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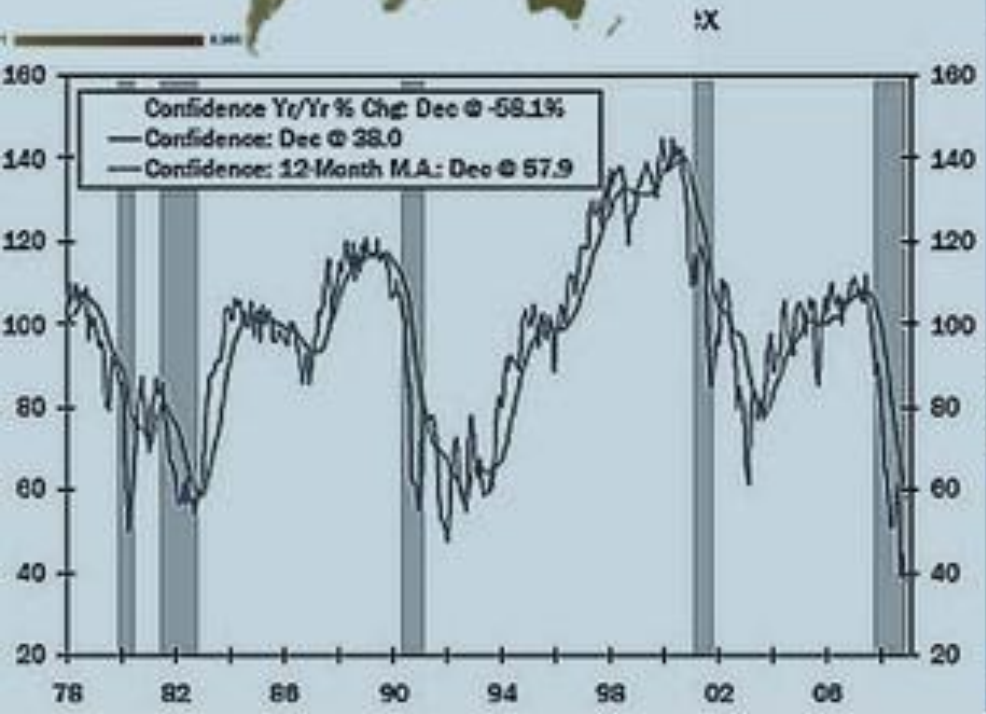

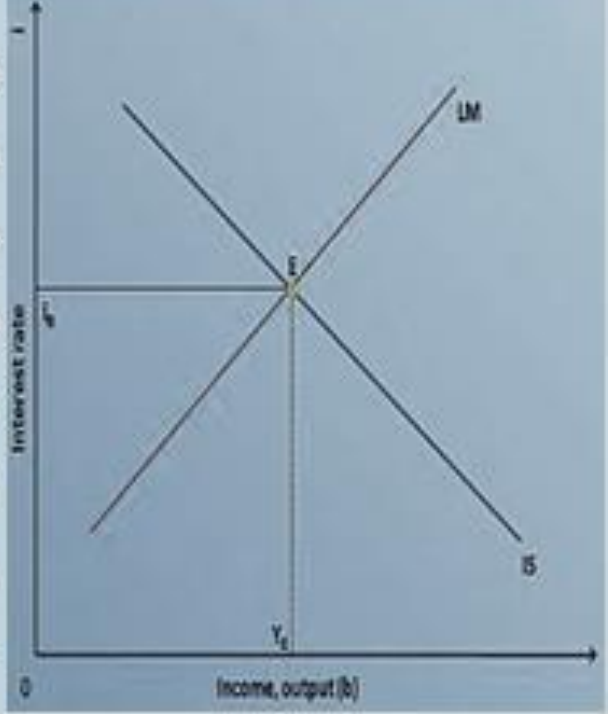

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Decision making under uncertainty in viticulture: a case study of Port wine

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Abstract

In decision making under uncertainty individual decision makers (winegrowers) must choose one of a set number of decision alternatives with ample information about their outcomes but, most of the times, have not enough knowledge or data about the probabilities of the several states of nature. This paper focuses on the classical Maximax, Maximin, Minimax Regret and Realism criteria. The different approaches are analyzed and compared in a case study of Port wine production and selling. The computational involvedness and efficacy of the criterion are also presented. The paper finishes with the results of all observed criteria and alternatives in the circumstances of uncertainty.

Keywords: decision making under uncertainty, maximax, maximin, minimax and realism Criterion, Port Wine.

JEL Classification: D81, D70, C44, M10.

1. Introduction

Usually, individual and professional decisions are made with difficulty. In an uncertainty decision environment, the decision maker has no knowledge about the several states, not even enough knowledge to permit the assignment of probabilities to the states of nature. Decisions emerge where the course is not clear enough and it is necessary to take a lot of time and effort in developing a systematic method of analyzing the several alternative courses of action.

The uncertainty is particularly expressed in viticulture. Of all the Portuguese wines, Port wine is the most successful both in Portugal and abroad. For most choices in viticulture, uncertainty with regard to climacteric conditions, soil, economic resources, worldwide distribution, market behavior, evolution of sales and marketing, and cost of production decisions occurs.

Harris (1998) said "Decision making is the study of identifying and choosing alternatives based on the values and preferences of the decision maker. Making a decision implies that there are alternative choices to be considered, and in such a case we want not only to identify as many of these alternatives as possible but to choose the one that best fits with our goals, objectives, desires, values, and so on."

This research started at the *Instituto dos Vinhos do Douro e Porto* (IVDP) (www.ivdp.pt) which has its headquarters in Peso da Régua and in Porto. Some of the largest companies producing and exporting port wine with headquarters in Vila Nova de Gaia, opposite the old city centre of Oporto, were contacted.

Martins (1998) states that wine growing always had an important role in Portuguese agriculture, as wine plays a major role in the national economy. Wine production is an ancient tradition and has always been a priority of the Portuguese State for the development of the national economy.

2. Background of Port wine

The name of the wine descends from the name of the city, which in English descends from 'the port' in Portuguese (o Porto), but in Portuguese is simply 'Porto'. In common usage, the wine is called only 'port'.

According to Loureiro and Fernandes (2011) "Port wine is a fortified wine produced in the demarcated region of Douro. This region is situated in the northeast of Portugal, in the Douro hydrographical basin, surrounded by mountains that give it exclusive mesologic, climacteric and agrologic characteristics that enable the production of quality wines. Port wine is the most successful of all Portuguese wines throughout the years, home and abroad."

Fortified wines are made by adding a quantity of grape spirit, or brandy, to the wine at some point during the production process. The addition of the brandy takes place before the wine has finished fermenting. This means that the wine retains some of the natural sweetness of the grape, making it rich, round and smooth on the palate. One of the interesting aspects of Port wine is its variety of different styles, each with its own characteristic flavours. Usually it is served just before the end of the meal with cheese, as a dessert wine or as an after dinner drink although some styles, like white Port, can also be enjoyed as an aperitif. Port is considered as one of the most civilized and sociable of wines which will help to make any occasion special, whether a quiet evening by the fireplace, an informal meeting of friends or a sophisticated formal meal.

The grapes, mainly of native varieties such as the Touriga Nacional, Touriga Francesa, Tinta Roriz, Tinto Cão or Tinta Barroca, are grown on the steep rocky hillsides bordering the Douro River. Many of the oldest vineyards, now classified as World Heritage, are planted on narrow terraces supported by hundreds of hand built dry stone walls.

According to Carrera (1999), the colour of the different types of red Port Wine may vary from deep purple to light gold, and all intermediary hues can occur (red, tawny, golden and light gold). White Port wines can also come in diverse shades (pale yellow, straw and golden white), all intimately related to the winemaking technique used. When white wines are aged in cask they acquire a golden hue very similar to that of very old red wines.

The process of ageing a Port Wine can be done in two different ways (www.ivdp.pt):

Ruby (bottled matured) - When the objective is to restrain the evolution of the red colour, more or less intense, and maintain the fruity flavour and vigour of young wines. This ageing process is applied to the following categories in ascending order of quality; Ruby, Reserve, *Late Bottled Vintage* and Vintage. The finest category wines, especially *Vintage* and to a lesser extent LBV can be bottled as they age quite well in bottle.

Tawny (wood ageing) - obtained from blending wines with different maturing degrees, aged in casks or bats. With age, the colour of the wines slowly develops into tawny, medium tawny or light tawny. The aromas remind you of dried fruits and wood, and these get stronger with age. The following categories fall in these styles: Tawny, Tawny Reserve, and Tawny with an indication of age (10 years, 20 years, 30 years and 40 years) and produce (Colheita).

Located in Northeast Portugal, within the Douro River basin, surrounded by craggy mountains that give it very particular soil and climacteric characteristics, this region spreads over a total area of approximately 250 000 hectares and is divided into three sub-regions (Lower Corgo, Upper Corgo and Upper Douro) that differ greatly from each other not only as regards the weather but also for socio-economical reasons.

Vines cover approximately 15.4% of all the land in the region. The land under vines is worked by approximately 39 000 farmers, each owning an average of 1 ha under vines. Small farmers are very representative in the production of Port Wine.

The most important single country foreign markets (Table No. 2) are France, Netherlands, Belgium, Portugal itself, and UK, collectively accounting for 78% of total sales (IVDP, 2013).

Table 1

Description of the Sub-Regions and Structure of the vineyards

Sub-Region	Total Area (ha)	Area Under Vines (ha)	Number of farmers	Area under Vines/farmers (ha)
Lower Corgo	45 000	14 582	**15 493**	**0,94**
Upper Corgo	95 000	20 969	**16 270**	**1,29**
Upper Douro	110 000	10 175	**7 348**	**1,38**
Total	250 000	45 726	**39 111**	**1,17**

Source: www.ivdp.pt (14/06/2013)

Table 2

PORT WINE TRADE JANUARY - APRIL 2013

MAIN MARKETS	MARKETS	BOTTLED STANDARD PORTS (1)			BOTTLED PREMIUM PORTS (2)		
	%	9 ℓ cases	euros	euros/litre	9 ℓ cases	euros	euros/litre
7- GERMANY	4.8	102 618	3 119 895	3.38	12 725	893 344	7.80
21- AUSTRIA	0.2	3 657	143 934	4.37	798	98 367	13.70
3- BELGIUM	11.2	248 468	7 823 117	3.50	18 743	1 844 566	10.94
11- BRAZIL	1.1	23 689	822 077	3.86	3 572	311 738	9.70
8- CANADA	1.8	13 203	640 869	5.39	28 523	2 767 722	10.78
12- DENMARK	1.1	17 885	555 602	3.45	7 675	701 091	10.15
6- USA	4.9	57 962	2 183 252	4.19	58 535	5 146 277	9.77
9- SPAIN	1.5	33 632	1 162 456	3.84	2 471	215 238	9.68
23- FINLAND	0.1	1 420	64 402	5.04	2 125	186 524	9.75
1- FRANCE	33.2	710 758	20 590 677	3.22	59 481	4 082 053	7.63
2- HOLLAND	16.5	362 949	10 325 724	3.16	30 303	2 317 785	8.50
22- IRELAND	0.2	3 657	192 649	5.85	727	44 161	6.75
14- ITALY	0.8	17 278	643 569	4.14	859	92 342	11.95
18- JAPAN	0.3	5 746	362 505	7.01	436	44 313	11.30
16- LUXEMBOURG	0.4	7 621	277 528	4.05	935	85 972	10.22
19- MEXICO	0.2	5 111	193 309	4.20	549	101 776	20.59
20- NORWAY	0.2	1 147	58 103	5.63	4 108	274 952	7.44
25- NEW ZEALAND	0.1	834	40 281	5.37	1 352	77 929	6.40
10- POLAND	1.2	24 543	631 753	2.86	3 942	188 748	5.32
4- PORTUGAL	10.5	215 639	7 123 717	3.67	34 942	3 790 491	12.05
5- UNITED KINGDOM	6.3	100 433	2 889 816	3.20	49 372	3 063 779	6.89
24- CZECH REPUBLIC	0.1	2 381	86 943	4.06	515	56 051	12.09
17- RUSSIA	0.3	5 062	178 676	3.92	1 640	237 185	16.07
15- SWEDEN	0.4	6 621	258 056	4.33	2 095	170 321	9.03
13- SWITZERLAND	0.8	16 456	666 253	4.50	1 946	278 479	15.90
OTHERS	1.8	27 421	1 110 323	4.50	15 755	3 690 446	26.03
TOTAL	100.0	2 016 190	62 145 486	3.42	344 123	30 761 650	9.93

Source: www.ivdp.pt (14/06/2013)

Note: (1) Includes Ruby, Tawny and White Port; (2) Includes Vintage and LBV

3. Elements of a decision-analysis problem

In a decision making process under uncertainty we can consider the four basic features of a decision-making situation.

- Decision Alternatives or Actions or Alternative Courses of Action are the number of choices or options available to the decision maker in any given problem situation.
- States of Nature or Events are the occurrences of nature that can happen after a decision is made that can affect the outcome of the decision and over which the decision maker has no control.
- The Payoffs are the benefits or rewards that result from selecting a particular decision alternative. In the financial investment industry, for instance, the payoffs can be small, modest, or big, or the investment can result in a loss.
- Decision criteria need to be well known because they will help the decision maker to select the best course of action.

So, the first step a decision maker must take is to list all the possible alternatives that must be considered in the decision. After having identified all the possible alternatives, the decision maker must list the future events that may occur. In order to evaluate each course of

action, a decision maker must associate a value or payoff with the result of each event. Then discusses which decision criteria under uncertainty: maximax, maximin, minimax and realism criterion, that best fits with the decision maker objectives.

4. Methodology

Decision analysis employs a diversity of tools to estimate all important information to support in the decision making process. A model is developed to characterize the decision making problem, assist the progress of rational analysis, and originate a suggested course of action. This is a very convenient method in managerial situations where risk is significant. The subsequent model is able to create optimal strategies for multi-stage decision making problems that involve several possibilities. Therefore, the Decision Matrix properly defines a decision analysis problem.

The Decision Matrix is frequently used to provide the payoff for each combination of an action/decision maker's alternatives and an event/demand/states of nature.

Table No. 3 shows the structure of a decision matrix or payoff table. On the left side of the table are the different decision alternatives or actions, denoted by $a_i, i = 1,...,m$. Through the top row are the actions or states of nature, denoted by θ_j, $j = 1,...,n$. In the middle of the table are the several payoffs for each decision alternative under each state of nature, denoted by $U_{ij}, i = 1,...,m, \quad j = 1,...,n$.

Table 3

Decision Matrix or Payoff table $U_{ij} = U\left(a_i;\theta_j\right)$

Actions/Alternatives	Events/States of Nature				
	θ_1	θ_2	θ_3	$\cdots$	θ_n
a_1	U_{11}	U_{12}	U_{13}	$\cdots$	U_{1n}
a_2	U_{21}	U_{22}	U_{23}	$\cdots$	U_{2n}
a_3	U_{31}	U_{32}	U_{33}	$\cdots$	U_{3n}
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\ddots$	$\vdots$
a_m	U_{m1}	U_{m2}	U_{m3}	$\cdots$	U_{mn}

The discussion about criteria for decision making has emerged in the early 1950s. Some decision criteria have been proposed to solve the problem of decision making under uncertainty. The most important ones are furthermore presented.

4.1 Maximax Criterion

Is an optimistic criterion, the decision maker will select the decision alternative which will maximize the maximum payoff.

The decision maker first selects the maximum payoff possible for each decision alternative and then chooses the alternative that provides him with the maximum payoff within this group.

The action to be chosen should then be the one that:

$$max_{a_i}\left\{max_{\theta_j} U\left(a_i;\theta_j\right)\right\}$$

4.2 Maximin Criterion

Is a pessimistic criterion, the decision maker will select the decision alternative which will maximize the minimum possible payoff.

