some networks. In accordance with regulations they have the obligation to finance only the construction of connections and

space where the main water meter and the measuring device should be located. Very often however, contractors are charged with additional costs, which do not arise from the law.

A large number of violations is a consequence of efforts that water and sewage utility makes to protect its own interests. However, very often, water and sewage utility makes it with violation of applicable laws. An example of such behavior can be disabling the responsibility of water and sewage utility for the deterioration of the service quality caused by certain events or penalties determined for damage of the measuring device. Among the analogous behavior the following should be mentioned:

- making the verification of the correctness of the main water meter at the request of a recipient of services from the recipient to pay the deposit as a whole cover of the costs of such action;
- imposing recipients the obligation to cover the cost of replacement or repair the water and sewage equipment or measuring device in the case of damage. The recipient is not required by law to cover the costs of that;
- forcing customers to less favorable terms of payment than those restricted by regulations, in particular a shorter period of payment or contribute additional safeguards;
- restrict the possibilities to dissolve the contract and cut water supply if the recipient is not eventuate from the contract.

These behaviors are the instances of imposing onerous terms which bring the water and sewage utility unjustified benefits.

A common abnormality is exclusion, by traders of their own responsibility for interruptions in water supply. By law, the entrepreneur is responsible for the situation which was caused by his fault and is obliged to repair the damage resulting from his actions or omissions.

Another common mistake is the method of determining the charge for levied water in case of loss or damage to the water meter because of the recipient's fault. In such situations, the entrepreneur should demand payment for the water that was actually levied. When you cannot accurately measure the amount of levied water, then it should be determined on the basis of the average consumption in the last three months when the water meter was working properly or alternatively on the basis of the average consumption in similar period from the previous year.

The irregularities found by the OCCP also apply to situations in which the municipalities or utility companies solve contracts with consumers, thereby ceasing to provide services. May do so in four cases: the unlawful implementation of connection, lack of payment for two full accounting periods counted from the date when the consumer received the reminder, illegal consumption of water and in situations when the quality of implemented sewerage did not meet the legal requirements or the damaged was found or omission of the measuring device.

Monopolistic positioning of water and sewage utilities enables them to impose the unfair prices to customers. These types of violations are very rare because it is extremely difficult to make it clear whether the specified price is unfair. However, the water and sewage sector precise tariff regulation, which – taken as a reference point – make it easier to define unfair prices. In particular, will be the prices which are not determined in accordance with applicable law or in other way they infringe the principle of the equivalence of benefits to the determinant of at least part of the recipients [5, p.87].

Decisions regarding the water and sewage sector were accounted in some years nearly half of all decisions issued by OCCP, on average accounting for about one-third of all decisions concerning abuse of a dominant position. Only in 2013, the President of the OCCP issued 39 decisions related to abuse of a dominant position and 24 decisions concerning the violation of collective interests of consumers, putting more than over 600 thou. zł of total penalty on entrepreneurs to provide water and wastewater receiving.

9. Conclusions

The last twenty years of providing water and sewage services in Poland is the period which completely changed the face of this sector. Many of the changes are a consequence of the economic reorganisation of the country after 1989. The greatest influence however, was the accession of Poland to the European Union. Poland was obliged to implement EU directives, which resulted in a change of law and a huge demand for investment capital.

A number of problems in the water and sewage sector in Poland is mainly connected with the specific provision of such services and also with the existing regulations, which are not always precise enough to describe

the rights and obligations and balance the interests of consumers and producers.

One of the fundamental problems in this market is the fact that the municipality may appear at the same time in two roles: organiser and supervisor of water and sewage services in its area. In addition, big fragmentation and the ownership structure of water and sewage sector can have a negative impact on the efficiency of its operation. Increasingly, there are calls concerning the consolidation of small utilities and return to regional units. Taking into consideration the very high number of irregularities disclosed during an inspection by the OCCP, also seems necessary the establishment of adequate, separate institution regulating water and sewage operations at the central or regional level.

Despite many barriers and interest of various interest groups, Polish water supply utilities are developing not only by modernizing and expanding machines and water sewage network but also by introducing modern methods of management and customer service departing from the typical monopolistic behaviors.

In addition, high impact to the modernization and development of water and wastewater management has the ability to raise funds from the EU funds for investment related to the implementation of EU directives. The process of modernization and construction of water and sewage infrastructure, which is realized currently in Poland although it is difficult and costly, it brings many benefits. It is expected not only to improve purity of water but also improving the living conditions, health status of Polish society and the rational use of natural resources. It will help to improve the image of Poland in the world in the field of compliance environmental requirements.

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CONTEMPORARY FARM MONITORING THROUGH INFORMATION SYSTEMS

Adrian NICOLAU *

Abstract. *In the scientific work the author is presenting the concerns regarding the evolution and development of the agriculture in Romania in the latest years. As we know the sustainable development of a domain means what we do today to preserve and leave the resources for the next generations. Agriculture is a domain with high potential in Romania but is unexploited in the way to provide the proper profitability and productivity. Romania needs a competitive agriculture, comparable with the agriculture of EU states that have to provide food, organic farming and biotechnological products, that can compete with the products of developed countries.*

Keywords: *sustainable development; agriculture; accountancy.*

JEL Classification: E32; F41; F42.

1. Introduction – national socio-economic context

Agricultural holdings and companies as well as all the commercial basis of agriculture are established under the law 31/1990 amended and supplemented, especially the law 441/2006, which contains general and specific authentication, detailed on the establishment in according to five categories of company money and men, commercial, collective companies, limited partnerships, corporations, limited liability companies and participations.

The new architecture of agriculture, in essence ensured Romanian agronomy European approach as agrarian structure and ultimately the possibility of joining the European Union.

Number of farms based on criteria including privately owned public and private skyrocketed. Agricultural Census (pragmatic purposes), taking as criteria not a trait inherent property, but the quality of having or not legal personality, introduced between farms and low volume business entities that do not justify this, also administrative entities not engaged in production agriculture, only the administration of land, etc., which led to a greater number of them.

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The number of agricultural holdings¹ (actually units with or without legal personality) who are owners of land without or only with animals is estimated at about 4.5 million. Of these, the overwhelming majority, over 99% are individual holdings.

Table 1.
Romania's number of agricultural holdings

Legal status of farms	TOTAL	of which:		
	Farms	With agricultural areas and livestock	Only with agricultural areas	Only with livestock
Individual far	4.462.221	3.396.310	881.005	184.906
Units with legal personality:	22.672	3.596	18.450	626
Societies / agricultural associations	2.261	333	1.891	37
Trading companies	6.138	1.416	4.290	432
Government units	5.698	944	4.674	80
Cooperative units	87	7	70	10
Other	8.488	896	7.525	67
TOTAL	4.484.893	3.399.906	899.455	185.532

Source: <http://www.insse.ro/cms/files/GAC/index.htm>.

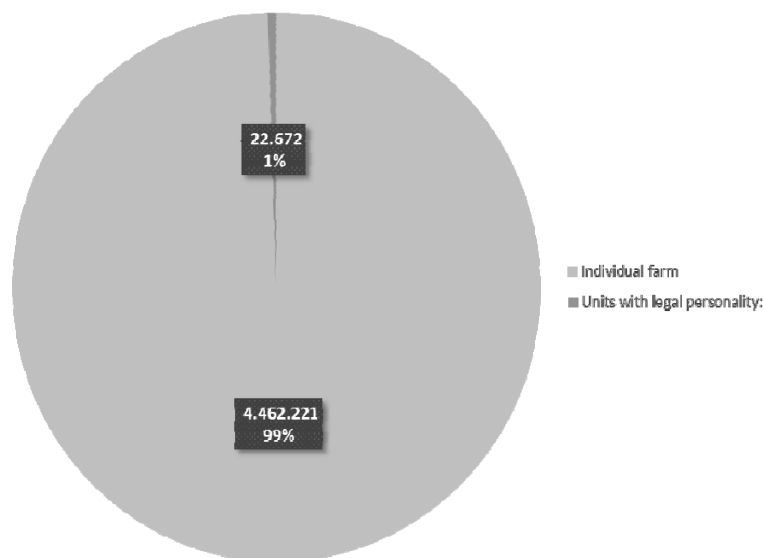


Figure 1. Legal status of farms.

Source: authors own concept.

¹ <http://www.insse.ro/cms/files/GAC/index.htm>

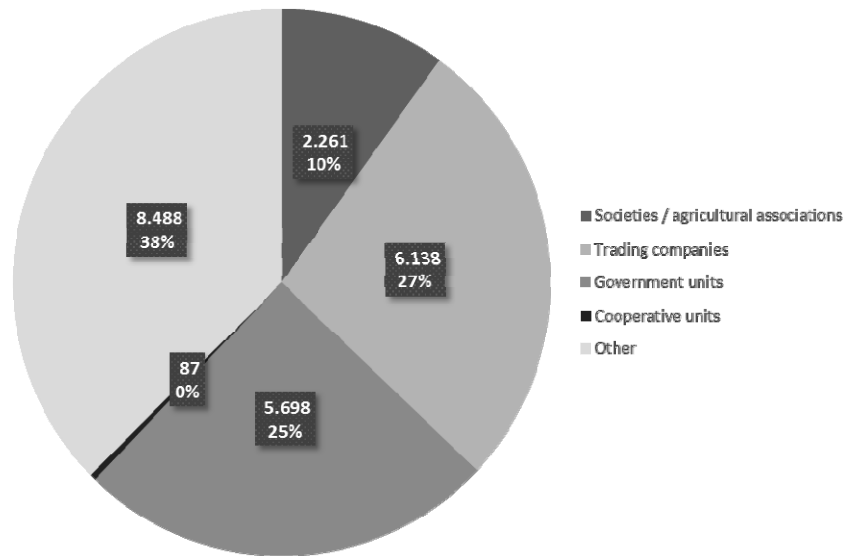


Figure 2. Units with legal personality.

Source: authors own concept.

Comparing EU and Romania during 2002-2010 in terms of farms (evolution, average size, number etc.), we can say that Romania is characterized by an average area of farms (3.45 ha) than those the European Union (11.7 ha) and a large number of people employed in agriculture 29.6% of the total active population, however with very low labor productivity compared to the EU average.