The decision maker first selects the minimum payoff possible for each decision alternative and then chooses the alternative that provides him with the maximum payoff within this group.

The action to be chosen should then be the one that:

$$max_{a_i}\left\{min_{\theta_j} U\left(a_i;\theta_j\right)\right\}$$

4.3 Minimax Regret Criterion (Savage)

This criterion gets away from the focus on optimism versus pessimism. Instead, its focus is on choosing a decision that minimizes the *regret* that can be felt afterward if the decision does not turn out well.

After decisions have been made and the events occurred, decision makers may express regret because they now know what event has taken place and may wish they had selected a different action. This criterion intends to minimize this regret.

To apply this criterion, the Decision Matrix must be transformed into a Regret Matrix, by using the following transformation

$$R\left(a_i;\theta_j\right)=max_{a_k}\left\{U\left(a_k;\theta_j\right)\right\}-U\left(a_i;\theta_j\right)$$

and the Minimax criterion must be applied to the Regret Matrix

$$min_{a_i}\left\{max_{\theta_j} R\left(a_i;\theta_j\right)\right\}.$$

4.4 Criterion of Realism (Hurwicz)

Is a middle ground criterion between maximax and maximin criterion, that is, between optimistic and pessimistic criterion. This criterion requires the decision maker to specify a coefficient of optimism, represented by α, where α is between 0 and 1 (0 express pessimism about nature, 1 express optimism about nature). First we must determine both the maximum and the minimum payoff for each decision alternative.

Then for each decision alternative, compute:

- Measure of realism = α(maximum payoff)+(1-α)(minimum payoff)
- Choose the action alternative with the best Measure of realism as the chosen decision.

5. Results

Decision theory has, for cases under uncertainty, two main techniques. The first one is to transform the uncertainty case into a case of risk by using probabilities, constructed on expert assessments on analysis of earlier decisions made in analogous situations. The second technique exploits criteria of choice developed in a wide-ranging situation by game theory**.** In the article the second approach was presented and applied. For the analysis Maximax, Maximin, Minimax Regret and Realism criteria are computed and discussed in the sample of Port wine production and selling.

A small farm representative in the production of Port Wine has been in business for 22 years in Pinhão. The company was created by father and son who had worked in the Port wine production since ever. They saw an opportunity to get into the Port wine business and as they wanted to get their own business, they decided to buy some hectares of land and to hire people to work in their business. They found a dedicated workforce and soon employed 73 people. Business had been really good until two years ago, when profits began to decline a little, with the Portuguese economic crisis. The company analysed the situation and as their vineyards were planted according to the natural slope of the land, mechanization is now

impossible on these terraces as there are no or few access roads and the steeper vineyards are heavily planted. Because of this and the high costs of labour that this type of terraces implies, they realize their company must invest in mechanization on their land so they will need to construct a new type of terraces. These are horizontal terraces with eartern supporting walls, each bearing 1 or 2 rows of vines planted far enough apart for a small tractor to move between them and with a low planting density of 3 000 to 3 500 vines/ha.

Image 1

Douro Vineyard Terraces

But they were uncertain about the amount of investment needed. Initial research led them to identify three possible courses of action (alternatives):

*A*1: A large investment, which would involve purchasing more land and machines, given the need of large plots of land for this type of vineyard (as it is not suitable for smallholdings). This new alternative would give them greater capability.

*A*2: A medium investment, which would give them the same general capability as alternative A1, after changing some of their own terraces and purchasing some machines. But the equipment wouldn't operate as fast as in alternative A1. This would prevent them from bidding on large contracts.

*A*3: A small investment, which would limit them to bidding on less than half of the possible contracts.

Of course, the alternative they should select depends on the future profits generated by the new investment in land and equipment. Therefore, they identified three states of nature, potential directions that they believed the demand for Port wine could take.

For them, the states of nature were:

*S*1: Large increase in demand due to the capability of the new equipment

*S*2: Moderate increase in demand

*S*3: Small increase in demand

Because their decision involved three alternatives and three states of nature, they had nine possible payoffs to consider, as we can see in the Table No. 4.

Table 4

Payoff Table for Port Wine Company Expansion Decision

	Events/States of nature (demand)		
	S1 (Large increase)	**S2** (Moderate increase)	**S3** (Small increase)

Actions/ Decision maker's alternatives	**A1** (Large investment)	500 560 €	350 034 €	- 200 123 €
	A2 (Medium investment)	300 437 €	400 354 €	- 150 937 €
	A3 (Small investment)	180 862 €	120 402 €	100 958 €

(Payoffs per year)

5.1 Maximax Criterion

As it is an optimistic criterion, the decision maker will select the decision alternative which will maximize the maximum payoff.

In Table No. 5, the maximum payoff possible for each of the three decision alternatives is in the last column.

Table 5

Results for Maximax Criterion

		Events/States of nature (demand)			
		S1	**S2**	**S3**	$max_{\theta_j} U(a_i;\theta_j)$
Actions/ Decision maker's alternatives	**A1** (Large investment)	500 560 €	350 034 €	- 200 123 €	500 560 €
	A2 (Medium investment)	300 437 €	400 354 €	- 150 937 €	400 354 €
	A3 (Small investment)	180 862 €	120 402 €	100 958 €	180 862 €

The alternative within this group of three which provides the maximum payoff is "Large investment", with an associated payoff of 500 560 € per year. This action corresponds to

$$500\,560 = max_{a_i}\left\{max_{\theta_j} U\left(a_i;\theta_j\right)\right\}$$

If they are not optimistic, they might select the alternative whose worst possible outcome is better than the worst possible outcome from any other alternative.

5.2 Maximin Criterion

Is a pessimistic criterion, the decision maker will select the decision alternative which will maximize the minimum possible payoff.

In Table No. 6, the minimum payoff possible for each of the three decision alternatives is in column number six.

Table 6

Results for Maximin Criterion

		Events/States of nature (demand)			
		S1	**S2**	**S3**	$min_{\theta_j} U(a_i;\theta_j)$
Actions/ Decision maker's alternatives	**A1** (Large investment)	500 560 €	350 034 €	- 200 123 €	- 200 123 €
	A2 (Medium investment)	300 437 €	400 354 €	- 150 937 €	- 150 937 €
	A3 (Small investment)	180 862 €	120 402 €	100 958 €	100 958 €

The alternative within this group of three which provides the maximum payoff is "Small investment", with an associated payoff of 100 958 € per year. This action corresponds to

$$100\,958 = max_{a_i}\left\{min_{\theta_j} U\left(a_i;\theta_j\right)\right\}$$

But maximax and maximin criteria have a disadvantage because they use only one value from the payoff matrix to make a decision. In evaluating the decision situation, the company owners can be interested in determining how much loss making the wrong choice would cause. Suppose they decided on the medium investment alternative and later found that the market for Port wine capability had a big expansion. The medium investment decision led to a 300 437 € yearly profit, but given perfect reflection, the best decision of making a large investment would have earned 500 560 €. The difference between the actual payoff and the optimal payoff for a given state of nature is an opportunity loss or regret resulting from their decision; in this case, it is 200 123 €. If they decided to use the minimax regret criterion, they would need to know the value of the opportunity loss.

5.3 Minimax Regret Criterion (Savage)

After decisions have been made and the events occurred, decision makers may express regret because they now know what event has taken place and may wish they had selected a different action. This criterion intends to minimize this regret.

In Table No. 7, we can see the regret values obtained by subtracting each entry in the payoff table (Table No. 4) from the largest entry in its column. The maximum regret for each of the three decision alternatives is in last column.

Table 7

Opportunity-Loss Table

		Events/States of nature (demand)			
		S1	**S2**	**S3**	$max_{\theta_j} P\left(a_i;\theta_j\right)$
Actions/ Decision maker's alternatives	**A1** (Large investment)	0 €	50 320 €	301 081 €	301 081 €
	A2 (Medium investment)	200 123 €	0 €	251 895 €	251 895 €
	A3 (Small investment)	319 698 €	279 952 €	0 €	319 698 €

Finally they choose the minimum of these three regret values, in this case, 251 895 € is the minimum regret value, and it is associated with deciding to "Medium investment". This action corresponds to:

$$251\,895 = min_{a_i}\left\{max_{\theta_j} P\left(a_i;\theta_j\right)\right\}$$

5.4 Criterion of Realism

According to this criterion, the decision maker is between pessimistic and optimistic attitude. Each result has been weighted according to optimistic coefficient (α = 0.7). The highest and the lowest values of each business alternative has been multiplied by optimistic coefficient (k = 0.7) and pessimistic coefficient (1-α = 0.3), as we can see in Table No. 8.

Table 8

Measures of Realism

Large investment	$0.7\times\left(500\,560\right)+0.3\times\left(-200\,123\right)=290\,355.1\,€$

Medium investment	$0.7\times(400\,354)+0.3\times(-150\,937)=234\,966.7$ €
Small investment	$0.7\times(180\,862)+0.3\times(100\,958)=156\,890.8$ €

The use of the realism criterion in this case advises to choose the alternative "Large investment" (290 355.1 €).

Summarized Results of Recommended Alternatives of Port Wine Production and Sales

Criterion	Recommended Alternative
Maximax Criterion	Large investment
Maximin Criterion	Small investment
Minimax Regret Criterion	Medium investment
Criterion of Realism	Large investment

6. Conclusion

The maximax, maximin, minimax regret and realism criterion are examples of non-probabilistic decision criteria. In non-probabilistic criteria we do not take into account the probability associated with the outcomes for each alternative. Consequently decision makers have to choose, in the absence of any information about the probabilities of the several states of nature, one of supposed business alternatives.

Observe that the first three criteria lead to different decisions; therefore, the decision makers (winegrowers) would determine which criterion best described their decision making attitude and use it to help them decide on their level of investment.

In this article was presented a decision making process under uncertainty related with Port wine production and sales. The maximax, maximin, minimax regret and realism criterion were evaluated and compared in the case study. The results indicate that the alternative "Large investment" is the best decision to make. We are certain of that there is a need to give more importance on determining the uncertainty in viticulture, especially in Port wine production.

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Analysis and forecast of employees' mobility on the labor market in Romania using Markov chains

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Abstract

The mobility of labor, defined as responsiveness and adaptation of persons or groups of persons on the challenges of the social and economic environment is therefore a social phenomenon depending on time and space. A high mobility increases opportunities for workers to find a job and employers to find persons with an adequate level of skills, thus boosting employment and economic growth. In recent years, in Romania there has been an accentuation of existing gaps, compared with the European Union countries, as regards the occupational structure of employment. In this context, the paper proposes an analysis of the evolution of labor mobility in the main sectors of the Romanian economy. Also, it was pursued the Markovian modeling of employees' mobility on the labor market and its forecast in Romania, under the impact of rapid and profound social and economic changes, and the correlation between them as well, with a view to make forecasts of the Romanian economy evolution in the short term.

Key words: employees, Markov chains, mobility, forecast

JEL classification: C19, C53, J21, J45, J61

1.Introduction

The transition to a market economy is a specific process that involves changing the property regime in favor of the private one and the competition promoting, specific regulating mechanisms of the market economy, mainly based on the law of supply and demand as well as the renewal of state intervention for the purpose of fiscal and monetary policy adjustment with the aim of fundamental economic imbalances relief.

Romania, as a member country of the European Union since 2007, is sustaining efforts to substantially reduce the still existing gap in relation to the countries of this region, for the modernization of the Romanian economy, in step with the needs of the transition to a modern informational economy, and to achieve performance criteria set by the Maastricht Treaty.

Yet faced with internal and external imbalances, Romania had to focus their efforts on: reducing the fiscal and quasi-fiscal deficit, continue the tax reform, to give up on using the exchange rate as an instrument of insuring balance, to accelerate reforms and fulfill the conditions in order that Romanian economy to receive the grade of a functional market economy. It has been pursued the promotion of coherent policies, compatible with the mechanisms of the European Union, aimed at selectively restructuring the economy, the development and modernization of physical, scientific and social infrastructure, revitalization of potentially competitive industries, building sustainable agriculture based on optimum size holdings, supporting information technology-based activities and the creation of an environment conducive to tourism development, expansion and diversification of financial services, of the tertiary sector in general.

Important roles in the development of forecasts on the evolution of macroeconomic indicators that contribute to re-launching economic growth and various models have, as well, the Markovian models. With their help, there can be analyzed and forecasted different phenomena and economic correlations between them.

After the 6th decade of the last century, Markov chains and processes have experienced an explosive growth of their use in the sciences about people and their problems: demography, social mobility theory, education systems, ecology, pollution, etc. Multiple applications of these methods may be found in biology and medicine.

Given the huge area of Markov chains use, in the first part of this chapter there is presented a summary of the progress made in the world use Markovian models in various fields of activity.

In the field of the economy, the use of these methods, particularly in the Romanian economy, it had however had a lesser extent. Addressing the issue of the population growth process and of the labor market parameters dynamics or Romania's external trade by using Markov or semi-Markov chains and processes, is a substantial contribution to the development of techniques for modeling economic phenomena and a useful tool in making economic forecasts.

The work presents a Markovian model developed both for the study of labor mobility in the various sectors of the economy, as well as for its forecast.

Application of the Markovian modeling theory on economic phenomena, as well as on the economic sectors issues, on the analysis of the main macroeconomic indicators' correlation degree in developing macroeconomic forecasts can contribute to re-launching economic growth that has become a priority for macroeconomic policy, starting from its importance, firstly, in the present situation of economic upswing, of surpassing the socio-economic problems due to the current economic and financial crisis.

2. The world stage of the analysis on the development of some processes/phenomena using Markovian patterns

The concept of Markovian dependency, due to the Russian mathematician A. A. Markov, appears for the first time in an explicit form in the article *Rasprostranenie zakona bolşih cisel na velicinî, zaviseaşcie drug ot druga*, published in 1906 in Izv. Fiz. – mat.obşc. pri Kazansk. Univ., 2-ia seria 15, no. 4, p. 135-156. In a series of works which begins with the cited one, Markov studies the properties of certain dependent random variables string, which today are called, in honor of his name, the Markov chains. Markov's intention was to generalize the classical properties of independent random variable strings to strings that do not satisfy the assumption of independence. Reliance also must be considered "natural", i.e. to meet the various possible applications.

The number of books and articles devoted to Markovian dependency, since 1906 until today is unimaginable. Books or monographs written by Hostinsky, R. von Mises, M. Fréchet, S.N. Bernstein, V. I. Romanovski, W. Feller and K. L. Chung have marked milestones in the history of Markov chains.

To the development of the Markovian theory an important role had as well the founders of the Romanian School of probability theory: Octav Onicescu and Gheorghe Mihoc.

The concept of Markovian dependency in continuous time was introduced by A.N. Kolmogorov in 1931.

If from the outset, Markov focused his attention on the theoretical aspects of dependency which he entered, subsequently he was preoccupied as well by the practical applications of the new concept. Thus, since 1913, Markov has achieved within an article, the statistical analysis of the novel Eugene Onegin by Aleksandr Pushkin. He concluded that the sequence of vowels and consonants in the text of the novel can be seen as a simple homogeneous Markov chain with two postures.

Started so by Markov, the use of the dependency which bears his name in the real phenomena modeling has known, after the war, a proliferation hard to imagine: a large number of articles on Markovian modeling were written covering a vast area, being used in very many sectors.