Applying the concept of sustainable development in agriculture

Sustainable development is based on three main pillars: Economic Pillar, Pillar Social and Environmental Pillar.

Any attempt to develop a sustainable agriculture must consider the transition from subsistence farming to intensive agriculture, but with the protection of the ecosystem.

Intensive agricultural practices environmentally unfriendly bring long-term, so a drop in production and an increase in crop development costs.

Intensive agriculture, non organic relies primarily on the use of chemicals (herbicides, fungicides, insecticides, etc.) and the increasing mechanization of agriculture. The effects of unsustainable agriculture are both ecological effects, as well as social and economic.

In this respect, the European Union governed by Regulation (EC) 834/2007 and Commission Regulation 889/2008, using the same unit and understanding the following terms: organic agriculture, biological agriculture and ecological farming.

Decisive factors of sustainable agricultural development in Romania

In order to develop sustainable agriculture must be considered all the factors involved in this field. Beginning with innovation and technology in all related areas and continuing with the development of human resources capable of managing these factors.

Involvement of innovation and technology is in turn comprehensive in all aspects, so innovation and technology concerns:

- Equipment performance and environmentally friendly. Exemplifying the transition to agriculture of "No-Till", meaning without plowing, technique that is environmentally friendly, preserving properties of the soil and increasing crop yields.
- Increase the use of ICT, and this in turn divided into several elements:
 - ICT a view to forecasting production by software systems that can calculate an estimated production, starting from the number of plants per hectare sown with seed drills asisted by computer
 - ICT in terms of efficient use of fertilizers and nutrients through the implementation of software systems in the soil samples analyzes and transmit real and concrete information regarding the needs of fertilizers and nutrients / Ha.
 - Last but not least an ICT system by implementing complex ERP (Enterprise Resource Planning) combining management practices with ICT technology, so all business processes are integrated in the system, in order to achieve objectives.

Human resource development should follow the same trend of innovation using computer systems. The technology-based learning (using e-learning platforms) is the method of the 21st century, the industry must be able to retain much faster workforce, and training programs must be shorter cycles for these companies to remain competitive².

² Nicoleta Gudănescu, *Using modern technology for emproving learning processes at different educational levels* – World Conference on Educational Sciences (WCES-2010) – Innovation and Creativity in Education, Bahcesehir University, Istanbul Turcia, publicat in Proceedia – Social and Behavioral Sciences Journal, ISSN:1877-0248, Elsevier Publishing LTD, Vol2, Issue 2, art.591, pag.5641-5645, Indexed ScienceDirect, Scopus, Thomson Reuters Citation Index (ISI web of science), <http://www.sciencedirect.com/science/journal/18770428>

To plan an effective activity in the sense of owning a trained and professional human capital requires a constant evaluation of human resources³.

Sustainable development – a concept conceptual approach by applying the accounting information system in agricultural societies (as an integrated module of the ERP)

Taking a more proactive approach applied in view illustrating the sustainable development of agriculture through the use of ITC, it can be shown to be necessary including a conceptual approach to innovation and use of information technology in a field less considered important, such as accounting.

The approach of "less important", acquired by most farmers, show their need and importance both in management decision, making that having the right information can be good and sustainable decisions, and if a financing need, whether type bank or as a form of grants, any financing having as cornerstone properly prepared and real accounts drawn.

Principle three pillars, listed at the beginning of this work, respect, and if we talk about using a conceptual accounting information system in agriculture, as follows:

- **economic pillar**

- efficiency.

Implementation of an integrated accounting information system not only can demonstrate its efficiency by eliminating human error in the process of making the record books, but also to develop performance indicators and efficient decision for managers of enterprises

- profitability.

Implementation demonstrates its profitability by reducing "losses caused" in terms of enterprise, but also a "profitability" of the state by a correct tax, eliminating the escapist element by misreporting

- **social pillar**

- welfare.

³ Nicoleta Gudănescu Nicolau, Maria Loredana Popescu, *Managementul Resurselor Umane*, Editura Victor, Bucuresti, ISBN: 978-973-1815-72-5, cod CNCSIS 15, 2013, pagina 245

Long-term profitable growth brings prosperity not only company shareholders, and employees of these and so everyone involved more or less in commercial and social relations with them

- justice, equity and social responsibility.

Proper accounting records, eliminating both intentional and not intentional errors, reporting to state institutions possibility to check data provided by a secure software brings long-term fairness and justice, even having a social impact in this respect, those involved in developing – and the spirit of fair, just and socially, transmitting also to their descendants

- **environmental pillar**

- eco-efficiency.

The eco-efficiency as long-term will be visible through the efficient use of fertilizers and herbicides/fungicides, given proper reporting by management unit, so their destructive application to the soil and the rest of nature, through the system "by ear" will disappear

- ecological balance.

Restoring ecological balance in the medium and long term there will no longer be only a theoretical concept in terms of agriculture. Accounting information system, through its effects on the information submitted, the use of substances correctly and sustainable, will lead to the restoration of ecological balance.

Sustainable economic factors in agriculture

The main objective of any company is profit, regardless of the field in which the organization operates.

However, getting profit must also be sustainable. A company founded by some investment costs without sustainable development, can lead to failure and non-recovery of the initial investment.

Agriculture, more so, is an area in which the initial investment amount is very large, machinery, even if some of them are used only once a year, they have a very high acquisition costs reported in their annual duration of use.

Exemplifyng we can take an acquisition of a performance drills for weeding plants that can execute works on an area of about 100 ha in just 5

working days, work done only once in a year, on spring in late April or early May. Such equipment is valued at approx. 24 thousand euros.

Returning to the approach of sustainable agriculture, as I already said, an intensive type agriculture and environmentally unfriendly can provide medium and long term harmful effects on the ecosystem, including financial losses for companies that exploit agricultural land.

In this regard Dr. Mae-Wan Ho, published a research on the website of Institute of Science in Society (ISIS)⁴ by showing that serious soil acidification threaten food safety and the environment worldwide.

The soil is naturally acidifying along the hundreds of millions of years, but excessive chemical fertilization make the soil to be degraded exponentially. The study reveals that since 1980, with vast agricultural industrialization in China, the results showed significant decreases in pH 0.13-0.8 pH (increase soil acidity), these soils are approaching the potentially toxic metals by the level of acidity.

Going over all aspects of environmental or social and summarizing only the financial impact on such a long-term situations, I made a financial simulation over the next 50 years of the impact of soil acidity on expenditure growth of agricultural societies with complex fertilizer type NPK (nitrogen-phosphorus-potassium) that adjusts also the soil acidity.

The simulation suggests an increase in the amount of NPK complex 50 kg / ha to 10 years to adjust soil continuous degradation, if no action is taken to protect it.

Table 2.

Simulation of NPK using on a degraded soil.

Year	2015	2025	2035	2045	2055	2065
NPK Quantity (kg / ha)	200	250	300	350	400	450
Cost/ha NPK at an average of 21euro / 50kg (euro)	84	105	126	147	168	189

Source: authors own concept

A single impact analysis reveals that the rate of profit falls every decade by increasing production costs.

⁴ www.i-sis.org.uk/chinasSoilRuined.php

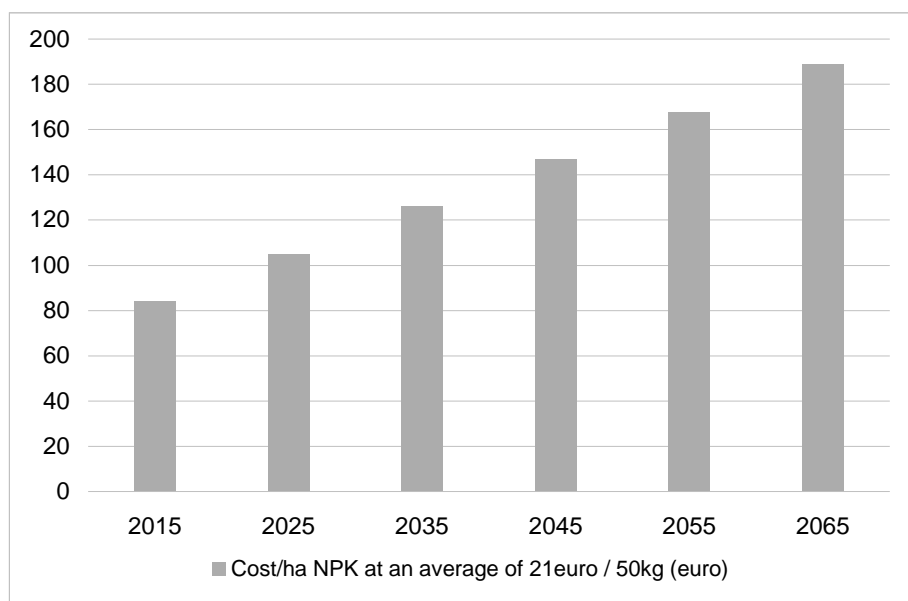


Figure 3. Increasing production cost simulation.

Source: authors own concept

Results as a percentage cost of production per hectare are expressed in the table and graph below, following the same trend and the same calculation period.

Table 3.

Simulation of NPK using on a degraded soil (%).

Year	2015	2025	2035	2045	2055	2065
NPK Quantity (kg / ha)	200	250	300	350	400	450
Increase cost / Ha influenced by NPK (%)	100%	125%	150%	175%	200%	225%

Source: authors own concept.

A sustainable agriculture would identify this type of problems and eliminate such factors.

Changing technology work using technologies "no-till" will stimulate the soil to self-regulate by creating a layer of organic matter on the surface to which besides the role of fertilizer and the "curtain" which retains water in the soil, is the decisive factor maintaining natural layer of humus. Humus is amorphous mixture of organic substances found in the soil, who conditions the fertility of the soil, and that is the result of converting plant material under the action of microorganisms.

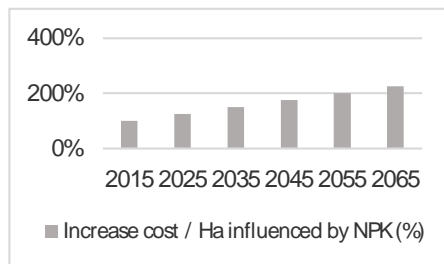


Figure 4. Increasing production cost simulation (%).