Some of the areas in which Markov chains apply worldwide are:

a) Applications in technics: statistic control of industrial production quality (Wilson & Burgess (1971)), safety in operation of complex technical systems (Barlow and Proschan (1965), Bhat Gnedenko (1972), (1972), BeliaevSoloviev, Gondran (1975), Anderson (2001), Wei Cai & Malvin (2002));

b) Applications in the so-called exact sciences: physics (Bharucha-Reid (1960), Esa Virtamo Hyytia & j. (2001), quantum mechanics, thermodynamics (Ehrenest model with recurring Markov chains has been used to explain some irreversible phenomena in thermodynamics, namely the elucidation of a paradox that, at the beginning of the 20th century was about to frustrate the efforts of L. Boltzmann to explain thermodynamics on the basis of kinetic theory of matter), statistic physics, chemistry, astronomy and astrophysics;

c) Applications of mathematical modeling in psychology and genetics – one of the most momentous achievements of the 19th century-biology is the cell theory – the type of cross models based on a Markov chain with two absorbent states and four non-recurrent states. The fundamental mathematical model of the genetic drift was introduced by S. Wright in 1931 and identified as a finished Markov chain by G. Malécot in 1944. Also, Markovian models are used to study the genetic composition of a fix volume haploid population;

d) Pioneering articles for tanks theory were dedicated, in their great majority, to establish the conditions under which a statistical equilibrium situation comes up, i.e. studying the asymptotic behaviour of Markov chain $(Z(n))_{n\in\mathbf{N}}$, n $\to\infty$, where Z (n) is the water quantity at the moment n$\in$N in a finite-capacity tank;

e) Renewal models use Markov chains and are of great practical importance since they are determined by the problems posed by the failure and replacement of some components of a complex system.

f) For performance evaluation of error correction and detectors codes there are used models of the numerical channels: Markov models with finite number of possible states or renewal models.

g) Queuing theory studies mathematical models with Markov chains for various units and requests waiting to be served in a certain order.

h) Markovian modeling of economic phenomena: Kemeney & Snell (1960), generally, *the production theory* of Sackowitz & Samuel-chan (1974/1975), *the mobility of labor*

Bartholomew (1973, 1982), *financial operations* Cyert Davidson & Thompson (1961), *bank notes circulation* Baroszynschi (1972/1973), Michael Dueker (2001). Markovian models on the *dynamics of labor* were developed by Bartholomew (1973), Feichtinger & Mehlmann (1976), Mehlmann (1997), Catherine Donati-Martin and Marc Yor (2000, 2001), Paul Biemer (2001), Alexandru Voicu (2002), Maloney & Arago (2001). *Study of economic cycles or economic growth* using Markov chains was conducted by Michael Dueker and Christopher J. Neely (2000), Qinru Qiu and Massoud Pedram (2001), Guillaume Guerrero and Yuri N. Levchuk, (2001).

Therefore, it can be said that the study of economic phenomena, due to its features, an important role lies as well, with their modeling using stochastic processes and in particular with the Markovian models.

3. Markovian models for the analysis of labour mobility – theoretical presentation

One of the time-dependent social phenomena is, also, labor mobility between different sectors of the economy or within the same sector. If it is considered an appropriate time scale, you can find that part of the labor force who suffers changes from one time period to another. It is assumed that at some point, an employee would like to be employed in any of the *m* "sectors of the economy". The number of employees in the system is assumed to remain the same throughout the analysis period.

It is assumed that the number of employment recorded at regular intervals as the number of employees which changes work during any period is known. Also it is assumed that their distribution is also posted.

Assuming the present experience of the employees in a sector influences the choice of other sectors, Markov chains model gives an approximation to the real behavior of employees in the labor force of the economy branches. Sometimes, this phenomenon can be best approximated with the help of semi-Markov processes. If it is assumed that the change of job of an employee occurs following a Poisson model - the length of time during which any employee could be at work has a negative exponential distribution – then, the Markov chains model is satisfactory.

If $\{S_n, n = 0,1,2,...\}$ is the employees' status at a given time and *n* the number of observations, the space of S_n 's states is $\{0,1,2,...m\}$, *m* being those sectors of the economy.

Transition probability matrix can be estimated using statistical data and information on the characteristics of labor mobility in the sectors concerned.

In the analysis carried in 1955 by Blumre, there were considered 11 sectors of the economy, ranging from agriculture, construction, publications, etc. to business and Government activities. In addition, the 11th component was considered unemployment.

The inclination of a particular category of labor force not to change work for a longer period determined dividing the occupied population into two groups: one that contains those individuals that do not change the work, and another, containing people who change work.

If *m* is considered to be sectors of the economy, with s_i $(i = 1,2,...,m)$ the fraction containing population who do not change the work *i*, then the crossing probability matrix for population changing the workplace can be written in the form:

$$\mathbf{R} = \begin{pmatrix} R_{11} & R_{12} & \dots & R_{1m} \\ . & . & \dots & . \\ . & . & \dots & . \\ R_{m1} & R_{m2} & \dots & R_{mm} \end{pmatrix} \qquad (1)$$

Crossing probabilities matrix for the entire active population becomes:

$$\mathbf{P} = \begin{pmatrix} s_1 + (1-s_1)R_{11} & (1-s_1)R_{12} & \dots & (1-s_1)R_{1m} \\ (1-s_2)R_{21} & s_2 + (1-s_2)R_{22} & \dots & (1-s_2)R_{2m} \\ . & . & \dots & . \\ . & . & \dots & . \\ (1-s_m)R_{m1} & (1-s_m)R_{2m} & \dots & s_m + (1-s_m)R_{mm} \end{pmatrix} = S + (I - S)R$$

(2)

where **S** is the corresponding matrix for the segment of occupied population not changing the workplace and it is a diagonal matrix:

$$\mathbf{S} = \begin{pmatrix} s_1 & 0 & . & . & . & 0 \\ 0 & s_2 & 0 & . & . & . \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ . & . & . & . & . & 0 \\ 0 & 0 & . & . & 0 & s_m \end{pmatrix} \tag{3}$$

For the first n steps of transition probabilities, it is assumed that no change occurs in the first category of labor force.

Then,

$$\left\| P_{ij}^{(n)} \right\| = \mathbf{S} + (\mathbf{I} - \mathbf{S})\mathbf{R}^n \tag{4}$$

with $\lim_{n\to\infty} R^n = \mathbf{\Pi}'$, where matrix $\mathbf{\Pi}'$ has identical lines, each line being the vector's limit:

$$(\pi_1', \pi_2', \dots \pi_m') \tag{5}$$

for the employees category that change their workplace.

If it is assumed $\lim_{n\to\infty} \left\| P_{ij}^{(n)} \right\| = \mathbf{\Pi}$, from relations (4) and (5) we get:

$$\mathbf{\Pi} = \mathbf{S} + (\mathbf{I} - \mathbf{S})\mathbf{\Pi}' = \begin{pmatrix} s_1 + (1-s_1)\pi_1' & (1-s_1)\pi_2' & \dots & (1-s_1)\pi_m' \\ (1-s_2)\pi_1' & s_2 + (1-s_2)\pi_2' & \dots & (1-s_2)\pi_m' \\ . & . & \dots & . \\ . & . & \dots & . \\ (1-s_m)\pi_1' & (1-s_m)\pi_2' & \dots & s_m + (1-s_m)\pi_m' \end{pmatrix} \tag{6}$$

what indicates that the labour force in different sectors of the economy does not depend on the initial state.

If the initial distribution of employees in various sectors of the economy is known, their distribution after *n* time periods can be obtained with the help of relations (4) and (6) for $n < \infty$ as well as for $n \to \infty$.

If $\left\{ p_j^{(n)} \right\}_{j=1}^{m}$ is the distribution of employees after *n* transitions, for the vector $p^{(n)} = \left(p_1^{(n)}, p_2^{(n)}, \dots, p_m^{(n)} \right)$ we get:

$$p^{(n)} = p^{(0)}S + p^{(0)}(I - S)R^n \tag{7}$$

and for $p^* = \lim_{n\to\infty} p^{(n)}$ we get:

$$p^* = p^{(0)}S + p^{(0)}(I - S)\Pi' \tag{8}$$

In practical problems, implementing this Markov model requires estimation of R crossing matrices' elements and of the number of employees in each category in each sector concerned. If, for a given period of time, it is not possible to determine the number of people who change or not the workplace, then it is necessary to know the overall number of persons who will retain the workplace for another period of time and the number of those who will leave. With this information there can be determined the crossing matrix. If n_i is the number of employees in the sector i at a given moment, from which $n_{ij}^{(1)}$ move to sector j $(j = 1, 2, ..., m)$, then, (i, j) element of the matrix **P** has an estimated maximum probability:

$$\left[s_i + (1 - s_i)R_{ii}\right] = \frac{n_{ii}^{(1)}}{n_i} = \hat{P}_{ii} \quad for \quad i = 1, 2, ..., m \tag{9}$$

and

$$\left[(1 - s_i)R_{ij}\right] = \frac{n_{ij}^{(1)}}{n_i} = \hat{P}_{ij} \quad for \quad i \neq j \tag{10}$$

If $f_i^{(k)}$ is the employees' fraction in the sector i $(i = 1, 2, ..., m)$ that stay within this sector for the next k time period, then:

$$f_i^{(k)} = \left[s_i + (1 - s_i)R_{ii}^k\right], \tag{11}$$

or

$$1 - f_i^{(k)} = \left[(1 - s_i)(1 - R_{ii}^k)\right] \tag{12}$$

Combining relations (9) and (12) we get

$$\left[\frac{R_{ii} - R_{ii}^k}{1 - R_{ii}^k}\right] = \frac{\hat{P}_{ii} - f_i^{(k)}}{1 - f_i^{(k)}} = h_{ii} \tag{13}$$

Combining relations (10) and (12) we get

$$\left[\frac{R_{ij}}{1 - R_{ii}^k}\right] = \frac{\hat{P}_{ij}}{1 - f_i^{(k)}} = h_{ij} \tag{14}$$

Relation (13) may be written also:

$$\hat{R}_{ii} = h_{ii} + (1 - h_{ii})\hat{R}_{ii}^k \tag{15}$$

which accepts a single solution within the interval $0 \le \hat{R}_{ii} < 1$ and $0 \le h_{ii} < \left(\frac{1}{k}\right)$

from relation (14) we get:

$$\hat{R}_{ij} = h_{ij}\frac{1 - \hat{R}_{ii}}{1 - h_{ii}} \tag{16}$$

When the workforce in the sector *i* is large, estimators R_{ii} and R_{ij} obtained above, are consistent. If you know the values for the parameters s_i, determined with the aid of the relation (9), then they can be rephrased alike:

$$\hat{s}_i = \frac{\hat{P}_{ii} - \hat{R}_{ii}}{1 - \hat{R}_{ii}} \tag{17}$$

($\hat{s}_i$ are noted for the estimation of s_i)

Solving the equation $\pi'\hat{R} = \pi'$ with $\sum_{i=1}^{n} \pi' = 1$, leads us to achieving the probability vector $\pi' = (\pi'_1, \pi'_2, ...\pi'_m)$.

4. Estimation of employees' mobility in the labour market in Romania using Markov chains and its forecast

The problem of labor mobility is addressed both in theory and in practice in connection with the need for a balanced social and economic development at the regional and sectorial level, combining structural issues with the functional reasons.

The current economic and financial crisis has strongly influenced the population's degree of employment in terms of volume and structure and has led to the adaptation of labor market policies.

Upon the conditions of the restructuring acceleration and increasing job insecurity in the labor market, a large number of social problems have accumulated. Employment has become one of the tensest areas of the society.

As a result of the fiscal adjustment authorities' efforts, the number of personnel in budgetary sector in Romania has dropped steadily from the end of 2008, mainly due to the freezing of vacant posts (in effect since May 2009) and the replacement of only a post for 7 released.

During the period September-November 2010, measures implemented from July 2010 to restore the budget balance, have had further negative effects on the labor market and on the real disposable income dynamics.

The persistence of a modest recruitment activity has led to the increase in the number of people who have given up looking for a job through the National Agency for employment (ANOFM) and therefore lowering unemployment.

In this category have entered also those affected by the restructuring of the budgetary sector, and a possible additional explanation for the phenomenon recorded at the ANOFM level might be as well the duration of procedures (according to ANOFM). From September to November 2010, the number of fired employees only in the public administration, defense and social security services surpassed with almost 17% the new registered unemployed people during the same period as a result of collective dismissals (including those from the private sector).

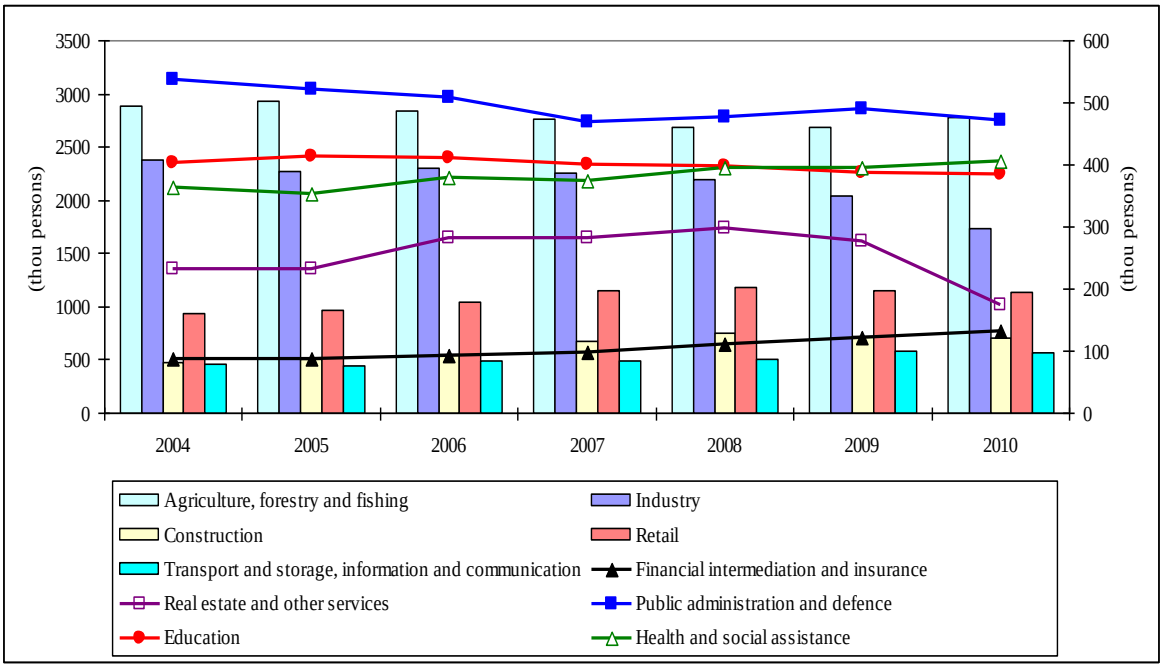
As a result, for the first time since the second quarter of 2008, the registered unemployment rate decreased on average by 0.2 percentage points in the third quarter of 2010 and by a further 0.5 percentage points during the months of October-November. The trend, however, is not found in the data on the ILO unemployment rate, which has increased by 0.3 percentage points in the third quarter of 2010, returning to the level of 7.4% in quarters IV 2009 and I 2010, which indicates that some of the unemployed people who have come out of the registers ANOFM continued to look for a job by their own means.

In the following, we are proposing an analysis of labor mobility in the various fields of economic activity with the help of Markov models.

For the proposed analysis data on employment in the Romanian economy during the period 2004-2010 have been used. Evolution of the number of employed persons in each of these branches is graphically presented in Figure 1.

Figure 1

Employment Structure, by Activity of National Economy



Source: Romanian Statistical Yearbook 2005-2011, National Institute of Statistics

For the proposed analysis there were considered 11 branches of the national economy: industry, agriculture, construction, trade, transportation, storage and communications, financial intermediation, real estate transactions and other services, public administration and defense, education, health and social assistance and other national economy activities (table 1). Status 1, 2,...11 are considered non-recurrent. There has been also introduced an additional condition, namely 0, this being regarded as being absorbent.