Source: authors own concept.

2. Role of accounting in sustainable development of agriculture using ITC

Due to the complexity of economic activity in general and in particular farms, accounting for a large majority acceptance is approached as a system.

This system can drill two large distinct components:

- On the one hand „financial accounting which should provide a chronological and systemic recording, processing, publishing and maintaining information about the financial position, financial performance and other information related to the work, to meet the domestic needs of real and reliable information and for the external environment of the farm, represented by: present and potential investors, financial and commercial creditors, customers, public institutions and other users"⁵;
- On the other hand two distinct components is management accounting or management which is optional for top management in agricultural holdings in Romania.

In terms of economic decision making in the internal decision of the entity, managerial accounting entity has priority because it substantiates

⁵ <http://www.rasfoiesc.com/legal/contabilitate/CONTABILITATEA-FINAN-CIARA- ROMA15.php>

activity level and structure of the activity is found in the general information that is reflected in financial accounting.

It follows that top management needs in investment and financing decision making on the farm, so the information in managerial accounting (management), but at the same time and relevant information from financial accounting.

Evolution of information technology, combined with the globalization of the economy, require optimization of economic information as part of the optimization work farms by implementing integrated software to ensure implementation of economic decisions in real time.

Therefore I consider that a possible solution for the problems can be solved by creating innovative software applications that automate the accounting records of an agricultural society, thus eliminating human error, fraud committed by employees and allow top management decision making based on a more than solid.

In terms of deployment solution for the environment, agricultural holdings as economic activity should have the utmost use of natural resources.

The pressures of commercial and economic order imposed applying intensive production technologies that have resulted in increased grain yields and consequently the economic efficiency of farms⁶.

To complement the technical approach on economic holdings economic efficiency must improve their accounting information system to provide decision makers economic information in a short time quality, most complete, so they can make the decision good in real time. These requirements can be achieved if policymakers will use and apply research findings leading to the implementation of complex embedded systems and the end will be getting a competitive advantage in the global market with a large number of competitors

Highlighted in this paper are based on a case study applicative included in the research farm operation is mainly vegetable production, especially in the field of hoeing cultures.

Technical stream found following discussions with representatives of ABS (Agro Business Solutions) and initial verification field is the set of processes and measures adopted to obtain the final products or cereals in the diagram below:

⁶ Burja C., Burja V., *Book of science Publishing House*, Cluj-Napoca, 2008, p. 5

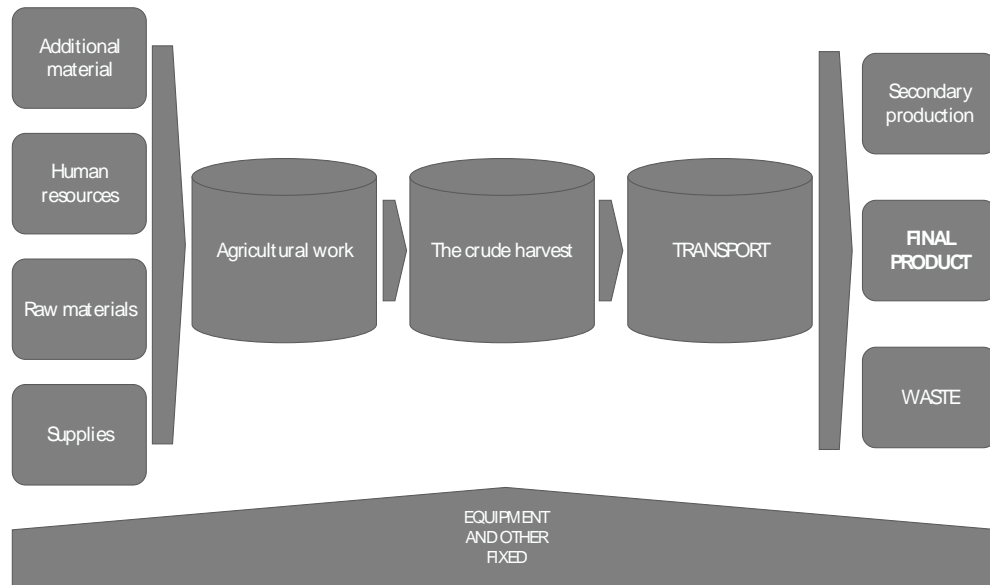


Figure 5. Technical stream – Agro Business Solutions.

Source: authors own concept

Proposed information system will be "cloud" type, and represents a set of distributed computing services, applications, access to information and data storage without the user needing to know the physical location and configuration of systems that provide these services⁷

The information will flow between all departments society and computer system sketch below automatically generated documents issued with a barcode system which will help to take information in electronic format from a physical document (eg: delivery note).

Proposed information system combined with available agricultural machinery can eliminate human error and automatically perform basic accounting records, providing correct information throughout the company manager.

Next we take as an example the use of the phase information collection and delivery of goods produced (field crops).

Modern combines are equipped with gauges in terms of quantity and quality of harvested products (tons / Ha, humidity etc.), this information

⁷ http://ro.wikipedia.org/wiki/Cloud_computing

will be linked directly to the computer system that will automatically entries in the accounting records on stock.

To exit the stock, the system will retrieve information from weighing heavy on the exit from the farm and automatically releases the shipping of goods, performing and related accounting records.

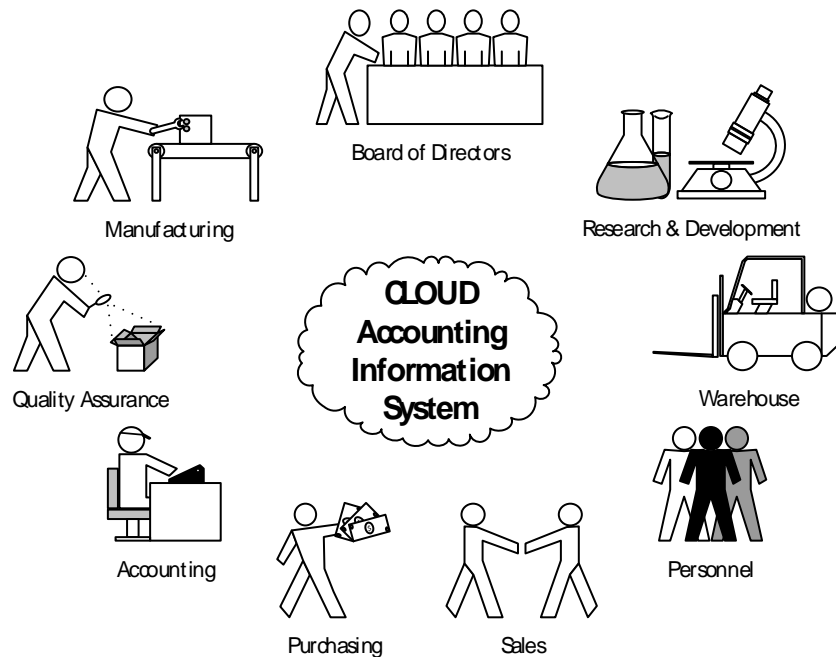


Figure 6. Cloud ITC system.

Source: authors own concept.

3. Managerial accounting – primary information for managerial decision adopting

Increased competition in the context of economic globalization makes the decision more difficult and if decision is not based on any concrete information leads companies even to bankruptcy.

The objectives defined in specific literature for managerial accounting are of three types:

- Analytical evidence objectives
- Performance objectives
- Forecasting and control objectives.

Performance indicators generated by managerial accounting, underlying general view of the company's situation and can generate alarm signals on the financial situation of the company are:

- Commercial margin;
- Added value;
- Production per year;
- Gross surplus exploitation;
- Self-financing capacity;
- Reserve management;
- Working capital;
- Working capital needs;
- Net treasury.

Referring specifically to agriculture, overall profitability and determining the specific type of crop / product, general and specific production costs are elements that in the absence of solid information go to achieve a type of management "by ear", type of management very common in this industry, especially in developing and emerging countries.

Creating a management "by ear" leads each time to lower company profitability. For example, a culture may be less cost-effective in certain geographical areas and non calculating exactly the production costs generates financial losses.

Starting from the theory of managerial decision-making information system which it states that a company is seen as a set of three interconnected systems:

- OPERATING SYSTEM – which performs the function of the enterprise;
- INFORMATION SYSTEM – which is building the company image;
- DECISION MAKING SYSTEM – the operating system that controls and manages the information system.

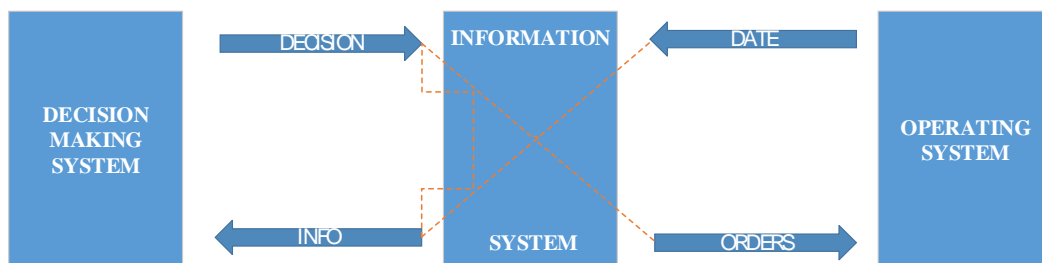


Figure 7. OID model (Operation-Information-Determination) of an enterprise.

Source: Albescu F. (1998), *Accounting Management Information Systems*, Ed. Fundației România de Mâine

We consider that, for the managers in financial and accounting departments from agriculture organization and not only in this is very useful to have a dashboard with all the information they need in order to make fundamented decisions.

Dashboard have to contain information on financial indicators, including physical and qualitative indicators, allowing the managers to take measures that increase the performance of the company, managing the business responsibly and taking the necessary decisions to achieve the company's goals.

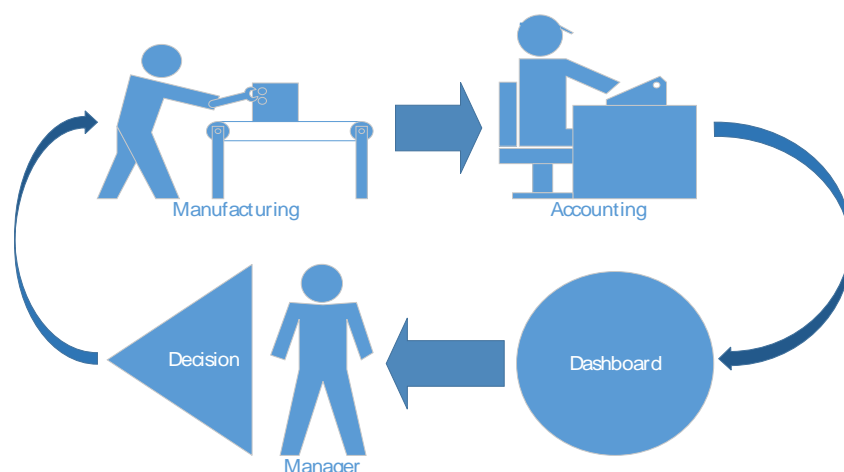


Figure 8. Decisions diagram using dashboard.

Source: Author's own concept.

For example in agriculture a Dashboard can be daily, weekly or monthly updated and will include indicators representative for the performance of the business such as:

- Consumption of fertilizers per hectare;
- Consumption of pesticides per hectare;
- Fuel consumption per hectare;
- Productivity per hectare;
- Milkings per cow per day;
- Milk production per cow;
- Report feeding;
- Slaughter rate.

Also the dashboard may be used for strategic decisions and will regroup the essential data in order to define an overall strategy of the company on a longer period of time.

Such an array can include indicators like:

- Market share;
- Costs;
- Prices;
- Investments;
- Other segment related indicators of activity.

4. Conclusions

Sustainable development of agriculture in Romania can not be done without the support of research and innovation in all related fields.

We presented, as example, the benefits of research and innovation only in terms of agricultural technologies use of "no-till", the excessive use of chemicals and innovation by introducing a system in terms of Managerial Accounting.

Extrapolating, we can see that the medium and long term effects of a policy of sustainable development in all its aspects will lead besides environmental and social benefits and the achievement of financial objectives of companies in this area.

Why cloud? For future managers need to be dynamic persons who must have access to information regardless of location or time. Cloud transcends geographical barriers and offers them the possibility of being ubiquitous managers, regardless of physical location.

Information technology gives the opportunity to perform functions for forecasting, control, including decisions in real-time communication to their end users regardless of their geographical position.

The impact of using such a system will bring financial benefits because of lead times low, information communication faster and more accurate decision-making.

The information and decisions can communicate safely with access by the hierarchical way, in real time using cloud system while ensuring the information security of the company.

ACKNOWLEDGMENT

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ENTERPRISE ARCHITECTURE FRAMEWORKS SIMPLIFIED SELECTION AND FEASIBILITY ANALYSIS IN PUBLIC ADMINISTRATION

Kazimierz PIOTRKOWSKI*, Michał BIJATA*

Abstract. *Corporate architecture can be an essential tool used by higher management, which can bring a lot of profits especially in the strategic management area. This publication provides description and exemplary implementation of simplified selection method and analysis of feasibility of corporate architecture in supporting public administration management.*

Up to 10th October 2014 52 different types of corporate architecture frameworks have been identified. To choose the right framework for a particular organization, especially one as complex as a public administration, from that many available solutions is not an easy task.

In this paper a simplified method of initial selection of architecture framework is presented (to obtain so called "short list") and then analysis of feasibility of the architecture frameworks on the short list in regards to adopted criteria of feasibility in polish public administration.

In order to obtain a short list of architecture frameworks for further analysis the following selection method was applied:

1. *Creating the following classification of frameworks:*
 - 1.1. *Classification according to the sector background of the framework owner;*
 - 1.2. *Classification according to representation of the internet;*
 - 1.3. *Classification according to popularity;*
2. *Selection of 6 frameworks originating from each sector, popular and having current representation on the Internet.*
3. *Rejection of 2 frameworks by using more restrictive criteria described in point 2.*
4. *Rejection of 2 frameworks by taking into account the specific needs of public sector.*

As a result of performed selection a short list was obtained containing 2 frameworks – FEAF and TOGAF. The main conclusion from the performed analysis (in regards to 3 criteria: defining architectural requirements, architectural requirements management, valuation of the architectural requirements fulfillment) is the fact, that none of those concepts are a complete tool for public administration needs. Taking into consideration the

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complementary of those concepts, hybrid approach seems to be the most appropriate – sourcing the best (the most suitable to the public administration specificity) elements from both frameworks.

Keywords: *corporate architecture in public administration, TOGAF, FEAF.*

1. Introduction

The beginnings of enterprise architecture dates back to 1987 when John Zachman, an IBM consultant, involved in the initiative of *Business System Planning* – BSP, published a *Framework for Information Systems Architecture* named later as Zachman's Framework. That new branch initially tried to respond to 2 problems in public administration in the USA at the time:

1. increasing complexity of systems – which caused many projects of large system constructions to fail,
2. insufficient adaptation to business requirements – despite built system, often already in the production phase and despite massive capital expenditure, the created system did not meet the business expectations.

That concept was the inspiration for the new branch to be born, which is today's

Enterprise architecture, understood as a formal description of structures and functions of the components of an enterprise (including people, processes, information and technology), interrelations between those components, principles and guidelines governing their creation and development over time.

Enterprise architecture can be an essential tool used by higher level management of an organization, which can deliver a lot of profit. First of all, it provides consistency between defined organisational strategies and implementation of IT projects. More than that, using this concept allows for the elimination or non activation of some of the projects and introduces high level understanding of the IT field by the management. That leads to a reduction of costs and eliminates wasting resources dedicated to unsuitable initiatives.

Especially over the course of the last 15 years that branch was developed dynamically. Many architectural framework concepts (understood as a structure for the contents or the process, which can be used as a tool for

structuring mental process, providing integrity and completeness¹) were created by organizations of different organizational profile and characteristics. Up to 10th October 2014 there were 52 different enterprise architecture frameworks identified².

Choosing the right architecture framework for a specific organization, and in particular for an organization as complex as public administration, from the many available options is not an easy task for the management.

In this paper a simplified method for the initial selection of architecture framework is presented (to obtain the so called “short list”) and then analysis of the feasibility of architecture frameworks from the short list according to the criteria of feasibility in Polish public administration.

2. Introduction to architectural frameworks

The term **framework** – leaving aside the definition of enterprise architecture and excluding the corporate architecture of a country The Open Group defines as “a structure for the contents or process, which can be utilized as a tool for structuring mental process, providing integrity and completeness”³. **The architecture frameworks are** “tools for supporting the creation of architectures specific for a particular organization”⁴.

Architecture requirements is “an expression of a need fulfilled by a particular architecture or a set – of tasks”⁵. **Defining architectural requirements** is a set of actions allowing for:

- gathering identified requirements into a common repository,
- requirements analysis,
- planning the order and time frame of their implementation.

Requirements management is a set of actions consisting of:

- regularly valuating progress in realization of planned objectives
- active identification of necessary changes and adopting them,
- change analysis,

¹ *The Open Group TOGAF® 9 Translation Glossary: English – Polish*, The Open Group, Berkshire, 2011.

² Own elaboration

³ *The Open Group TOGAF® 9 Translation Glossary: English – Polish*, The Open Group, Berkshire, 2011, page 15.

⁴ *Ibidem*, page 10.

⁵ The Open Group, *The Open Group Architecture Framework Version 9...*, *op.cit.*

- implementing proposed changes in a controlled way according to change priorities,
- providing accordance with used methodology in the fields of documentation and change management.

Valuation of the architectural requirements fulfillment is a process composed of 2 activities: examination and determining the degree of architectural requirements fulfillment.

3. Simplified framework selection method and criteria used in the further feasibility analysis

To obtain a short list of architecture framework for further analysis, the following method was implemented:

1. Creating the following framework classification according to:
 - 1.1. Classification according to the sector background of the framework owner,
 - 1.2. Classification according to representation on the Internet,
 - 1.3. Classification according to popularity.
2. A choice of 6 frameworks from each sector, popular and having current representation on the internet.
3. Rejection of 2 frameworks by implementing more restrictive criteria described in point 2.
4. Rejection of 2 frameworks by taking into account specific needs of the public sector.

3.1. The role of management in the process of selecting framework

It is necessary that the top management of an organization are involved in the process of selecting architecture frameworks from the very beginning. In the case of public administration, it would be at least the minister responsible for the implementation of IT solutions. Enterprise architecture and in particular, the architecture framework connected with it, applies not only to the IT field, but also the whole organization. That is why it is the key to reassure an appropriate support translated into all levels of organization. Additionally, to provide effective supervision of the IT field, it is essential to provide a proper understanding of products of work above later developed enterprise architecture via its key stakeholders.