Table 1

Economy branch	***Status***
Agriculture	1
Industry	2
Constructions	3
Trade	4
Transportation, storage and communications	5
Financial intermediations	6

Real estate transactions and other services	7
Public administration and defense	8
Education	9
Health and social assistance	10
Other national economy activities	11

Based on the relations shown in subchapter 2, in a first stage, the vector corresponding to the number of employed persons in each branch has been determined:

$$\eta(2004) = (2893;\ 2377;\ 479;\ 943;\ 454;\ 86;\ 232;\ 538;\ 402;\ 362;\ 240)$$

$$\eta(2005) = (2939;\ 2269;\ 507;\ 968;\ 450;\ 86;\ 232;\ 520;\ 413;\ 353;\ 255)$$

$$\eta(2006) = (2840;\ 2296;\ 557;\ 1049;\ 492;\ 92;\ 281;\ 508;\ 410;\ 379;\ 263)$$

$$\eta(2007) = (27579;\ 2259;\ 679;\ 1151;\ 489;\ 97;\ 282;\ 468;\ 400;\ 375;\ 253)$$

$$\eta(2008) = (2690;\ 2199;\ 747;\ 1176;\ 509;\ 110;\ 298;\ 476;\ 397;\ 396;\ 211)$$

$$\eta(2009) = (2689;\ 2048;\ 726;\ 1157;\ 578;\ 122;\ 276;\ 490;\ 386;\ 395;\ 211)$$

$$\eta(2010) = (2761;\ 2035;\ 719;\ 1113;\ 565;\ 133;\ 268;\ 479;\ 381;\ 405;\ 201)$$

Calculations led to getting of the crossing probabilities matrix for the population changing workplace, namely:

$$\mathbf{R} = \begin{pmatrix} 0{,}2 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}7 \\ 0{,}4 & 0{,}1 & 0{,}1 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}2 \\ 0{,}2 & 0{,}0 & 0{,}3 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}4 \\ 0{,}2 & 0{,}0 & 0{,}0 & 0{,}4 & 0{,}1 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}2 \\ 0{,}1 & 0{,}0 & 0{,}1 & 0{,}1 & 0{,}3 & 0{,}1 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}4 \\ 0{,}1 & 0{,}0 & 0{,}0 & 0{,}2 & 0{,}2 & 0{,}3 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}1 \\ 0{,}0 & 0{,}0 & 0{,}0 & 0{,}3 & 0{,}1 & 0{,}0 & 0{,}3 & 0{,}1 & 0{,}1 & 0{,}0 & 0{,}4 \\ 0{,}0 & 0{,}0 & 0{,}0 & 0{,}3 & 0{,}0 & 0{,}0 & 0{,}3 & 0{,}2 & 0{,}0 & 0{,}0 & 0{,}1 \\ 0{,}0 & 0{,}0 & 0{,}0 & 0{,}1 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}5 & 0{,}0 & 0{,}4 \\ 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}2 & 0{,}3 & 0{,}5 \\ 0{,}0 & 0{,}0 & 0{,}0 & 0{,}6 & 0{,}2 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}0 & 0{,}2 \end{pmatrix}$$

Crossing probabilities matrix for the entire active population becomes as relations (2):

$$\mathbf{P} = \begin{pmatrix} 0{,}950 & 0{,}000 & 0{,}002 & 0{,}003 & 0{,}001 & 0{,}000 & 0{,}000 & 0{,}001 & 0{,}000 & 0{,}000 & 0{,}043 \\ 0{,}380 & 0{,}274 & 0{,}140 & 0{,}005 & 0{,}001 & 0{,}001 & 0{,}000 & 0{,}001 & 0{,}001 & 0{,}000 & 0{,}197 \\ 0{,}100 & 0{,}010 & 0{,}696 & 0{,}010 & 0{,}000 & 0{,}001 & 0{,}000 & 0{,}000 & 0{,}001 & 0{,}000 & 0{,}182 \\ 0{,}050 & 0{,}005 & 0{,}010 & 0{,}880 & 0{,}017 & 0{,}001 & 0{,}000 & 0{,}001 & 0{,}000 & 0{,}000 & 0{,}037 \\ 0{,}015 & 0{,}000 & 0{,}010 & 0{,}020 & 0{,}870 & 0{,}020 & 0{,}000 & 0{,}000 & 0{,}000 & 0{,}000 & 0{,}065 \\ 0{,}010 & 0{,}000 & 0{,}002 & 0{,}030 & 0{,}030 & 0{,}910 & 0{,}000 & 0{,}000 & 0{,}000 & 0{,}000 & 0{,}018 \\ 0{,}000 & 0{,}000 & 0{,}000 & 0{,}010 & 0{,}002 & 0{,}000 & 0{,}970 & 0{,}002 & 0{,}002 & 0{,}000 & 0{,}014 \\ 0{,}001 & 0{,}000 & 0{,}000 & 0{,}020 & 0{,}001 & 0{,}001 & 0{,}020 & 0{,}950 & 0{,}000 & 0{,}000 & 0{,}007 \\ 0{,}000 & 0{,}000 & 0{,}000 & 0{,}003 & 0{,}000 & 0{,}000 & 0{,}002 & 0{,}001 & 0{,}970 & 0{,}000 & 0{,}024 \\ 0{,}000 & 0{,}000 & 0{,}000 & 0{,}000 & 0{,}000 & 0{,}000 & 0{,}000 & 0{,}000 & 0{,}010 & 0{,}970 & 0{,}020 \\ 0{,}001 & 0{,}000 & 0{,}001 & 0{,}100 & 0{,}030 & 0{,}004 & 0{,}001 & 0{,}001 & 0{,}002 & 0{,}003 & 0857 \end{pmatrix}$$

and the corresponding matrix for segment of occupied population not changing workplace, can be written in the form:

$$\mathbf{S} = \begin{pmatrix} 0{,}938 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0{,}213 & 0 & . & & & & & & & 0 \\ . & 0 & 0{,}546 & 0 & . & & & & & & . \\ . & . & 0 & 0{,}798 & 0 & . & & & & & . \\ . & . & . & 0 & 0{,}821 & 0 & & & & & . \\ & & & & 0 & 0{,}867 & 0 & & & & \\ & & & & & 0 & 0{,}960 & 0 & & & \\ & & & & & & & 0{,}953 & 0 & & \\ . & . & & & & & & 0 & 0{,}943 & 0 & . \\ . & . & & & & & & & 0 & 0{,}956 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0{,}825 \end{pmatrix}$$

Initial distribution of employment in the various economic branches is given by the components of the vector:

$$\pi_0 = \{0{,}4047; 0{,}2317; 0{,}0399; 0{,}0950; 0{,}0356, 0{,}0106; 0{,}0076; 0{,}0164; 0{,}0485; 0{,}0405; 0{,}0691\}$$

and its distribution in the following years may be determined with the help of relations (10)-(17).

For the proposed analysis, we have got:

$$\pi_1 = \{0{,}3857; 0{,}2275; 0{,}0546; 0{,}1014; 0{,}0408, 0{,}0121; 0{,}0080; 0{,}0174; 0{,}0489; 0{,}0414; 0{,}0621\}$$

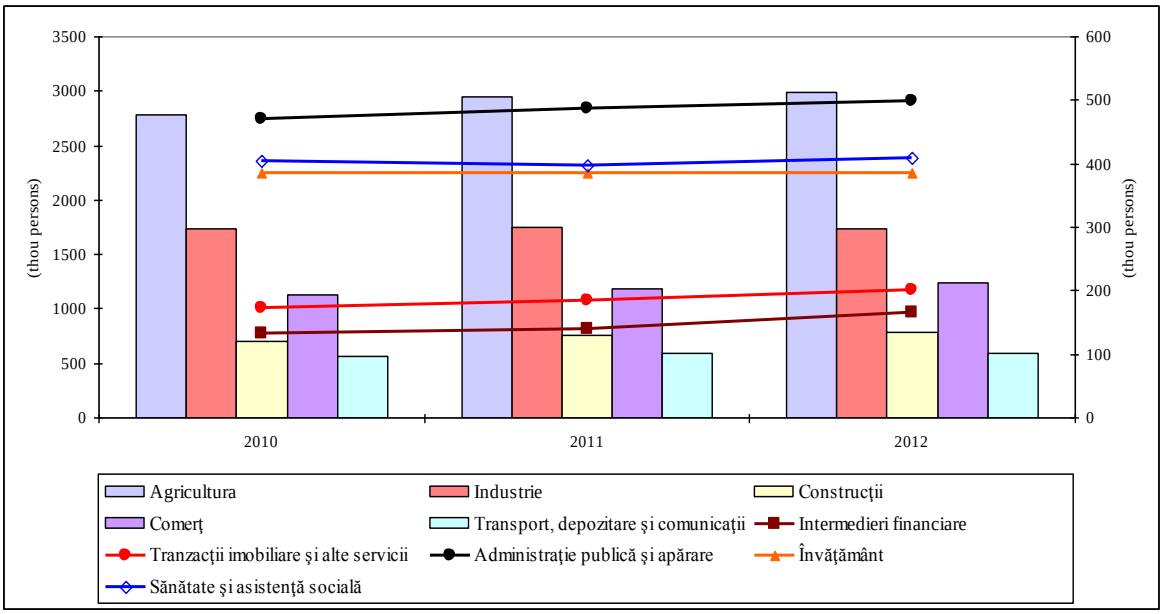
$$\pi_2 = \{0{,}3682; 0{,}2257; 0{,}0656; 0{,}1087; 0{,}0464, 0{,}0135; 0{,}0082; 0{,}0176; 0{,}0498; 0{,}0416; 0{,}0544\}$$

$$\pi_3 = \{0{,}3520; 0{,}2238; 0{,}0727; 0{,}1162; 0{,}0522, 0{,}0148; 0{,}0091; 0{,}0180; 0{,}0521; 0{,}0433; 0{,}0457\}$$

With the help of relations such obtained, labor mobility may be predicted. Thus, for the analysed sectors, the results shown in Figure 2 have been obtained.

Figure 2

Forecast of Employment Structure, by Activity of National Economy



Source: historical data: Romanian Statistics Yearbook 2010, forecast: author's calculations

Evolution of employment will be influenced by several factors. On the one hand there is the foreign investments flow that will generate new jobs. Small and medium-sized enterprises expect to have also a positive contribution to employment growth. On the other hand, the continuation of the process out of the current economic and financial crisis will induce pressure on employment, resulting in new layoffs in some sectors of activity. Despite a relatively high economic growth, labor market remains strained, mainly because of age and profession structure of unemployed persons, which is not identical with the demands of the economy.

Increasing the employment will be achieved by moving the focus on social protection of the unemployed policies from passive to active measures and the promotion of measures to prevent unemployment, especially among young people and persons exposed to the risk of becoming long-term unemployed.

Implementation of this concept and mentality of continuous training or education, without social discrimination, will respond to the needs of rapidly adapting to structural changes of technology and economy, in order to face a large professional mobility in the foreseeable future.

5. Conclusions

Overcoming the difficult moments that Romania is currently crossing largely depends on developments in the European and international economic situation. Significantly, however, the resumption of a healthy growth will be determined in the case of Romania by the consistency of implementing the prescribed landfill and stabilization measures stipulated by the agreements concluded with the European Union, the International Monetary Fund and the World Bank, convergence programs with a view to the adoption of a single European currency and the use of intelligent benefits that membership of the EU offers.

In the current situation, when the resumption of economic growth is tried, it is natural that the decision makers to use various methods and techniques of estimation which may allow them to study the evolution of macroeconomic and the same time to provide scientific support for economic phenomena forecast. One of the important elements of the macroeconomic analysis is also the study on the mobility of the labor force in the national economy.

Markov model used to study the mobility of labor in various sectors of the economy, has enabled the analysis of this phenomenon in the period 2004-2010 in 11 of the sectors of the economy. With the help of elaborated patterns there was made and forecasted labor mobility in the short term.

The results presented in this paper in the form of graphics, emphasies the tendencies of change in the number of employed persons in each of the sectors concerned. Evolution of employment will be impacted by several factors. On the one hand, there is the foreign investment flow that will generate new jobs. Small and medium-sized enterprises expect to have also a positive contribution to employment growth. On the other hand, the continuation of the process of restructuring as a result of the current financial and economic crisis consequences will induce pressure on employment, generating new layoffs. Despite an up economic growth, job market remains strained, mainly because of age and profession structure of unemployed persons, which is not identical with the demands of the economy.

Increase employment in the conditions of accelerated continuing of the crisis exit processes, will be achieved by moving the focus on social protection of the unemployed policies from passive to active measures and the promotion of measures against unemployment, especially among young people and of persons exposed to the risk of becoming long-term unemployed.

Implementation of this concept and mentality of continuous training or education, without social discrimination, will respond to the needs of rapidly adapting to structural changes of technology and economy, in order to face a large professional mobility in the foreseeable future.

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Sustainable growth

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Abstract

This paper aims to analyze the economic growth in general as well as in Romania, trying to highlight the elements that stand at the foundation of this process. The beneficial effect of the growth process, resulted in the improvement of living standards and the need to implement measures to improve this process in our country, were decisive elements that led to an improvement in the standard of living of the individual.

Keywords: economic growth, harmonious development, economic gaps.

JEL codes: F43; O10; R11.

1. Introduction

Given the state of the Romanian economic and social development, economic growth can be characterized by the pursuit of macroeconomic indicators expressing the potential and the actual level of the economy, its structure, input use efficiency and level of international competitiveness and living standards of the population.

Economic forecasts for 2007-2013 in Romania are based on the assumption that the business environment will remain stable and the growth of main trading partners will not significantly decrease.[1] EU accession will accelerate economic and social development of Romania. The domestic capital and labor are needed to support continuous and sustainable growth, along with global level trends, namely: globalization, communication and information technologies, environment protection. An important condition for accelerated economic development is the exploatation of internal growth potential (evaluated by the National Prognosis Commission and the European Commission at a level ensuring economic growth over 6%) and consequently improvement of the domestic product contribution to national aggregate demand (see table no. 1).

[1] Burghelea, C., Dumitrescu, M., Cristea, D., G., *Analysis of Romania's Foreign Trade Policy*, Ovidius University Annals, Economic Sciences Series, Volume XIII, Issue 1, Year 2013, pp.19-24

Table 1

Gross Domestic Product

	2006	Average rate 2007-2013 (%)
Domestic demand, of which:	9.5	7.2
- individual consumption of population	9.4	6.2
- collective consumption of public administration	4.0	3.3
- gross fixed capital formation	12.6	11.1
Exports of goods and services	13.1	.2
Imports of goods and services	18.0	11.1
Gross Domestic Product	**7.0**	**5.7**
Industry	6.4	5.1
Agriculture	0.5	2.7
Building	15.2	10.7
Services	6.8	5.9

Source: www.cnp.ro

2. Economic diversity

The European Union is one of the most prosperous economic areas of the world, but the differences between Member States are striking, and this discrepancy is more obvious if we take into account the 250 different regions of the Union.

To assess these differences, we must first measure and compare the level of prosperity in each country determined by gross domestic product (GDP) of each. For example, in Greece, Portugal and Spain, GDP per capita is only 80% of the Community average. Luxembourg exceeds the average percentage over 60 percent. The ten most dynamic regions in the Union have a GDP nearly three times the ten least developed regions. In other words, not all Europeans have the same advantages and chances of success for the challenges of globalization. It all depends on where you live, whether it is in a prosperous or a poorer region, in a dynamic or declining zone, in cities or in the countryside, on the outskirts of the Union or in one of its economic centers.

Solidarity between the peoples of the European Union, economic and social progress and greater cohesion are stipulated in the preamble of the Treaty of Amsterdam. Therefore Member States implement EU regional policy financed by European funds (Structural Funds and Cohesion Fund), which reflects the political solidarity between citizens.

The European Union comprises 27 member states forming a community and domestic market of 493 million citizens. However, social and economic differences between these countries and their 268 regions are very large. One of four countries has a GDP per capita below 75% of the average of the 27 EU countries (see table no. 2).