3.2. Classification according to the sector background of the framework owner

Justification of used classification: architecture frameworks originating from a chosen sector in the vast majority of cases are also addressed to that sector. It is important to take into consideration that concepts they include might be typical only for that particular sector. That is why when searching for appropriate representatives of architecture framework one needs to consider:

The outcome of the analysis:

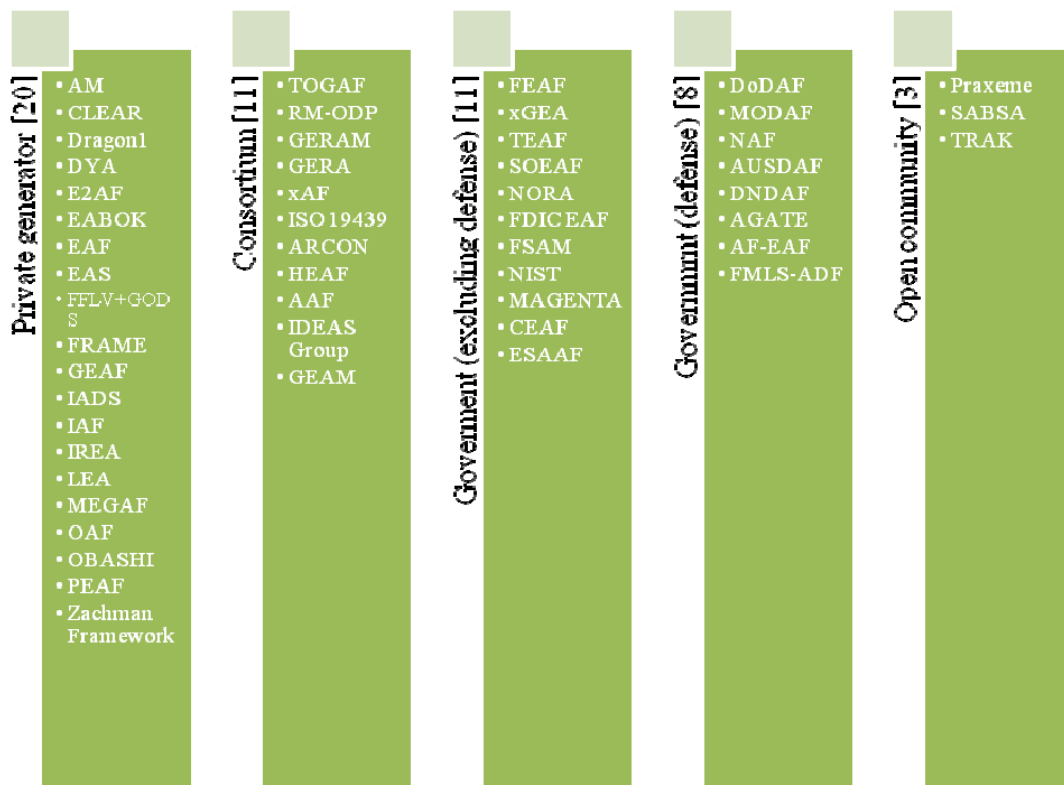


Chart 1. Division of architecture framework according to the background sector of the owner.

Source: own elaboration

3.3. Classification according to representation on the Internet

Justification for used classification: the list of identified architecture frameworks is extensive. Some of those ideas are not developed, niche or very closed. This classification allows for excluding some of such frameworks. If the author is serious about his product, without any doubt he should create and update a website dedicated to his product.

Result of analysis:



Chart 2. Division of architecture framework according to representation on the internet.

Source: own elaboration

3.4. Classification according to popularity

Justification for that classification: frameworks of large popularity are frameworks that provided foundations of this knowledge domain, or one of the best and the most consistent ideas.

The result of analysis (limited to 10 most popular frameworks):

Table 1.

Chart of architecture framework according to popularity

Short name	Number of results – Google	Number of results – Google Scholar	Popularity Ratio ((Results_Google/1000)*30%+ Results_Scholar*70%)
TOGAF	1 620 000	3730	3097
Zachman Framework	184 000	3280	2351
DoDAF	251 000	1140	873
MODAF	2080	1130	792
FEAF	199 000	820	634
EAS	338 000	644	552
RM-ODP	75 500	520	387
xGEA	256 000	428	376
GERAM	26 300	474	340
IAF	166 300	350	295

Source: own elaboration.

3.5. Selection of frameworks for the short list

Based on a conducted analysis, a short list of frameworks was selected – potential representatives for further analysis (originating from each sector, popular and represented on the internet). These frameworks are:

1. TOGAF.
2. Zachman Framework.
3. DoDAF.
4. MODAF.
5. FEAF.
6. EAS.

Frameworks 3, 4 and 5 originate from one sector. From those three, the FEAF frameworks were chosen, because they are it is still being developed (unlike DoDAF) and offer a wide range of publications associated with them. After that elimination, the short list of frameworks is:

1. TOGAF.
2. Zachman Framework.
3. FEAF.
4. EAS.

The summary of results of classification is presented in the chart below.

Table 2.

Results chart of classification of selected architecture framework.

Analysis factor	Zachman	TOGAF	EAS	FEA
Background sector of the framework owner	Private generator	Consortium	Private generator	Government
Representation on the internet	Available and updated	Available and updated	Available and updated	Available and updated
Popularity	Very high	Very high	Very high	Very high

Source: own elaboration

Ultimately, the following frameworks were selected for further analysis according to their feasibility in the Polish public administration:

1. Application of framework in public administration in other countries.
 - Justification: FEAF frameworks are used in American public administration since the nineteen nineties. It was a fundamental point in the history of enterprise architecture development. Furthermore this is one of the five most popular frameworks in the world.
 - Chosen FEAF framework.
2. Popularity of frameworks in publications on Polish administration.
 - Justification: TOGAF frameworks are incontestably the most often listed frameworks in all publications on Polish administration.
 - Chosen: TOGAF framework.

3.6. Criteria for evaluating the feasibility of architecture framework in Polish public administration

To evaluate the feasibility of the framework in Polish public administration the following criteria were adopted:

1. Criterion I: Defining architectural requirements.
2. Criterion II: Managing architectural requirements.
3. Criterion III: Valuation of architectural requirements fulfillment.

To validate adopting the above criteria, it is important to emphasize, that in each project the requirements are very important, because they translate directly into results. Furthermore, in Polish administration, the requirements are especially important. They are recorded as SIWZ⁶, on the base of which a final valuation, schedule and suppliers are selected. At the stage of implementation, the flexibility of Polish public administration regarding the requirements is very small, much smaller than in business. For this reason that field (at the stage of definition, management as well as control of results) should be treated as a critical issue for the success of such a complex undertaking, as without doubts a design of creating a state architecture is.

4. Architectural Framework of Enterprise Architecture of USA Federal Administration

4.1. Criterion I: Defining architecture requirements

Defining architecture requirements as part of FEAF was placed in the first step of Collaborative Planning Methodology (CPM) – *Identification and Validation* including sub-stages described in Chart 1.

Sub-step 1.1 – involvement of sponsors and accessing architecture stakeholders needs is the first action related to arising new architecture in CPM methodology. The output elements are the needs of different stakeholders, on the base of which the new architecture will be created. Its course is as follows:

1. Involvement of all stakeholders groups – sponsors, business owners and others in creating the project.
2. Identifying the key business needs, risk elements, deficiencies in efficiency and main objectives of the projects of each identified stakeholders group separately.
3. Creating a shared list of key business needs, risk elements, deficiencies in labor efficiency and main objectives of the project for all the stakeholders groups.
4. Identification of limited, small group of projects' sponsors.

⁶ In Polish Public Administration – Specification of Major Order Conditions used in tenders

Table 3.*Sub-steps of identification and validation CPM step.*

1.1	Involvement of sponsors and assessment of needs of stakeholders of architecture	Stakeholders, sponsors, management	Absence (only stakeholder's needs)	Draft list of stakeholders needs)
1.2	Analysis and validation of needs	Planners, stakeholders	Draft list of stakeholders needs, risks and their effect, deficiencies in efficiency)	Factors of change assumptions, restrictions. Validated list of stakeholders needs)
1.3	Formulating the concept of addressed needs	Planners, stakeholders, sponsors	Validated list of stakeholders needs, change factors, assumptions and restrictions	Vision, goals and defined scope
1.4	Identification and management's involvement	Planners, stakeholders, management	Vision, goals, identified scope	Absence

Source: own elaboration based on Chief Officer Council, *Federal Enterprise Architecture Framework Version 2*, Chief Officer Council, Washington, 2013, page 72

The result of the work of this sub-step is a draft list of stakeholder's needs, which will be then converted in the next sub-step, being its key input element.

Sub-step 1.2 – Analysis and needs assessment – concentrating on deepening the analysis within sub-step 1.1. It consists of the following actions:

1. Identification of change factors, assumptions and restrictions related to the requirements – both specific ones for each stakeholder's group, and the ones resulting from interactions between groups.
2. Analysis of influence of identified change factors, presumptions and restrictions on identified needs (presumed scope of analysis: each need with change factor/presumption/restriction).

⁷ Only artefacts related to requirements were listed.

⁸ Only artefacts related to requirements were listed.

3. Validation of requirements, change factors, presumptions and restrictions eliminating needs that are not possible to achieve, but leaving the final list of needs (requirements) to be realized.

Sub-step 1.3 – formulating the concept of addressing needs – based on a formulated set of realistic requirements has a goal to formulate their priorities and final decision regarding the scope of the project. Its course is the following:

1. Formulating priorities to identify the requirements based on what was agreed with stakeholders
2. Estimating implications, values, risks of all the requirements and the interplay between them.
3. Formulating the vision, goals, brief overall expression of the goal and the scope of the project.

Sub-step 1.4 – Identification and management involvement – connected only with project management mechanisms and not with the architecture requirements.

Identified requirements in step 1 (identification and validation) are essentially developed in step 3 – designing and planning. In this step (sub-step 3.24 – the analysis and completing the vision of the project regarding expected results) expected success measurements are given, in which the projects should meet together with the definition of the way they should be measured, for identified and validated requirements.

4.2. Criterion II: Managing architecture requirements

FEAF does not describe management processes of managing architecture requirements. Guidelines of step 3 (designing and planning) indicate that each organization should already have in place their own project management methodology. Without doubt, one of the elements of such methodology is the administration of change management. According to the FEAF framework, requirements management should be included in that process.

4.3. Criterion III:

Valuation of architecture requirements fulfillment

The process of architecture requirements fulfillment according to FEAF, was cited as the last step of Collaborative Planning Methodology (CPM) – *Perform and Measure* consisting of the following sub-steps:

Table 4.*Sub-steps of identification and validation CPM*

No.	Product name	Participants	Input artifact ⁹	Output artifact ¹⁰
5.1	Starting a new activity with new skills	Planners	Integrated Plan	Absence
5.2	Measurement of achievements in regard to earlier adopted metrics	Planners	Integrated Plan, Document analyzing costs, values and risk	Set of measurements in regard to adopted metrics
5.3	Analysis of gathered data and feedback information	Planners, stakeholders	Integrated Plan, Document analyzing costs, values and risk	Absence

Source: own elaboration based on Chief Officer Council, *Federal Enterprise, Architecture Framework Version 2*, Chief Information Officer Council, Washington, 2013, page 142

The main output element to sub-step 5.1 is the Integrated Plan. It is one consistent document produced in step 1 (Identification and Validation) and 3 (Designing and Planning). It includes destination architecture described at all levels, financial expectations for the project together with a set of budgetary constraints, metrics of expected achievements of the project and identified mile stones for the project of architecture's transformation.

Sub-step 5.1 concentrates on commencing operational activity as part of newly formed architecture. When that activity is stabilized, the sub-step 5.2 is performed, which is a measurement of achievements in regard to metrics defined in the Integrated Plan document and alternatively in cost analysis documents, values, risks (created optionally in step 3 – designing and planning, including, inter alia, additional metrics related to costs, values and risks).

After taking measurements of achievements sub-step 5.3 is carried out, in which gathered measurements are analyzed, on their base conclusions regarding the set the requirements are formulated. Those conclusions are then passed to the stakeholders as feedback.

⁹ Only artefacts related to valuation of requirements fulfilment were listed.

¹⁰ Only artefacts related to valuation of requirements fulfilment were listed.

5. Architectural Framework of The Open Group (TOGAF)

5.1. Criterion I: Defining architecture requirements

Defining architecture requirements in regard to the created and developed architecture is concentrated in Phase A – Architecture Vision. As part of this phase the Architecture Vision Document is created, which aims to deliver in the early stage of the ADM Cycle formally agreed results of the project. One of the main parts of the document is its part dedicated to requirements.

TOGAF does not define, in which way (by using which tools, or languages) the requirements which should be described. The most common approach is the usage of complementary language to model corporate architecture – ArchiMate, which is also owed by the Open Group.

Phase A is not the only stage of defining requirements in regards to enterprise architecture. TOGAF assumes that on that basis, between phases A and B (as part of Architecture Requirements management Process) the relevant *Architecture Requirements Specification* document will be created. The document will then be developed and complemented between phase B and phase F.

The recommended contents for The Architecture Requirements Specification document:

- success measures,
- architecture requirements,
- business service,
- application service contracts,
- implementation guidelines,
- implementation specifications,
- implementation standards,
- interoperability requirements,
- IT service management requirements,
- constraints,
- assumptions.

A complementary document to The Architecture Requirements Specification is *The Architecture Definition Document*, which is a specific container for most artifacts created as part of project of developing a new architecture TOGAF Framework by introducing clear separation of roles of two documents with regards to architecture requirements:

- Architecture Requirements Specification – it should deliver quantitative picture delivering measurable criteria, which should be fulfilled by the project of implementation of new architecture.
- Architecture Definition Document – should deliver quantitative picture communicating at the same time architects’ plans.

The below table, in a synthetic way, summarizes the role of the described documents, additionally introducing placement of each document in TOGAF framework.

Table 5.

Documents for defining the requirements within TOGAF Framework.

Document’s name	Document’s role	It is output element of phases:	It is output element of phases:
Architecture vision Document	Formalizing requirements in early stage of the project	A, E	B, C, D, E, F, G, H,
Architecture Requirements Specification	Measurable criteria to fulfill	B, C, D, E, F	C, D,
Architecture Definition Document	Document’s container; Communication of architects’ design qualitative criteria to fulfill	B, C, D, E, F	C, D, E, F, G, H

Source: own elaboration based on The Open Group, *Architecture Deliverables*, http://pubs.opengroup.org/architecture/togaf9-doc/arch/chap36.html#tag_36_02_20, The Open Group (documents date: 2011, read on: 01.10.2011).

5.2. Criterion II: Management of architecture requirements

The management of architecture requirements applies to all phases of The ADM cycle, being a central point of TOGAF framework. Overall, that process is based on continual identification, formalization and introduction of changes in regards to corporate architecture.

At the output of to the process of managing requirements the following elements are recommended:

1. Requirements’ repository.
2. Organisational Model of Corporate Architecture including:
 - the scope of organization included in the project;

- the estimation of organization’s maturity;
 - the requirements in regards to project’s budget;
 - the description of supervision elements and support methods for the project;
3. Architecture framework adapted to organization’s needs.
 4. Architectural Works Declaration (defining scope and approach, which will be used to complete the architectural design, including measurements of success of the project).
 5. Vision Document of Architecture (a document with a large degree of generality, based on requirements obtained from the most important stakeholders).
 6. Specification of requirements for destination architecture (initially the requirements set at the beginning of the project – in phase A – Vision of Architecture).
 7. Estimating the influence of the requirements gathered so far on the current architecture of the organization.

The high level flow of managing architecture requirements process in TOGAF is as follows:

1. Identification and documentation of new requirements.
2. Analysis of input requirements:
 - identification of priorities for the currently performed phase of the ADM cycle,
 - documentation of set priorities,
 - confirmation of stakeholders support.
3. Monitoring of requirements completion
4. In case of the development of new or change of current requirements
 - adding, removing, modifying requirements;
 - identification and settling possible conflicts with existing requirements;
 - re-establishing priorities (in agreement with key stakeholders);
 - analysis of the influence of new or changed requirements:
 - current architecture,
 - activity in the current phase of ADM cycle,
 - already finished phases of ADM Cycle;
 - decision regarding the schedule of the implementation of changes (current phases or next phase);
 - documentation update: Architecture Requirements Specification, Requirements Repository, Analysis of Requirements influences (on current architecture).

4. Implementation of requirements emerging from phase H (change management).

5. Implementation of changes in current phase and possible return to previous phases.

The output elements of the architecture requirements managing process in TOGAF are as follows:

1. Updated Architecture Requirements Specification.
2. Updated Architecture Requirements Repository.
3. Influence Analysis document (new and modified) Requirements (on current architecture).

5.3. Criterion III:

Valuation of architecture requirements fulfillment

The valuation of architecture requirements in the TOGAF framework is carried out in phase G - Supervision of implementation, where after finalization of implementation the *post-implementation review* is carried out, after which the closure of the whole project takes place.

Within the review an actualization of the 2 documents is carried out:

1. Vision of Architecture Document
2. Definition of Architecture Document (which also includes Architecture Requirements Specification).

Actualization consists of comparison (qualitative and quantitative) of the results against adopted requirements.

6. Summary and conclusions

Corporate architecture can be an essential tool used by higher management, which can provide a number of benefits in the strategic management area. Nonetheless it is necessary for the top management to be involved from the very beginning of the process of the selection of architecture framework. In the case of public administration it would be at least the minister responsible for the implementation of IT solutions.

Deliberating the two above selected architecture frameworks, in regards to implementing them in public administration in such areas as defining requirements, managing requirements and controlling the results, it must be noticed, that there are far-reaching differences between them.

In the case of **Criterion I – defining requirements** regarding architectural framework, both frameworks define, in a clear manner, the location of that activity as part of the creative process of architecture.

TOGAF framework in a notable way omits the process of defining the requirements, putting greater emphasis on the contents of requirements' definition products (mainly requirements specification). However it does not provide any validation mechanisms by the key stakeholders, which could be an essential element in the context of public administration.

The FEAF Framework is concentrated on the process of defining requirements itself in order to provide complete, consistent and agreed requirements. This is achieved by introducing a multistage way of formulating them from the definition, through analysis and naming priorities and double validation including all key stakeholders. The roles of all the actors in this process are also clearly defined. This approach providing broad coordination of requirements seems to be more beneficial from the public administration's point of view.

The FEAF framework in case of **Criterion II** of analysis (**requirements management**), does refer directly. The framework provides only guidelines for that area saying that it should be addressed through change management within the adopted project management methodology of each of organization units. This approach completely disregards validating the realization of requirements and saving their consistency during each stage of the project. Using standard change management mechanisms does not include specific issues for requirements area either – even keeping consistency in regards to current requirements.

By contrast, the TOGAF framework clearly defines the process of requirements management, placing it in the central location of the ADM cycle. At the same time addressing specific requirements for changes issues, including providing their consistency in case of possible changes. For obvious reasons, that type of approach is more complete, and also more adequate for public administration.

In the case of **Criterion III – validation of results** with regards to the earlier defined requirements, the differences are also significant. In fact the only similarity is the concept itself – consisting of being a separate phase of cycle of producing architecture based on verification of the achieved results. The TOGAF framework presents a laconic approach, giving only general guidelines, that comparison of output documents versus the cycle of creating architecture should in general take place.

In contrast, the FEAF framework describes, in a complex way, not only the process itself (actors, responsibilities, activity chain) but also its products (measurements ways and their results published in a specially prepared portal available to public). By reason of completeness of the

description of that area, that approach seems to be more beneficial when considering public administration.

To summarize, when validating the feasibility of frameworks with regards to public administration needs in definition area, management and requirements control of architecture requirements control and accomplishment – the FEAF framework shows a higher completeness of included concepts completing each other, however the most accurate seems to be the hybrid approach – sourcing the best (the most matched to public administration specificity) elements from both frameworks.

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SUSTAINABLE DEVELOPMENT, A SOLUTION TO THE ECOLOGICAL CRISIS*

Ramona Maria CHIVU**

Abstract. *The current ecological crisis is the result of human activities. The paper analyzes environmental problems in order to determine the causes which led to the ecological crisis. The article argues that the ecological crisis is the result of our unconscious aggression on the natural systems that sustain us. Public awareness on environmental decline, which supports life and our existence on Earth, has led to ecological crisis. The ecological crisis is a phenomenon that concerns a particular region of the world, a country, but a real threat to life and health of all. More than ever, pollute soil, water and atmosphere at a rate that will not ever allow a return to the state from which we started. The article also proposes some solutions to this global problem. The conclusion is that the solution to this crisis is the sustainable development based on the integration and balance the economic, social and ecological and environmental education. To solve this problem requires political will, real and concentrated, the states agreed to implement environmental strategies at the global level, which would give a strong ecological content concept of sustainable development and globalization.*

Keywords: *ecological crisis, environment, sustainable development, globalization.*

JEL classification: M41, M48, Q56, Q51 Q20 N27.

1. Introduction

It has become increasingly clear that human activities have profound impacts on nature and its riches, especially given that human influences on the environment are becoming larger as a result of population growth, human agglomerations development and technology industries.

The famous French biologist and philosopher Jean Rostand, "Science has made us gods, before they deserved to be human", and began destroying everything: and animals and forests and waters and

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continue to destroy the environment. We will not spare anything and we will find ourselves at a time on a poor planet, wondering how long we could survive.

Knowledge without wisdom nature generated ignorance of its deterioration and the risks that we ought to draw attention today.