After 2004 these differences have widened, with the accession of twelve new member states whose incomes are lower than those in the EU. You can see differences in levels of prosperity both between and within member states. Even before enlargement, the top ten of the most dynamic regions had a level of prosperity, in terms of GDP per capita, nearly three times higher than the last ten less developed regions. Most prosperous regions are all urban London, Brussels, Hamburg.

GDP per capita in London is nine times higher than in the poorest regions of the EU, for example in Romania. These inequalities have various causes and may result in permanent handicaps imposed by geographic remoteness or the recent social and economic changes. In the new member states, part of the problem is the result of inheritance of the former centralized planned economic systems. The impact of these systems is often highlighted by social deprivation, mediocre education, high unemployment rate and inadequate

infrastructure. Dynamic effects of EU membership combined with a strong organized regional policy can generate positive results. The case of Ireland is particularly encouraging: its GDP which was 64% of the EU average at the accession date in 1973 is now one of the greatest.

Table 2

GDP per capita in European Community countries (relative to EU average)

Countries that joined the EU in 2004 - GDP/capita (EU 27 = 100)			
	2004	**2008**	**2010**
Hungary	63	64	65
Czech Republic	78	81	80
Poland	51	56	63
Slovenia	87	91	85
Countries that joined the EU in 2007 - GDP/capita (EU 27 = 100)			
	2006	**2008**	**2010**
Bulgaria	38	44	44
Romania	38	47	46

Source: http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database

One of the priorities of regional policy post 2004 is to raise living standards in the new member states near the EU average as quickly as possible. Regional policy of transferring resources from the rich to the poor is both an instrument of financial solidarity and a powerful engine for economic integration. Solidarity and cohesion are the values on which the EU regional policy is built. Solidarity aims that citizens and regions that are disadvantaged compared to the EU average to benefit both socially and economically of this policy.

Cohesion implies benefits for all, so that differences between income and prosperity in poorer countries and regions to be reduced. EU regional policy seeks to reduce structural disparities between EU regions, to promote sustained and balanced development throughout the EU by promoting real opportunities for all. European regional policy is designed to bring concrete results, social and economic cohesion in order to reduce disparities between the levels of development of the various regions. Through a specific approach, regional policy brings added value to on-field actions, helping to finance concrete projects for the regions, cities and their inhabitants. The idea is to create potential so that the regions can fully contribute to achieving higher growth and competitiveness and at the same time, exchange of ideas and practices.[2]

We can take into consideration few important things for the welfare of a country as the growth rate of the economy. For rich countries a positive rate means higher wages, higher profits, more jobs, and more opportunities for business. For poor countries means not only fewer poor people, but also reducing infant mortality, life expectancy at birth higher, better health care, better access to education, reducing discrimination against women, increase of public freedoms and democracy.[3]

Romania has advanced between 2006 - 2010 to 46% of the EU average in terms of GDP per capita to 11,400 euro, ranking third in the EU12. Romania has recovered 11 points

[2] Burghelea, C., Ene, C., M., Uzlău, C., *Impact of economic models on European Union economies development*, Theoretical and Applied Economics, Volume XX (2013), No. 4(581), pp. 91-102

[3] Work paper- The Global Competitiveness Report 2003-2004, World Economic Forum, Chapter 1

from the gap. According to the analysis, in the same period Romania has recovered 6.8 percentage points of the gap towards the EU average in terms of labor productivity per hour worked, being ranked 4th place in the EU12, after Slovakia, Estonia and Latvia, while the Slovenia and Czech gaps have widened.

Minimum wage increased by about 68 euro during the last 5 years, from 89.7 euro to 157.2 euro, with an average annual growth of 11.25 euro. From this point of view, we rank after Slovenia (39.4 euro), Latvia (25.4 euro) and Slovakia (22.5 euro) but ahead of Hungary (5.6 euro), Bulgaria (6.8 euro) and Czech Republic (9.7 euro).

The unemployment rate rose 0.9 percentage points from 7.3% to 8.2%. We ranked 5 in the EU12, after Poland (-4.6 percentage points), Czech Republic (-0.4 percentage points) and Slovakia (-0.2 percentage points) and ahead of Lithuania (9.5 percentage points), Latvia (9.3 percentage points) and Estonia (6.6 percentage points).

Inflation fell by 0.7 percentage points from 6.6% to 5.9%. Therefore Romania is ranked 3rd among the new member states, after Bulgaria (-3.8 percentage points) and Latvia (-2.4 percentage points), while Poland (2.4 percentage points), Cyprus (1.2 percentage points), Estonia (0.8 percentage points) and Lithuania (0.2 percentage points) registered increases of the inflation rate.

In terms of the budget deficit, Romania also grew by only 2.2 percentage points below the European average advance, which was 3.2 percentage points in the last five years.

Romania's exports also increased by an average of three billion euros per year, reaching 49.8 billion euros in 2011, while imports increased by an average of two billion per year to 55.3 billion euros, in 2011. In both cases, Romania ranks fifth in the EU-12.

Romania's trade deficit halved between 2006 and 2011, from 11.74 billion euro, reaching 5.51 billion euros. This trend puts us in second place in the EU, after Hungary, who succeeded moving from a deficit of 0.82 billion in 2006 to a surplus of 8.17 billion euros in 2011. Employment rate of population aged 15-64 years has remained constant, between 2006-2010, to 58.8%, compared to the European average, which fell by 0.4 percentage points.

Romania is ranked 5 in the EU-12 in terms of evolution of this indicator, being surpassed by Poland, Malta, Bulgaria and Cyprus which registered increases in employment rates. Share of economic sectors in the GDP of the country has changed substantially, so that in 1990, when he started the transition from socialist economy to capitalist market economy, the share of sectors was as follows: 49% industry, 36% services and Agriculture 5% (see table no. 3).

Table 3

Evolution of economic activities march - may 2012

Evolutions	Processing Industry		Building		Retail		Services	
	Feb.2012-Apr.2012	Mar.2012-May.2012	Feb.2012-Apr.2012	Mar.2012-May.2012	Feb.2012-Apr.2012	Mar.2012-May.2012	Feb.2012-Apr.2012	Mar.2012-May.2012
Economic Situation	↗	↗	→	↗	→	↗	→	↗
Number of employees	→	→	↘	→	↗	→	→	→
Prices	↗	↗	→	↗	↗	↗	↗	↗

Source: www.insse.ro

From the economic point of view the EU is one of the richest areas in the world, but the standard of living differs considerably between regions in different member states as well

as between regions of the same country. Luxembourg, the most prosperous country in the EU is more than seven times richer than Romania and Bulgaria, the poorest Member States that joined the Union most recently. Using indicators such as GDP and income per capita to measure the productivity of nations highlights the significant gaps. Most experts say that the greater the nation's GDP is, the country is richer or the higher per capita income is, the country's economy is more stable. Income per capita somewhat dictates how much each individual resident in the country earns annually. GDP (gross domestic product) estimates the nation's market production of goods and services. Therefore, higher GDPs can almost always refers to greater productivity in the country.

Romania and Bulgaria have the most worrying situation; these countries ranking penultimate respectively last according to Eurostat. In Romania, after a slight growth of 3%, the purchasing power in the period after accession, this increase is likely to disappear by the end of the year because of drastic austerity measures envisaged by the Romanian authorities to tackle the budget deficit. Danger of political instability and poor preparation of economic structures for application of sustainable measures, leading to economic growth also add to this situation. These differences in standards of living are due to discretionary personal income, considered as the average monthly amount that a consumer can spend only for himself, in addition to any expenditure at household level and not considering expenses for food, shelter, household items or personal services.

The economic crisis in Europe, accompanied by austerity and wage cuts or layoffs and price increases, has directly affected the living standard of the population. While countries with a large Gross Domestic Product (GDP) per capita managed to maintain top positions and even increased compared to the EU average, Romania and Bulgaria, under the bottom, were thrown even further.

Between 2000 and 2008, GDP per capita in the EU27 increased on average by 1.8% annually. During the economic boom during 2003-2007, growth rates amounted to 2.7% and were much higher in some countries of Central and Eastern Europe. However, due to the economic crisis, GDP growth per capita fell first to 0.1% in 2008, and then in 2009 to -4.6%. Since 2010 there has been a steady growth of about 1.6 percentage points.[4]

Growth rate of GDP / capita in Romania fell to -6.9% in 2009 due to the economic crisis. For year 2014, a growth of 2.2% and 2.7% is forecasted.

3. Proposals for stimulating and improvement of the Romanian economy

After we managed to form an image on the Romanian economy and having identified the factors that had a beneficial role in economic activity, now we have to recognize the elements that negatively influenced its evolution.

Following a brief reassessment of what we have presented so far, we noticed a set of critical points in the evolution of Romanian economy, and we will try to find some solutions to mitigate them.

Over the period, despite a set of economic, political and social events that took place in the Romanian society, we see that the Romanian economy has faced a growing internal demand. Here comes the importance of how the aggregate supply fails to respond to this challenge, as it must take into account consumer preferences and tastes, traditions, and the specificities of different regions in order to meet their expectations. So, to obtain more

[4] Panait I., Lupu I., *The behavior of the Bucharest Stock Exchange during the current financial markets crisis and proposed measures for its sustainable development*, Analele Universităţii Spiru Haret – Seria Economica, Vol.1, ISSN 1582-8336, Bucureşti, 2009, pag.73-80

performance, you need to focus on improving methods of management and marketing, to streamline all economic activity.

Another problem that arises in our economy is the drastic reduction of industrial and agricultural sector's contribution to GDP over the period. It is time to put a question mark on that and try to identify the conditions that constrain the activity of these important sectors in our country. It is clear that to remediate the situation; we need to introduce changes that would stimulate production and efficiency in these sectors. Therefore, a first solution in terms of achieving performance in agriculture is the introduction of plans to modernize the machinery and methods of production. Another solution to boost agricultural activity is to strengthen tax incentives for this sector. These solutions can have a big impact on this area, possibly leading to increased competitiveness of Romanian agriculture.

To influence industrial production growth in Romanian, developing of small and medium enterprises is needed; they have to be encouraged to intervene in the foreign market, which may have a beneficial role on the economy, reducing net exports.

Education, research and development and healthcare are important sectors to be continually stimulated as their development has vital effects on the economy are even areas that form the pillars of sustainable economic growth.

While making these changes one must take into account the ratio of variables in order not to damage the balance relationship or disrupt the normal operation of the economy.

4. Conclusions

Following this brief presentation, we can see the importance of the economic growth process has over the economic activity of a society. Since economic growth means the way living standards can be improved, it needs to occupy a prominent place among the objectives of any nation.

Given that economic growth process aims to obtain a better life for the whole society, it takes a certain government intervention to help achieve this. Therefore, the government has an important role in the economic growth, as it can intervene in the economy in certain situations, in mitigating the business changes by implementing appropriate measures. But state intervention must be strictly oriented to the problems can not be solved except through it, because excessive intervention may have negative effects on the economy.

Through its role of ensuring a legal economic activity and ensure the production of collective goods utility that could not be produced in the private sector, the state plays an important role in the growth process. Therefore, the government is obliged to pay attention to this process, focusing their forces to achieve those actions that are aimed at positive results, which translates into a better life for citizens. For the achievement of economic growth, the government should take into account three dimensions: economic, environmental and social. The economic dimension is supported by scientific research and stimulates investment in innovative capacities of human capital, social concerns sensitive reduction of various social groups, access to material wealth, education, culture and information, and the environmental dimension involves restoring the balance between society and nature by cultivating the population a responsible behavior towards the environment. The measures implemented by the state should not adversely affect any of the three dimensions, as non-compliance leads to reduced growth or deterioration process.

Therefore, when designing measures for growth special attention is needed in order to meet all these sides, so that the growth would be sustainable and would not lead to a transformation of this process into a phenomenon of economy overheating.

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Statistical properties for European stock indices returns during 2007-2012

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Abstract: *This paper presents a set of stylized empirical facts resulted from the statistical investigation of the daily and monthly price variations of European stock market indices during the period April 2007 - March 2012. We study 21 regional and global stock market indices calculated by MSCI Barra, divided into three categories: mature, emerging and frontier markets. Our analysis confirms most of the stylized facts introduced by Cont (2001) but finds that frontier markets showed less volatility than emerging and developed markets and that monthly squared returns presented less evidence of autocorrelations in comparison with the daily squared returns.*

Keywords: stock returns, stylized facts, emerging markets, frontier markets

JEL codes: G11, G15

1. Introduction

This article presents some statistical properties for European stock index returns during April 2007 and March 2012. We followed the work of Bekaert et al. (1997, 1998 and 2005), Peiro (1999), Cont (2001), Harrison et al. (2010) and other authors interested about the characteristics of the distribution of financial assets returns, on different frequencies, and their practical significance for portfolio allocation and investment decisions.

Our original contribution is represented by a comparative approach that is based on three different dimensions: (1) at first we were interested to find the statistical differences of stock market returns between mature, emerging and frontier markets; (2) subsequently we looked for particularities of monthly returns that are different from ones of the daily returns; (3) and in the end we compared the statistical properties of returns during periods of up-trend and down-trend.

Our conclusions are relevant for money managers and investors since they show the importance and efficiency of portfolio diversification among different categories of international markets, on different time horizons and during different states of market cycle.

The rest of the paper is organized as follows: section 2 describes the data that we worked with and the methodology that we have used; section 3 presents the results that we have obtained; and section 4 summarizes the most important conclusions.

2. Data and methodology

In our study we used the non-tradable stock market indices computed by the international financial advisory company MSCI Barra.

For our research purpose we have selected 16 European stock markets, 2 international markets and 3 global stock market indices (needed in order to be able to make comparisons of the results). All those 21 indices were grouped in three categories: 6 developed market indices, 6 emerging market indices and 6 frontier market indices. We have collected daily and

monthly prices of these indices for the period April 2007 – March 2012. Because the price time series are not stationary, we transformed all the 21 price time series into returns time series.

Regarding the returns estimation, as Strong (1992) pointed out "there are both theoretical and empirical reasons for preferring logarithmic returns. Theoretically, logarithmic returns are analytically more tractable when linking together sub-period returns to form returns over long intervals. Empirically, logarithmic returns are more likely to be normally distributed and so conform to the assumptions of the standard statistical techniques". This is why we decided to use logarithmic returns in our study since one of our objectives was to test of whether the daily returns were normally distributed or, instead, showed signs of asymmetry (skewness). The computation formula of the daily returns is as follows:

$$R_{i,t} = Ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right) \quad (1)$$

where $R_{i,t}$ is the return of asset *i* in period *t*; $P_{i,t}$ is the price of asset *i* in period *t* and $P_{i,t-1}$ is the price of asset *i* in period *t-1*.

As a result of this initial data gathering we obtained 21 time series of log-returns, each with 1295 daily observations and 60 monthly observations.

For those 21 time series and two return frequencies we have computed the mean, standard deviation, skewness and kurtosis and also we have applied the Jarque Bera test of the normality of distribution of the daily returns.

3. Results and interpretations

The first step in investigating the properties statistical represents the calculation of the averages, variances, the asymmetry coefficients and the flattening coefficient. The results obtained for the daily series of returns are presented in the table below. The specific parts for the monthly data will be will be discussed in the second part of this study.

Based on the table below we can already confirm that, for all the European stock markets included in this study, even though we speak about mature markets, emerging or frontier markets, even though the study is done on general indexes or on individual markets, the average of the long-term daily returns tends to zero. Also, included for all the markets in this study, we confirm that the average is statistically significantly close to the value of the median. Apart from observing the effective values from Table 1, these statements have been confirmed also by running the t-statistic test for the hypothesis of an average equal to 0 and respectively by the Sign, Wilcoxon and Van der Wareden tests for the hypothesis of a median equal to 0 in the case of all the 21 assets.