Environmental problems can be treated in different ways. They are recognized as part of the contemporary world issues. In the current period, environmental protection is a major problem of all mankind. Every year, hundreds of research or publications are devoted to these problems, which are required by their priority. It shows the diversity of viewpoints and theoretical positions, in terms of their identifying features and their resolution.

However, debates on political action and democratic mechanisms continue to occur in air, without taking into account the underlying basis of people's lives and their activities: the ecosystems in which they live.

When we talk about ecosystems, the first word that comes to mind is the crisis. Because this planet really undergoing a global ecological crisis of considerable proportions.

2. The ecological crisis. Causes and solutions

Humanity is facing an environmental crisis of great magnitude and tends to worsen. Its manifestations can be grouped into two major issues closely related. First, environmental degradation, involving air pollution of watercourses (surface and underground) and soil. So called, climate change has become the most visible today. And secondly, gradual depletion of natural resources essential to human life, natural water, minerals, fertile land, energy sources. Statistics indicate that the global demand of biological resources of the planet exceed 30% regenerative capacity of nature.

In general, an environmental crisis occurs when the habitat of a species or population changes as far as threatening the continuity of the species and its survival. In particular, the ecological crisis can be critical state of the environment in a region, a country, a macro or even worldwide (global ecological crisis), generated by irrational use of natural resources, air and water pollution, increasing volume of waste and industrial waste.

In any of these cases, the cause of the environment's degradation reflects to the needs of the species that inhabit it.

The ecological crisis is primarily a crisis of deficiency: lack of raw materials, energy, land and environmental areas to keep up with the current economy. The mode of production and consumption ignore the physical

limits of the planet. Humanity now exceeds 50% of its capacity to regenerate natural resources we use and absorb the waste we throw away.

Decline in the population on the environment which sustains life and our existence on this earth has led to ecological crisis. Realizing the huge scale of this phenomenon, policy makers and world class and national lately, trying to establish a firm and urgent to save nature for conservation of human life and which, unfortunately applies sporadic and timid.

The ecological crisis is not a phenomenon to a particular region of the world, a country, but a real threat to life and health of all. More than ever, pollute soil, water and atmosphere at a rate that will not ever allow a return to the state from which we started. In a recent study, it is estimated that if the accelerated pace of pollution and alteration of the environment will be maintained at current levels in less than a century, over 40% of species of creatures on Earth will disappear.

Sustainable development was conceived as a solution to the ecological crisis caused by intense industrial exploitation of resources and the continuous degradation of the environment and seeks primarily to preserve environmental quality. The concept of sustainable development as a starting point fixture of the global ecological crisis 1929-1933 and later developed by incorporating all spheres of economic and social and human, reaching as today, sustainable development represents a new way of humanity.

A possible cause of the ecological crisis has been identified by many sociologists and scientists in ignorance and ignorance of people's growing. Ignorance and ignorance caused us not to be aware of the extraordinary life connections that exist between the phenomena of nature and us.

According to Greek theologian Georgios Mantzaridis, "the ecological crisis is related to the entire personal and social life of man. Religion convenience, lack of respect for things, irrational waste, lack measure, irresponsibility, injustice, exploitation, filthy lucre, Eudaemonism, which manifests in all areas of life and human activity are factors that cause. The ecological crisis reveals the crisis of science, technology, economy, politics, justice, morality, religion. It is the last expression the inner crisis man and all forms of activity and expression of it. It can be characterized as metastasis in creation of spiritual and moral crisis of man".

Type of economic development mainly quantitative known for centuries, an exponential expansion worldwide, is based on linear technology, consuming raw materials and energy. The ecological crisis occurs as a result of advanced technology development and its misuse. A technological development requires a strong control of production and

supply-demand policy is completely wrong. The current economy is based on a destructive principle: demand-supply, thereby emphasizes environmental destruction, increased demand means an abuse of the planet. Because the price is determined by the quantity of products on the market, so it encourages poor quality products which have low price. These low quality products have a short existence and use a significant share of deposits exploited.

If an analysis of consumption and pollution caused by private cars, there may be a rate not negligible contribution to environmentally destructive factor. Destructive factor is probably the number one private car. In several hundred million, these machines have produced serious personal problems due to exhaust air and are commonly used by a large amount of deposits, including not only the oil consumed, but also others such as iron. Man cannot come back in the Middle Ages, in the middle of equine transport, but for a healthy society is bound to develop only means of transport.

According to Adrian Florea, "a particular problem in the process of pollution is the waste, whether they escape control and spread into the air, soil or water, whether it is stored and stored. In this second case, the danger is potential and problems of storing large amounts of waste that accumulates in amazingly large flows are intractable. And in this matter, as elsewhere in protecting the environment, comes the notion of profitability, understood in the narrow sense. Elimination of tons of waste, costs about \$ 160, while storage costs 40-60 dollars. It is understood that manufacturers seeking maximum profit, not wanting to recycle waste, but store them (being about 4 times cheaper). As a result, many underdeveloped countries receive legal or illegal waste their territory. Guinea Bissau had a contract worth three times the national income (about \$ 600 million) for the storage of 20 million tons of waste per year. Countries like Senegal, Benin, Zaire and others, are flooded in different ways but products not only useless and dangerous. It is estimated that waste is higher traffic drug trafficking".

Guilty of ecological crisis, multinational companies are exploiting intensive certain areas, leaving behind economic and social problems, the most serious consequences on the environment. For many underdeveloped countries poverty is the main source of environmental degradation and the main brake on development.

The decrease in agricultural productivity as a result of the destruction of fertile layer of soil, the disappearance of forests and lower subsoil resources, especially hydrocarbons (whose reserves enough for 250 years), represents another aspect of the current environmental crisis. The mentality

that water is still a good unlimited worthless, completes scientific image current environmental crisis.

Of course, pollution is the essence of the ecological crisis, because what is soulless nature is more easily destroyed and profit maximization, although there seems to be obstacles, gets himself obstacle to reconciliation of man with nature. The fact that there is clean energy puts people at a serious crossroads and development.

In my opinion, first must focus on environmental education. Why? Because today billions of people misusing the natural resources of the Earth. In every corner of the world though, people cut forests, extract minerals and energy sources, eroding surface soil, polluting the air and water, creating hazardous waste and causing a rupture of natural areas at a rate unprecedented in the history of life on earth, is impossible to escape the consequences of serious degradation of the environment: the extinction of species, expanding desert, pesticide contamination, increased health problems, hunger, poverty and even loss of lives.

Only in this way can people gain knowledge, skills, motivations, values and commitment they need to make effective use of land resources and take responsibility for maintaining aces environmental quality.

In my opinion, environmental issues are urgent and must be addressed by the entire community, and education must be an integral part of the solution.

According to Dumitru Stăniloae, "nature can be basic human solidarity. Human solidarity manifested by the fact that all men embodies its nature, not separate, but each fully, and therefore it receives events and intentions of each. If someone alters and pollutes the work of evil and negative affect all the intention, therefore man must relate to responsibility and caring nature".

Reuse, reconditioning will be a core activity for the coming years. People are not allowed to consume only between boundaries fields, fields being and survivors. Also, the reservoirs have an important role in life on the planet, the deposit of substances to enrich the soil, bringing plant. To enrich the amount of deposits that can be used, people will be forced to recycle everything that can be recycled.

In essence, concern for environmental issues had as a starting point, awareness of the need gravity phenomena and environmental protection. Manifestations current environmental crisis, consist of natural resource depletion, increasing the speed of extinction of species of plants and animals, which destroy ozone pollution which results in warming the earth, overcrowding. This further multiplication of men, beyond resistance planet

generates depersonalization and emotional relationships inevitable increase aggressiveness.

3. Conclusions

Starting from the fact that man is part of the ecosphere and the ecosphere is support for its activities, the ecological crisis is a state of imbalance in the ecosphere, a state of conflict between man and nature, generated by economic activities today's technological society.

In my opinion, the entire responsibility for the ecological crisis is attributed to man, contemporary technological society. Man, through his activities as technological and economic, affecting network of relationships.

The ecological crisis is the result of our unconscious aggression on the natural systems that sustain us.

The solution to this crisis is the sustainable development based on the integration and balance the economic, social and ecological and environmental education.

To solve this problem, we need political will, real and concentrated to states to implement environmental strategies agreed at global level, which would give a strong ecological content concept of sustainable development and globalization.

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THE CONSEQUENCES OF DEMOGRAPHIC AGING FOR ROMANIAN ECONOMY

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***Abstract.** In Romania, as in other countries affected by demographic aging, the direct causes that led to the affirmation of population aging were the demographic: lower birth rate and the death rate and migration flows influence.*

The phenomenon of leaving the country, mainly by young people and adults also enroll as a factor leading to accelerating demographic aging in Romania.

Effects of aging on the development of economic and social life and the future demographic trends will emerge over time, causing disturbance to the school population, fertile population and the working age population.

The aging population must not be allowed to fall into poverty, a situation that implies greater financial stress later for health care at home and the targets and the measures that ensure better social cohesion.

***Keywords:** aging, birth rate, death rate, social consequences, economic consequences*

1. Introduction

In Romania, as in other countries affected by demographic aging, the direct causes that led to the affirmation of population aging were the demographic: lower birth rate and the death rate and migration flows influence.

The main role played by low birth rates that considerably influenced by age structure of the population, helping to accelerate the aging process; decrease in mortality or in other words increasing life expectancy had a secondary role.

In Romania, decreasing birth rates was influenced by the phenomenon of alienation of young people from rural areas who moved heavily in urban areas, gradually abandoned the traditional peasant

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demographic behavior procreative and passed to a new demographic behavior based on rigorous planning births. Thus there was an emphasis on aging in rural areas and a gap between the two areas.

The phenomenon of leaving the country, mainly by young people and adults also enroll as a factor leading to accelerating demographic aging in Romania.

The evolution of demographic phenomena and processes in Romania was specifically influenced and economic, social, political, cultural, healthcare professionals.

Declining birth rate in Romania is part of a European trend model specific demographic and population aging as a result of this trend is a normal process that developed and will evolve further in line with the overall specificity of this European model.

2. Economic consequences

Unlike the consequences of demographic, economic expresses more acute character while becoming particularly serious in recent years.