Table 1. Descriptive statistics for the series of daily returns

		Medie	Mediană	Maxim	Minim	Std. Dev.	Skew-ness	Kurtosis	Jarque-Bera	p-v.
Mature markets	Austria	-0.0010	0.0000	0.1277	-0.1119	0.0225	-0.026	6.951	841.994	0
	Franta	-0.0004	0.0000	0.1036	-0.0932	0.0174	0.099	7.899	1,296.085	0
	Germania	-0.0002	0.0000	0.1113	-0.0739	0.0169	0.130	8.245	1,486.650	0
	Italia	-0.0008	0.0000	0.1100	-0.0864	0.0184	0.043	7.269	982.833	0
	UK	-0.0003	0.0004	0.0950	-0.0938	0.0164	-0.106	8.711	1,761.008	0
	SUA	0.0000	0.0007	0.1044	-0.0915	0.0165	-0.151	9.026	1,962.978	0
	DM_Index	-0.0001	0.0007	0.0850	-0.0696	0.0124	-0.220	8.684	1,752.461	0
EM	China	0.0001	0.0002	0.1404	-0.1171	0.0224	0.171	7.665	1,179.811	0
	Cehia	-0.0002	0.0004	0.1675	-0.1568	0.0192	-0.287	16.662	10,081.670	0
	Ungaria	-0.0006	-0.0002	0.1733	-0.1999	0.0270	-0.028	9.208	2,077.982	0

	Polonia	-0.0004	0.0000	0.1125	-0.1124	0.0222	-0.223	6.335	610.344	0
	Rusia	-0.0002	0.0007	0.2376	-0.2334	0.0274	-0.294	18.032	12,201.200	0
	Turcia	0.0000	0.0002	0.1484	-0.1243	0.0246	-0.065	6.736	753.310	0
	EM_Index	0.0001	0.0006	0.1008	-0.0848	0.0151	-0.123	9.051	1,977.405	0
Frontier markets	Bulgaria	-0.0015	0.0000	0.1105	-0.1605	0.0193	-1.456	15.560	8,962.712	0
	Croatia	-0.0005	-0.0002	0.0998	-0.0803	0.0130	-0.199	13.701	6,182.963	0
	Estonia	-0.0005	0.0000	0.1241	-0.0924	0.0192	0.244	7.264	992.929	0
	Romania	-0.0007	0.0000	0.1043	-0.3358	0.0242	-2.179	32.879	49,158.980	0
	Slovenia	-0.0007	0.0000	0.0915	-0.0883	0.0139	-0.404	11.285	3,735.895	0
	Serbia	-0.0013	-0.0008	0.1502	-0.1725	0.0247	-0.352	11.196	2,847.822	0
	FM_Index	-0.0004	0.0004	0.0458	-0.0688	0.0104	-1.187	9.449	2,546.213	0

Source: MSCI Barra, calculations made by the author

The results of the Sign, Wilcoxon and Van der Wareden tests from above are presented in Table 2 and show that we cannot reject the null hypothesis (the mean = 0 and that median = 0) at the maximum permissible error level of 1% for none of the markets included in the study.

In this situation, we confirm that for all the investigated assets, the average and the median for the daily returns does not differ significantly from zero: Also, we can statistically test if the affirmation that states that the averages and the medians for all the 21 temporal series with daily frequency are equal is valid.

In order to test the equality of the medians we used the F test (ANOVA version and the Wech version), and for equal medians we used Chi squared tests, Kruskal-Wallis and Van der Waerden as seen in Table 3. The results for these tests are presented below in table 3 and show indeed that we have additional statistical arguments to state that medians and averages of the series for daily returns in all 21 studied assets are equal and have the value zero.

Table 2. The results for the statistic tests for the null hypothesis for the average=0 and the median=0 for the of daily returns series

		average=0	median=0			
		t-statistic	Sign (exact binomial)	Sign (normal approx.)	Wilcoxon signed rank	van der Waerden (normal scores)
		p-value	p-value	p-value	p-value	p-value
Mature markets	Austria	0.1297	0.627	0.627	0.385	0.2314
	Franta	0.3651	0.9328	0.9328	0.7036	0.4759
	Germania	0.5985	0.4139	0.4139	0.8543	0.8581
	Italia	0.1075	0.9775	0.9775	0.3759	0.1942
	UK	0.5696	0.1688	0.1688	0.8069	0.8561
	SUA	0.9677	0.0231	0.0231	0.2718	0.5542
	DM_Index	0.6927	0.0241	0.0241	0.2735	0.7173
Emergent markets	China	0.8406	0.4512	0.4512	0.7187	0.8293
	Cehia	0.7092	0.3873	0.3873	0.724	0.9393
	Ungaria	0.4278	0.6551	0.6551	0.4414	0.4013
	Polonia	0.4777	0.8011	0.8011	0.9433	0.7087
	Rusia	0.7712	0.3156	0.3156	0.4561	0.7295
	Turcia	0.9551	0.7174	0.7174	0.7222	0.8872
	EM_Index	0.8556	0.0846	0.0847	0.2327	0.4815
Frontier markets	Bulgaria	0.0146	0.1298	0.1298	0.0373	0.0253
	Croatia	0.1527	0.0547	0.0547	0.2115	0.2062
	Estonia	0.3382	0.0652	0.0652	0.1077	0.1431
	Romania	0.3247	0.9554	0.9554	0.7718	0.6253
	Slovenia	0.055	0.1528	0.1528	0.0611	0.0632

Serbia	0.0925	0.0184	0.0184	0.0106	0.0235
FM_Index	0.1632	0.1259	0.126	0.5437	0.8401

Source: MSCI Barra, calculations made by the author

Returning to the other statistical characteristics of daily returns on stock markets, from Table 1 we observe that for all the 21 investigated assets, the standard deviation is higher than the value of the average (which we saw above that we can approximate to zero). This study confirms similar findings of previous research.

Interestingly, the results presented in Table 1 show us that we do not have enough statistical arguments to affirm that volatility (risk), measured by standard deviation (and implicitly by variance) is higher for emerging stock markets. Although, as we can observe, standard deviation values for most of the six mature stock markets included in the study present lower figures compared with those of emerging and frontier markets, however the standard deviation for the daily returns in Austria is 0.0225 which exceeds the values for most emerging and frontier markets. This unusual situation is maintained also when we analyze the global indices.

The statistics presented in Table 1 show that for all the 21 assets studied, the kurtosis value (coefficient of vaulting) is higher than 3 (the specific value of normal distribution). This situation shows that the distributions of stock's daily returns are mostly leptokurtic, sharper than the normal distribution, with many values concentrated around the average values and thicker tails means high probability for extreme values (i.e. higher risks). Within the sample that contained mature markets, the kurtosis value does not exceed 10, showing the lowest levels. The highest levels of kurtosis are found for the frontier stock markets, which according to the figures from above signify a higher risk of investments in undeveloped markets compared to mature markets, findings that confirm results of previous similar studies.

Table 3. The results of statistical tests for the equality of averages and medians for the series of daily returns

	Anova F-test p-value	Welch F-test p-value
Null hypothesis: "all averages are equal"	0.924	0.907

	Med. Chi-squared	Kruskal-Wallis	van der Waerden
Null hypothesis: "all medians are equal"	0.000	0.267	0.617

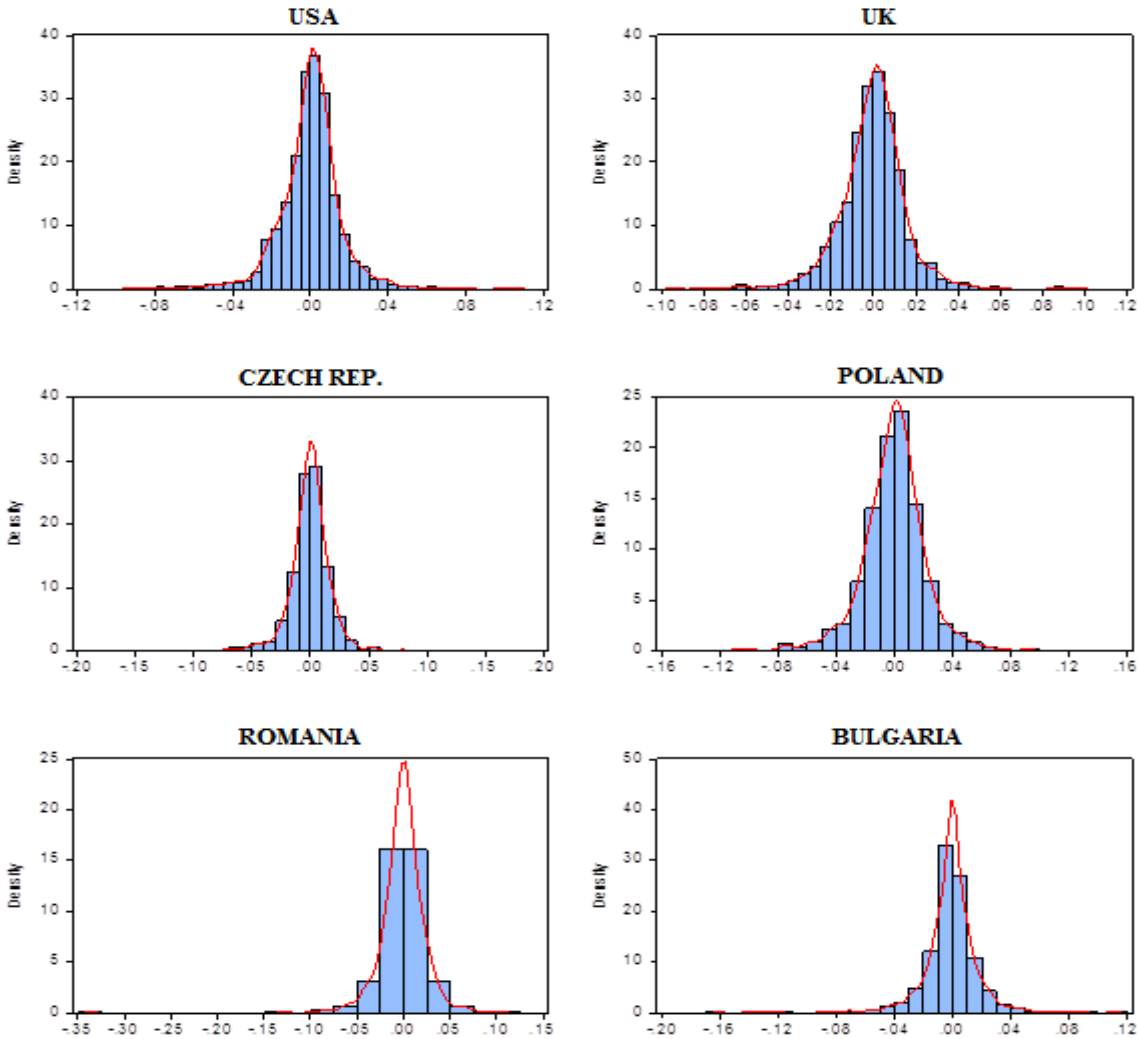
Source: MSCI Barra, calculations made by the author

Taking into account that the period analyzed in this study includes both a crisis cycle on the stock markets (with large and persistent declines in the period starting from June 2007 until February 2009) and an accelerated growth phase (between March 2009 - April 2012), offers us motifs to study the behavior of standard deviation and maximum amplitude of variation for the two different stages. The result of this investigation is shown below in Table 4 and indicates that for all the 21 assets, the maximum variation amplitude during a trading session was lower during the upward trend compared to the crisis period.

At same the time we observe that for all 21 assets, their corresponding standard deviations had lower values during the upward trend compared with the values during the crisis.

Therefore this study confirms previous research findings, according to which the volatility of daily returns is amplified during downturns. The behavior characteristic of the daily stock returns is easily visible in Figure 3. Likewise, we observe that periods of high variance correspond to periods of high amplitude for daily returns.

Figure 1. Comparison between actual probability distributions and the normal distribution of series of daily returns



Source: MSCI Barra, calculations made by the author

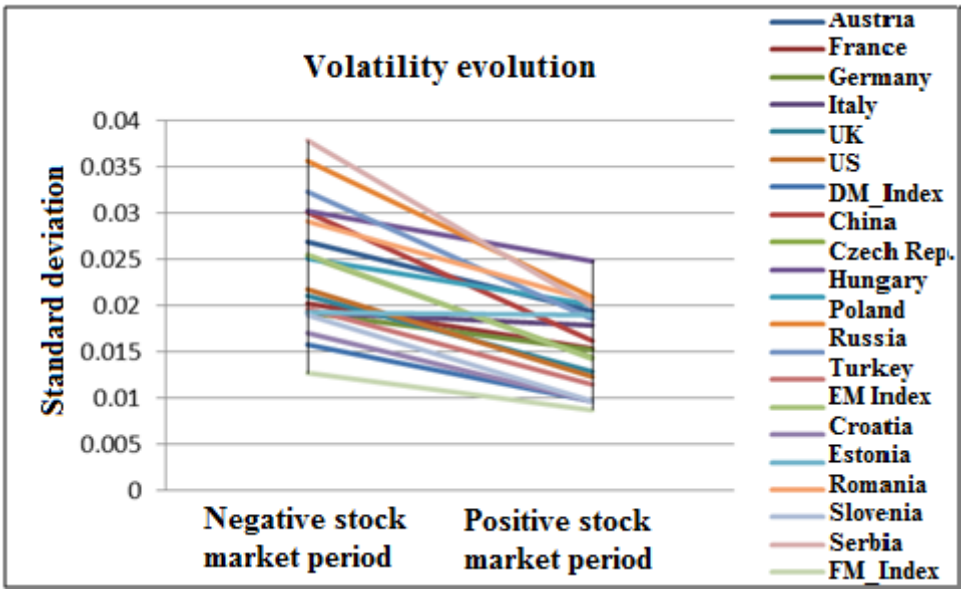
Table 4. The evolution of volatility and business cycle asymmetry on the types of stock markets

		Standard period		Only the crisis			Only the upward trend		
		Std. Dev.	Skewness	Ampl. max	Std. Dev.	Skewness	Ampl. max	Std. Dev.	Skewness
Mature markets	Austria	0.0225	-0.026	0.1277	0.0269	0.098	0.0962	0.0195	-0.037
	Franta	0.0174	0.099	0.1036	0.0203	0.231	0.0883	0.0154	0.018
	Germania	0.0169	0.130	0.1113	0.0193	0.450	0.0601	0.0152	-0.161
	Italia	0.0184	0.043	0.1100	0.0193	0.411	0.1043	0.0179	-0.207

	UK	0.0164	-0.106	0.0950	0.0211	0.048	0.0642	0.0128	-0.146
	SUA	0.0165	-0.151	0.1044	0.0218	0.000	0.0693	0.0124	-0.188
	DM_INDEX	0.0124	-0.220	0.0850	0.0158	-0.029	0.0522	0.0097	-0.270
Emergent markets	China	0.0224	0.171	0.1404	0.0301	0.221	0.0648	0.0163	0.086
	Cehia	0.0192	-0.287	0.1675	0.0254	-0.257	0.0731	0.0144	0.018
	Ungaria	0.0270	-0.028	0.1999	0.0303	-0.146	0.1478	0.0249	0.172
	Polonia	0.0222	-0.223	0.1125	0.0251	-0.306	0.0985	0.0202	-0.023
	Rusia	0.0274	-0.294	0.2376	0.0356	-0.189	0.1018	0.0210	-0.148
	Turcia	0.0246	-0.065	0.1484	0.0323	0.055	0.0834	0.0186	-0.096
	EM_Index	0.0151	-0.123	0.1008	0.0197	0.014	0.0498	0.0115	-0.093
Frontier markets	Bulgaria	0.0193	-1.456	0.1605	0.0255	-1.536	0.0686	0.0143	0.132
	Croatia	0.0130	-0.199	0.0998	0.0170	0.031	0.0736	0.0098	-0.280
	Estonia	0.0192	0.244	0.0828	0.0193	-0.410	0.1241	0.0190	0.662
	Romania	0.0242	-2.179	0.3358	0.0291	-3.178	0.1285	0.0205	-0.056
	Slovenia	0.0139	-0.404	0.0915	0.0190	-0.282	0.0670	0.0098	-0.231
	Serbia	0.0247	-0.352	0.1725	0.0379	-0.354	0.1233	0.0200	0.450
	FM_Index	0.0104	-1.187	0.0688	0.0127	-1.511	0.0458	0.0088	-0.214

Source: MSCI Barra, calculations made by the authors

Figure 2.



Source: MSCI Barra, calculations made by the author

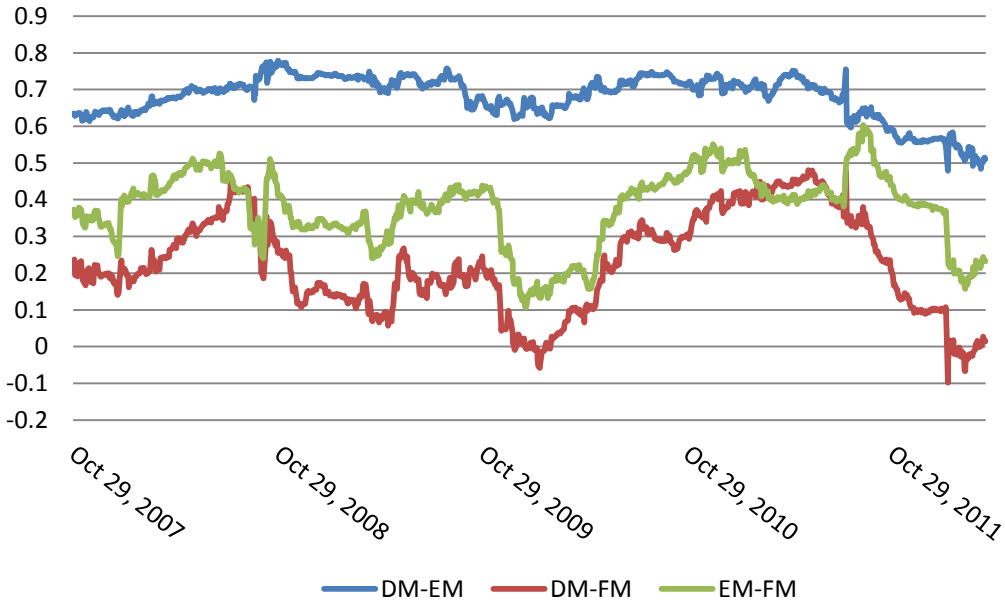
In order to highlight the evolution of the correlation coefficients we used a sample size calculation "rolling" of 130 days (the equivalent of six calendar months of stock trading). The result is shown below in Figure 3 and demonstrates that the value of the correlation coefficient varies over time and their evolution is likely influenced by the stock market situation. For example we observe that during periods of declining stock markets (2007-2008 and then the end of 2010 until mid 2011) the intensity of correlations between all types of markets has been growing, while during periods of an upward trend (2009 and early 2012) the correlation coefficient values are reduced.

We test the presence of the phenomenon of autocorrelation for daily returns by using AC functions ("autocorelation") and CAP ("partial-autocorelation"), for correlations between the current returns and the previous 100 past returns, for all the 21 assets that were analyzed.

The values of autocorrelation coefficients and partial autocorrelation respectively show that the phenomenon of autocorrelation in daily returns is not present.

In the second part of the paper we analyzed the behavior of low frequency returns (using monthly data) for the 21 assets. Similar to the approach in the first part of this paper, we have calculated the average, variance, the coefficient of asymmetry (skewness) and the flattening coefficient (kurtosis) for the monthly returns. The results are presented in Table 5 below.

Figure 3. Evolution of the correlation coefficients between global indices for mature markets, emerging and frontier markets



Source: MSCI Barra, calculations made by the author

As it can also be observed in the case of the monthly returns, we do not have enough statistic arguments to affirm that the average is not equal to zero. This is confirmed both by the values offered in the table and by the t-statistic test applied to each of the 21 monthly time series. At same the time, similar to the situation of the daily returns, the F statistical test (ANOVA and Welch variants) indicate that the value of the averages are equal for all 21 series of monthly returns that were analyzed.

Table 5. Descriptive statistics for the series of monthly returns

		Average	Median	Max	Min	Std. Dev.	Skew-ness	Kurtosis	Jarque-Bera	p-value
MM	Austria	-0.0197	-0.0150	0.1758	-0.3650	0.0997	-1.07	5.22	23.3857	0.000
	France	-0.0085	-0.0087	0.1197	-0.1517	0.0594	-0.36	2.74	1.4339	0.488
	Germany	-0.0045	0.0057	0.1451	-0.2075	0.0681	-0.68	3.75	5.9795	0.050
	Italy	-0.0164	-0.0233	0.1714	-0.1672	0.0684	0.04	2.97	0.0151	0.992
	UK	-0.0055	0.0010	0.1167	-0.1216	0.0518	-0.32	2.91	1.0090	0.604
	UD	-0.0002	0.0010	0.0922	-0.1029	0.0469	-0.36	2.45	1.9981	0.368
	DM_INDEX	-0.0027	0.0029	0.1055	-0.1090	0.0463	-0.39	2.92	1.5453	0.462
Emerging markets	China	0.0021	0.0116	0.1605	-0.2555	0.0865	-0.76	3.41	6.1297	0.047
	Czech Rep.	-0.0039	-0.0074	0.1685	-0.2465	0.0721	-0.37	4.66	8.1727	0.017
	Hungary	-0.0116	0.0069	0.2259	-0.4660	0.1185	-0.96	5.37	22.7556	0.000
	Poland	-0.0092	-0.0014	0.2356	-0.3110	0.0992	-0.33	4.00	3.5361	0.171

	Russia	-0.0049	0.0117	0.1997	-0.3327	0.1064	-0.65	3.54	4.9252	0.085
	Turkey	-0.0005	0.0033	0.2588	-0.3183	0.1182	-0.23	3.52	1.1591	0.560
	EM_Index	0.0016	0.0068	0.1528	-0.2193	0.0695	-0.69	3.83	6.3317	0.042
Frontier markets	Bulgaria	-0.0326	-0.0108	0.2339	-0.5339	0.1179	-1.60	8.22	92.0749	0.000
	Croatia	-0.0115	-0.0154	0.1835	-0.2659	0.0754	-0.63	5.78	22.8355	0.000
	Estonia	-0.0117	0.0062	0.4322	-0.3796	0.1158	0.34	6.61	33.2325	0.000
	Romania	-0.0146	0.0186	0.2774	-0.5980	0.1423	-1.40	6.71	52.9945	0.000
	Slovenia	-0.0163	-0.0108	0.1645	-0.1712	0.0622	-0.37	4.11	4.3181	0.115
	Serbia	-0.0278	-0.0071	0.3537	-0.6457	0.1719	-1.13	5.99	26.8283	0.000
	FM_Index	-0.0089	-0.0004	0.1001	-0.1981	0.0600	-0.96	4.63	15.6336	0.000

Source: MSCI Barra, calculations made by the authors

The following conclusion is drawn from Table 5 as the monthly data confirms the hypothesis that the value of the standard deviation is significantly higher than the average. At the same time, 19 of the 21 series of monthly returns validate the property of a skewness figure that has negative values, although these values do not have a large dimension. However in terms of flattening coefficient (kurtosis), we observe that unlike the case of the series of daily returns, the monthly returns offer values that are much closer to the value three (the characteristic value of a normal distribution) for 10 of the 21 active investigation. This observation, together with the previous one according to which the skewness values do not have a large dimension, lead us to expect that the form of monthly returns distribution is closer to the normal distribution, which represents an important value for processing and modeling their behavior.

Indeed, the values of the last column in Table 5 show that the Jarque-Bera test results lead to the conclusion that, for 13 of the 21 series of monthly returns analyzed, the hypothesis in which the distribution is described in a Gaussian waveform cannot be rejected at an error level of maximum 1%. We obtain statistical arguments to assert that, for more than half of the series of monthly returns analyzed, the shape of the distribution curve does not differ significantly from the normal (theoretical) distribution.

4. Conclusions

Our paper investigate the statistical characteristics of daily and monthly returns during April 2007 – March 2012 for 16 European national market indices, 2 international indices and 3 global market indices. We compared the results between three categories: developed markets, emerging markets and frontier markets.

(1) The data that we investigate confirmed that the average of returns is not statistically different from zero. This finding is valid both for daily and monthly returns. Also, it is valid for all the three types of markets (developed, emerging and frontier).

(2) Our results also confirm that standard deviation consistently registers higher values comparing with the average, both for daily and monthly returns. We noticed that the developed markets have lower values for standard deviation in comparison with emerging and frontier markets.

(3) For all the types of markets the distribution of daily returns is significantly different from the normal (theoretical) distribution. At the same time, we found evidence that the lower frequency returns (in our case the monthly returns) tend to have empirical distributions close to the normal (theoretical) distribution. For the developed markets the monthly returns are close to the normal distribution, but the monthly returns of the emerging and frontier markets still differ significantly.

(4) We found negative asymmetry for most of the 21 indices investigated, both for the daily and monthly returns.

(5) The daily returns present excess kurtosis for most of the indices and for all types of markets. This conclusion is also valid for monthly returns from emerging and frontier markets. Not surprisingly, the monthly returns of the developed markets (which we found to have empirical distribution close to the normal distribution) have kurtosis values near 3.

(6) For the daily returns we were able to confirm the „leverage" stylized fact described by Cont R. (2001). More specific, we found that during the high volatility periods, the absolute values of effective returns are also higher. We were unable to test this property for the monthly returns because during the period April 2007 – March 2012 we had only 60 empirical observations for each of the 21 time series.

(7) The study that we have conducted confirms that most of the characteristics of the returns change with time. Especially volatility and correlation coefficient tend to register higher values during market crises and lower values during the periods of positive market evolution. This confirms the hypothesis of contagion between markets. Also, we found that mature markets are highly correlated with other mature markets and less correlated with emerging and frontier markets. On the other hand, the frontier markets tend to have lower correlations both with other frontier markets and with emerging and developed markets.

(8) The daily time series show no autocorrelation of simple logarithmic returns, but present autocorrelations of squared returns. On the other hand, we found that the monthly squared returns tend to be less autocorrelated.

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The nonlinear GDP dynamics[5]

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Abstract

The oscillatory behavior of GDP and its components leads to a Fourier transform analysis that results in the eigen values of the dynamic economic system. The larger values are dominating the transient behavior of the GDP components and these transients are discussed along with the specific behavior of each component. The second order differential equations are determined, for each component, to describe the oscillatory behavior and the transient resulting from a step excitation. The natural frequencies are determined and the correlation of pairs of components' cycles result in 'beats' process where the modulated wave cycles are compared and discussed. Based on these correlated influence terms the solutions of the differential equations of each component are determined along with their evolution in the phase space and with the specific Lagrangian. The possible occurrence of dynamical behavior basins for GDP is explored, associated to time interval least action considerations. Important conclusions are drawn from this analysis on the dynamics of GDP and its components, in terms of general versus local equilibriums and their evolution.

Keywords: nonlinear models, oscillatory behavior, GDP cycles, equilibrium

JEL Classification: C3, C61, C62, D7, D87

1. Introduction

Oscillatory processes are imbedded in economic systems' behavior due to the intrinsic nature of human activities and natural phenomena with which they interact. Various names are coining this behavior such as cyclic, seasonal, yearly or quarterly periodic, etc. Moreover the scale of time constants of various activities range from seconds e.g. the ticks of the stock exchange, to tens of years e.g. T bonds of the US Treasury.

As shown in the selected references, there are various papers that have identified nonlinear behavior and described it with various models that show features such as bifurcation, discontinuity, periodicity, etc. What we intend to present here is a systematic analysis of the oscillatory behavior of the GDP and its components that applies well known mathematical instruments e.g. Fourier transform, differential equations, flows, Lagrangean etc. We give below, in chronological order, a few relevant quotes related to cyclic behavior:

"The general character and agreement in the periodic turn in movements of factors of circulation -- these are the specific problems of business cycle theory which have to be solved within the closed interdependent system. … If a business cycle theory which is *system-*

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conforming cannot be built, then "general overproduction" will not only drive the economy but also economic *theory* into a crisis." (Adolph Lowe, "How is Business Cyle Theory Possible at All?", *WWA*, 1926: p.175).

"Since we claim to have shown in the preceding chapters what determines the volume of employment at any time, it follows, if we are right, that our theory must be capable of explaining the phenomena of the Trade Cycle." (John Maynard Keynes, *General Theory*, 1936: p.313)

"Keynesian economics, in spite of all that it has done for our understanding of business fluctuations, has beyond all doubt left at least one major thing quite unexplained; and that thing is nothing less than the business cycle itself....For Keynes did not show us, and did not attempt to show us, save by a few hints, why it is that in the past the level of activity has fluctuated according to so definite a pattern." (John Hicks, *Contribution to the Theory of the Trade Cycle*, 1950: p.1)

Further on, one should mention Samuelson, Minsky and Gandolfo, as well as S.Keen, that contributed substantially to the formulation of models that present oscillatory dynamics and to the discussion of their various basins of behavior. As an example, Keen says;

“The economic fixation upon equilibrium appears quaint to these mathematically literate economists, and this alone may significantly undermine the hold which static thinking has on economics” (Steve Keen, *Debunking Economics*, 2007: p309)

We will leave for the references the multiple papers at the basis of our survey of models imbedding cyclic behavior done by Hicks, Dussenbery, Kalecki, Kaldor, Goodwin, etc. that either introduce limitation such as ceilings and floors or consider nonlinear components that allow the occurrence of cycles.

2. Complex systems behavior

2.1. Economies as complex systems

Complex systems theory has developed specific concepts that may help to focus the description of economic behavior Following Kay and Regier (2000), one may identify some characteristics of complex systems, as dealt with later, as follows:

- non-linear behavior (generated also by feedback);
- hierarchical structure (layers of nested systems made up of systems);
- internal causality (self-organizing causality characterized by objectives, positive and negative feedback, autocatalysis, emergent properties, and sudden change);
- the fact that there may not exist single equilibrium points; and that multiple attractor points (steady states) are possible;
- they show catastrophic behavior, with bifurcations and flips between attractors; and even chaotic behavior, where our ability to forecast and predict is limited.

Economies are observing the above characteristics of complex adaptive systems, i.e. composed of large and increasing number of both components and of the relationships between them.

They also learn from mistakes and from present developments, and they react, by changing both the actions undertaken and the objectives defined; they are thus self-reflexive.

Economies are also systems having an objective, or goal, they tend to self-maintenance, development and they are capable of incorporating the deduced consequences of

achieving their objectives into the present decisions and definitions of new objectives, they are thus anticipatory.

They also have the ability to adapt to new changing limits (seen as boundary conditions), but they may consciously alter the limits (e.g. in their relation with the environment). This is why the economy, as a human system, can be understood as a complex, adaptive, self-reflexive, and self-aware system (see Kay and Regier, 2000 and Purica and Martinelli 1992).

The study of the evolution under the complex system framework will help us to better conceptualize the relationship between the development of economies and their equilibrium dynamic evolution. For a deeper analysis on economies as complex systems, see Ramos-Martin (2002).

2.2. GDP components and energy evolution as indicators of a complex system framework

The hierarchical structure of the economy, as well as the working of the feedback loops between the different hierarchical levels, induces non-linear behavior in the system. This is so because positive feedback loops might generate self-reinforcing mechanisms. This non-linear behavior is not only induced by external shocks as is normally implied by economic theory, but also by internal causes within the system. Both non-linear behavior and far from equilibrium situations, lead to the existence of several stable states (Proops, 1985) or attractors.

An attractor represents a region, in the phase space, where the behavior exhibited by the system is coherent and structured (Kay et al., 1999). Once the system reaches the attractor, it fluctuates in that region and its parameters move only short distances, at least for a certain period of time. This is known as ‘lock-in’, and prevents the system from taking another trajectory for a period of time (Dyke, 1994; Kay et al., 1999).