Romanian society felt today the full effects of aging processes, not very advanced compared to other countries, but with a strong dynamism in subsequent periods.

The economic downturn and the impact of restructuring create intractable problems on the line to ensure minimum social and economic protection, in which the most important weight to hold elderly beneficiaries.

Costs already aging processes have adequate coverage funds and short-term at least appreciate that these issues will hardly find solution in the future.

The national economic context, the economic dependency ratio experienced a continuous deterioration in the postwar period, due to the fact that the total share of active population decreased in parallel with the increase of inactive people.

Statistical data show that in the country recorded between 1956-2013, although the absolute number of active population fluctuated around long 10.5 million, share in the total decreased from 59.7% to 44, 9%, with a downward trend in the absolute number continuously in recent years.

Table 1.*Changes in the population structure on both active and inactive categories of people.*

- Thousands people -

	1956	1966	1977	1992	2002	2007	2013
Total	17.489,4	19.103,2	21.559,9	22.810,0	21.814,1	21.551,3	20.552
Active	10.449,3	10.362,2	10.793,6	10.465,5	10.079,5	9.994,3	9243
Inactive	7.040,1	8.741,0	10.766,3	12.344,5	11.734,6	11.557,0	11309

- percents -

	1956	1966	1977	1992	2002	2007	2013
Total	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Active	59,7	54,2	50,1	45,9	46,2	46,4	44,9
Inactive	40,3	45,8	49,9	54,1	53,8	53,6	55,1

Such changes in the population structure in the two categories of active and inactive significantly influenced the economic dependency ratios.

The values of this indicator increased overall and environment and sex. The largest increases were in urban areas, in both sexes, but more in women, where the increases were significant.

Table 2.*Participation in the labor force population, sex and area, 2013.*

	Thousands people				
	Total	Male(men)	Female(women)	Urban	Rural
The active population of which:	9977	5568	4409	5552	4425
Employed population	9247	5128	4119	5058	4189
Unemployed	730	440	290	494	236
Inactive population	11309	4791	6518	6091	5218

Evolution inactive people as a percentage of total inactive population reveals a significant increase in the proportion of inactive people in all age groups, with a net decrease in the male adult population in the 15-59 years group, from 56.5% (1956) to 39.2% (2013).

The most significant growth is found in the group of elderly population, overall and most significantly in women compared to men.

Demographic dependency ratio provides a relative measure of economic consequences caused by aging demographic.

Evolution of indicators indicates accelerating demographic aging after 2000, when older people (plus 60 years) outnumbered young people (0-14 years).

Eating proper and satisfying the company's consumption needs for the elderly is another group of economic consequences, since the resolution depends on the income level of the elderly and implicitly their living standards and their quality of life.

Although the nominal value of pensions has increased in recent years, in terms of real value and purchasing power they have declined alarmingly as a result more and more elderly cannot ensure the daily minimum pension expenses related the food, home care and medicines. The situation becomes more difficult when seniors are alone, with no family or other relatives.

The decrease of the real level of pension determined by the avalanche of rising prices, products and services led to the erosion of purchasing power profound effects on livelihoods and quality of life of older people.

In the year 2013, the share allocated to food consumption in total consumption expenditure by households of pensioners, 48.4% overall and 43.4% in urban areas, 54.7% in rural areas respectively, indicates the degree enough advanced poverty in this population.

Among the economic consequences generated by aging demographic, financial ones on the costs of this phenomenon has a very special importance, for according to how they are resolved depends largely solve many other consequences, such as the social, medico-social or socio-cultural.

Compared to the total population in 2013, 25.7% of which has the status of retired to the number of employees representing a surplus of 15.0%, a situation that is really worrying.

3. Social Consequences

The issue of social consequences that aging involves groups of people is an area of research due to multiple situations where this population is and having different features.

In this context it is appropriate that they be investigated homogeneous differentiated sub-collectivities, as some implications generates for example the elderly or longtime group, as others among the elderly are the implications of male to female ones, or those married versus those widowed, divorced, alone.

Both social consequences vary in relation to other aspects such as economic, socio-cultural, psychological and social care.

Among the social consequences of demographic aging, mention:

- The cessation of professional activity that determines the effects of social, family and individual.

The specialty literature shows that the impact of such a moment is felt differently from individual to individual and shows features related to sex, social background and education.

It appreciates that training is required before retirement population to prevent so-called "disease of retirement".

- Feelings of hopelessness and social isolation resulting social consequences of aging

They are more pronounced among males and those from urban to rural areas and to people with poor preparation for the group of qualified people and particularly those with higher education. Also, these states could increase with age and disability. In turn, these conditions negatively influence the health status of the elderly, favoring the installation of serious mental illness, especially depression and anxiety ones.

- Ageing family and household members that attract some social consequences.

- Loneliness, negative social consequences and more common. The feeling of loneliness is increasing with age and that society poses special problems for a number of obligations incumbent on line supervision and care of persons deprived of their support. Specialized studies recommended possible recourse to keeping the elderly in the family, resorting to institutionalization, as a last resort.

- The social relationships with peers and elders of other age groups, particularly young people. Loss of social relations emphasizes the feeling of loneliness, social isolation and installation favors depression. The elderly need young and active socialization. Their recognition as useful members of society is vital for them.

- Organizing free time of the elderly. If for adult people the leisure activity means a leisure activity independent of professional obligations for the elderly, it is an essential stage of life and should therefore be held useful for the person and for the family and society. Involve the elderly to solve various activities in their family and society creates them a sense of social utility, particularly important factor. Other forms of leisure for older people can be geriatric actions which besides tourism trips and enjoyable leisure time they plan to organize courses and spa procedures, physical therapy and physiotherapy, medical physical culture exercises conducted by qualified and tailored individual conditions.

4. Medical and medico-social consequences

Overall, those consequences relate to several groups of issues such as:

- morbidity of pre age people, the elderly and the longtime and health of these groups;
- mortality rate specific to these groups, the phenomenon causes of death and trends;
- addressing the health and social and how specialized units providing medical and social service needs of pre age people , elderly and longevity;
- forms and means of medical and social intervention pre age specific people, elderly and longevity;

As regards the general and specific characteristics of morbidity elderly, they may be summarized as follows:

- poly pathology of elderly compared to other population groups. Studies undertaken indicate their supra morbidity, among which is found on average 2-3 chronic / person, and at advanced ages, the number of illnesses per person is higher.
- high frequency of disease is another feature of morbidity and longevity for older people. At age 60 and over, compared with people of 15-59 years, prevalence overall index is 2.4 times higher, with large differences in cardiovascular diseases (about 6 times) in rheumatic diseases chronic kidney, and so on.
- main causes of disease of older people are hearing and sight disorders, diseases and articular rheumatism (osteoporosis), which in addition to holding a high frequency of severe social consequences, heart disease and circulatory system (heart diseases, atherosclerosis and arteriosclerosis, hypertension), urinary incontinence problems, senile dementia, falls and fractures consecutive and others.

At the age of 80 years are for chronic diseases, long-term, which requires a higher consumption of healthcare and medico-social assistance and are much more common. Within this population, have an increased incidence of disorders and various forms of senility.

Knowledge of morbidity in the aging population peculiarities of great importance for the orientation and prevention work medico-social intervention to be made differently, on populations, the urban and rural categories, in relation to the degree of demographic aging, gender, geographical or other categories of subpopulations.

In this way is well known etiology and predisposing factors, both genetic or biological order, but also the physical and social environment,

including an essential role they have way of life, working conditions, food, climate and microclimate, stress, physical inactivity, smoking, drug addiction minor-represented by drinking too much coffee and alcohol.

Share deaths of older people (60 years old and over) in total deaths has grown constantly.

In terms of addressability medical consequences and socio-medical derives from the growing number of elderly.

Outstanding issues are raised by those who live more prevalent among whose need of medico-social order. From them addressing a range of special care which takes multiple forms: at home, outpatient and in some hospitals and care. A lot of them have great social problems, being alone, insufficient income or no income and a high degree of dependence.

Important order consequences of healthcare and medico-social causes of demographic aging processes in terms of organization and planning of health, resource allocation and development of technical equipment for the development and upgrading of hospitals and special care for the training and development of staff for research.

5. Psychosocial and socio-cultural consequences

Ageing communities cause a number of psychological causes, psychosocial and socio-cultural negative effects on the adaptability of individuals and their implications for livelihood and social integration. The term implications psychosocial and socio cultural processes generated by demographic aging is very different in relation to a number of characteristics-demographic, economic, social, territorial, medical.

The psychology of human groups formed while being influenced by specific conditions specific historical, geographic, economic, social, cultural, characteristic traditions and customs.

Psychological changes are caused by a complex of biological and environmental factors that ensure adaptive modeling and personality, dynamic ensemble that gives its unique character and individual human.

It is known that aging brings significant changes in the individual's personality and resilience decreases, reaching some individuals to real forms of maladjustment.

Socio-cultural consequences should be examined closely correlated with two factors: the economic one – represented by income level that can ensure the relative independence of elderly and second, preparedness – the elderly report that know how to organize time and overall lifestyle by performing activities, hobbies and cultivate social relationships and

stimulatory effect compensatory desire to maintain life, a sense of social utility and health.

6. Other consequences

The consequences set out processes generate demographic aging and other implications, as important political, legal, administrative, educational, directly concerning elderly relationship with the company.

Politically, such as the consequences deriving from elderly people that make up part of the electorate.

In legal terms, the increasing of number of older people require more attention to the knowledge needs of this population and their transposition into legislation in all fields, especially in terms of health and social security.

On the administrative level requires a broad and active support of the local factors who know best the concrete needs of the elderly in the community.

In terms of education, there are serious problems especially in some rural aging, to ensure the completion of enrollments. It is noteworthy that both the downward trend in the birth rate is responsible for such situations, and especially in the countryside existence of aging demographic structures, which may contribute to the "production" of life.

The accelerating the process of aging, since 2010 has major importance for social policy. Their objective is to ensure a decent standard of living in a society whose population is aging.

Effects of aging on the development of economic and social life and the future demographic trends will emerge over time, causing disturbance to the school population, fertile population and the working age population.

The aging population must not be allowed to fall into poverty, a situation that implies greater financial stress later for health care at home and the targets and the measures that ensure better social cohesion.

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