If we study the evolution of the parameters above and we state that the system is on an “attractor point” some changes in, for example, GDP components, will not always lead to changes in the studied variable.

Over half a century ago, Schumpeter (1949) understood non-linear evolutionary development and discontinuity by means of his theory of creative destruction. This idea has been later named ‘punctuated equilibrium’ by some analysts (Gowdy, 1994), using the same term that is in use in paleontology to describe this step-wise evolution (Eldredge and Gould, 1972; Gould and Eldredge 1993).

One way of analyzing the existence of this discontinuity is by means of a phase diagram. This methodology has been used in the case of CO2 emissions (Unruh and Moomaw, 1998), and in the case of energy intensity (De Bruyn, 1999; Ramos-Martin 1999, 2001). The phase diagrams are intended to show whether the evolution of certain variables, over time, is stable (even dynamically stable) or divergent. Thus one may find if there are attractor points or not.

The fact that a particular system is evolving around one attractor point constrains the future available trajectories and attractors, by paving the path for future developments on a least action based evolution. The system moves along a trajectory that passes from a given attractor in a given time period to another attractor in the next time period. In order to make a calculable analysis we are going to make specific considerations on the system. In a simple case we may consider that the system (economy) behavior is an oscillatory one where GDP components are each described by oscillations resulting from various causes not to be detailed at this point. To each a second order ordinary differential equation is associated. The evolution of the GDP is actually not a sum of components but a superposition of oscillations. Seeing it in this way the combinations of oscillations are resulting in modulated short and

long time periods (i.e. high and low frequencies) waves. This modulated behavior creates a sum of excitation terms that act as an excitation in the differential equations describing each GDP component. Two main things are looked for in the second order differential equations: (i) the pattern of solutions in the phase space that may indicate convergent behavior and thus, the existence of an attractor (indicating stability) or divergence that may trigger the onset of change to an unstable behavior; (ii) the existence of a Lagrangean function of the system such as to identify the types of terms associated to the energy equivalent of the system (e.g. elastic terms, kinetic terms, potential terms).

Once we have determined the Lagrangean functions one may consider analyzing the existence of extremes that would indicate points of equilibrium toward which the system would go in each time period. Since we talk about time periods and the Lagrangean one may think of the functional integral of the Lagrangean (measuring the Action equivalent of the system) to identify the equilibrium points, that the system will path through from one time interval of interest to the next. This least action technique, (path integral), was introduced by Feynman in 1942 (Feynman, 2005). It integrates the time dependent coefficients of a Lagrangean over each time interval of interest in order to identify the points of equilibrium of the system that its evolution trajectory is passing through. Obviously these equilibrium points may not be the same from one time interval to the next.

Further on we will consider the data series of GDP and its components and apply the approach described above. The actual data are from Romania and have a quarterly disaggregation.

3. Case analysis Romania

By applying this type of analysis to the real GDP data from a given economy (Romania) we obtain a set of second order differential equations. Each of these equations has its specific solutions. Actually the resulting amplitudes of the Fourier analysis could be considered eigen-values of these equations and the flow of trajectories may be discussed in terms of convergence/divergence, stability and the underlying potential.

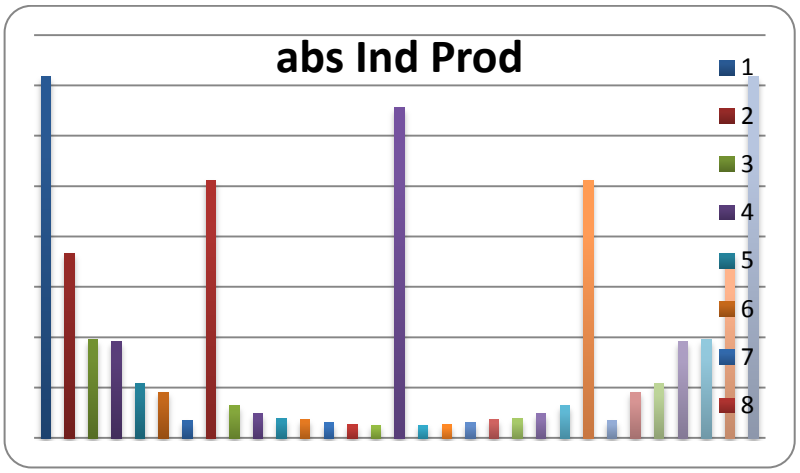
We have done a basic analysis of this sort (Purica 2011) in a previous paper for the industrial production. In what follows we are extending the analysis to the GDP and all its components.

3.1. Data and Fourier analysis

The data of the GDP and its components are taken as quarterly series in the period Q1 2000 – Q4 2008 (before the crisis starting). The source is the National Institute of Statistics of Romania. The values are retrievable from the site of the institute. We have taken the data given in current values, and performed the Fourier analysis on the series, taking the last 32 values of each, as required by the Fourier calculation. Although we have calculated the values for all the GDP components we are keeping here only the industrial production (a convergent component) and finance (a divergent one) for the sake of showing our point. Some results will though consider the full data calculations. The resulting graphs of the amplitudes are given below.

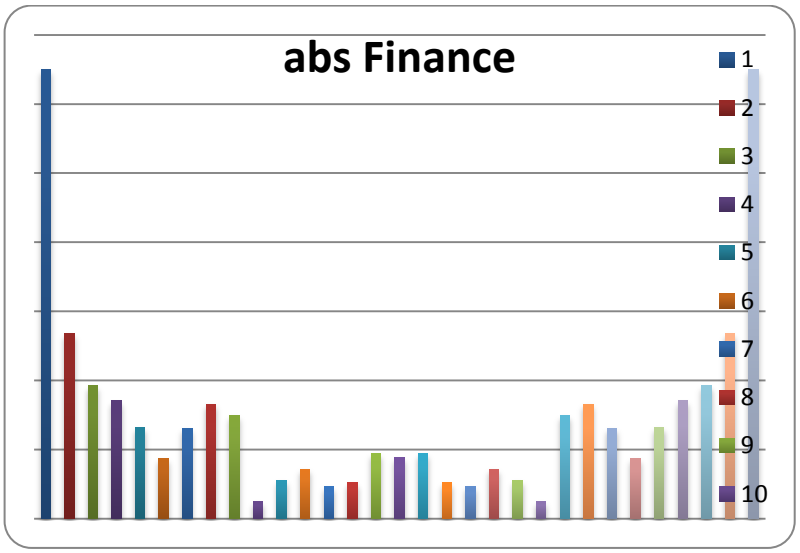
It is important to note that the representations above are only giving the real values of the amplitudes. The representation in the complex plane may actually be considered as the one that gives the eigen values of each component us determining the flow of trajectories.

Industrial Production



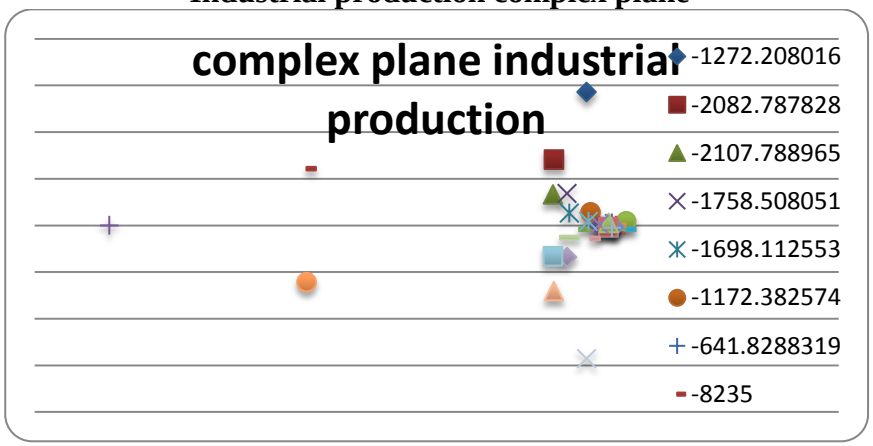
Source: Author's calculations

Finance



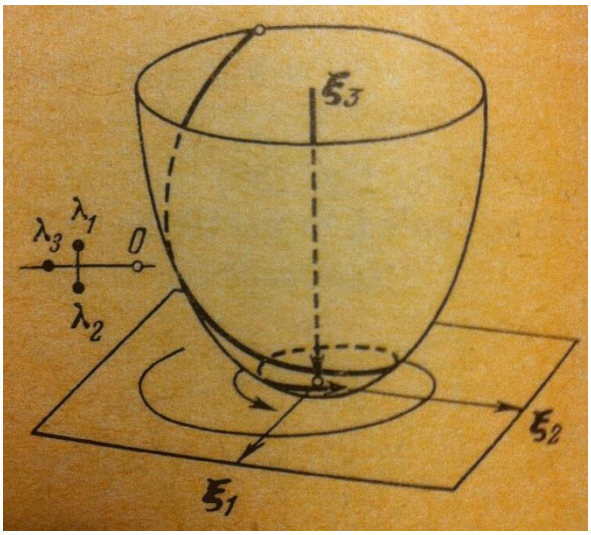
Source: Author's calculations

Industrial production complex plane



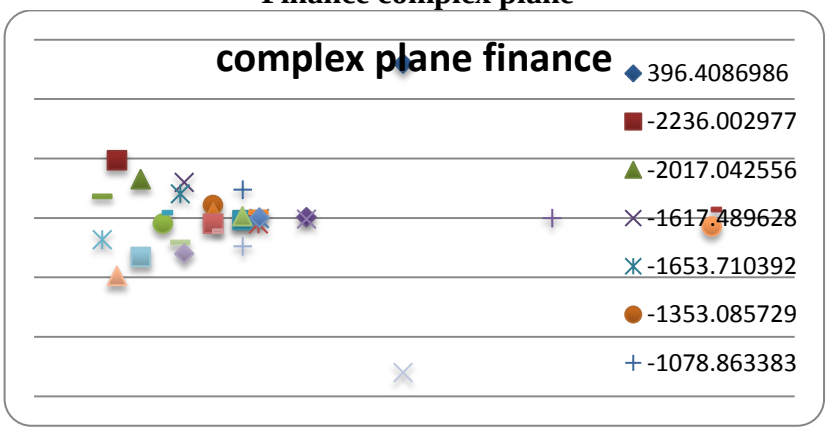
Source: Author's calculations

Industrial Production flow



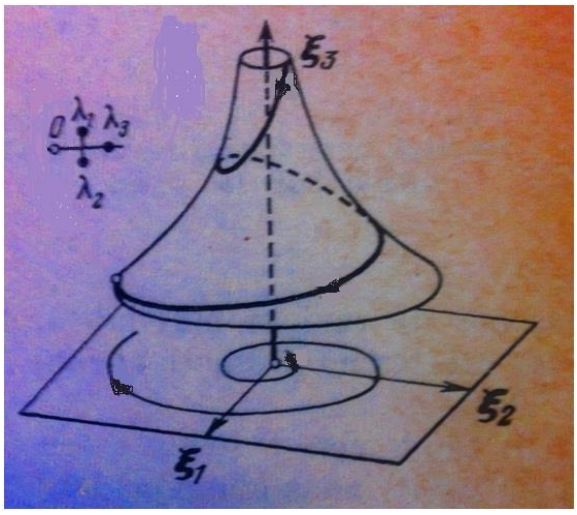
Source: Author's calculations (see also Arnold 1974)

Finance complex plane



Source: Author's calculations

Finance flow



Source: Author's calculations (see also Arnold 1974)

3.2. Determination of the differential equations

The differential equations describing the oscillatory solutions have been determined for each component in two cases: (i) a case of unperturbed evolution that results in the specific frequencies of each case and, (ii) a case of perturbed evolution by a step excitation that gives the natural and transient frequencies, to be used later in the calculations. We are giving here only the perturbed case. The equation for each component is:

$$M\frac{d^2}{dt^2}x(t)+2\frac{c}{2}\frac{d}{dt}x(t)+kx(t)=u(t)$$

Table 1. Coefficients and dynamic parameters for step function excitation.

Component	M	c	k	T	S	C
AGR	1.026	0.864	1.15	5.934	6.468	2.374
COM	5.452	2.765	5.414	6.305	6.52	3.943
CTR	0.985	0.703	2.428	4.002	4.109	2.802
FIN	1.012	0.824	1.102	6.021	6.538	2.458
IND	2.857	1	3.656	5.554	5.622	5.713
SRV	11.072	6.213	15.907	5.242	5.392	3.564

Legend
AGR - Agricultural production
COM - Commerce
CTR - Constructions
FIN - Finance
IND - Industry
SRV - Services

Further on we will start analyzing the correlation of various sectors. It is clear that there is mutual interdependence among the sectors e.g. finance and industry are interdependent as well as finance and every other sector. Moreover, there is interdependence among the nonfinancial sectors such as industry and agriculture or agriculture and commerce, etc.

3.3. Long and short time inter-sectorial cycles

If one combines two cyclic processes the resulting pattern of behavior results in high frequency cycles (given by the sum of the two frequencies) modulated by lower frequency cycles (given by the difference of the two frequencies). In physics the process is called ‘beats’ and its perception is mostly demonstrated in sound waves.

Up till now we have considered only single GDP component oscillatory behavior, with no interconnection among sectors. Let us now try to assess more information from combining two sectors and analyze the resulting behavior.

The resulting wave is a product of the sine of the frequency sum, sin((wf+wi)/2), by the cosine of the frequency difference, cos((wf-wi)/2). The shape of the resulting wave is giving information not only on short term cyclic behavior but also on the modulating cycle that may imply there is an intrinsic long term cyclic behavior which may be associated with what we usually perceive as ‘crises’, or that have been shown to exists by various authors (of which the most known is Kondratiev).

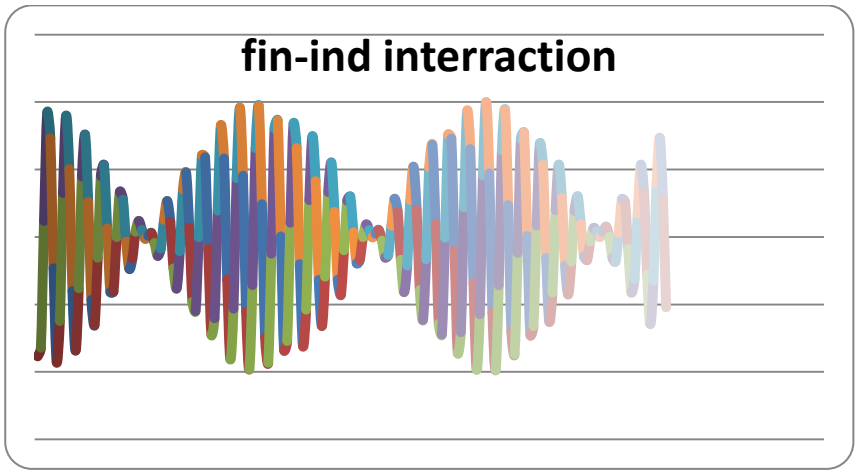
We keep the notations from table 1 above for the sectors (but in small characters) we give the two frequencies for each correlation. Also we note $w=2\pi/T$ (T from table 1 above). As mentioned we are giving only finance and industrial production.

Finance and industry (fin ind): the time units are measured in quarters [Q], so the short period is 2π/(wfin+wind)=2.89 Q i.e. less than one year, while the modulation (long period) is 2π/(wfin-wind)=69.78 Q i.e. about 17 years.

The period of the modulation is of the order of the investment cycles in the industrial sector. We may have found by this method a way to assess the length of the investment cycles in given economies as given by the modulated wave of the correlated financial and industrial cycles of the respective GDP components.

The fin-ind frequencies

wfin-wind	wfin+wind
-0.09	2.17



Source: Author's calculations

The following table is a synthesis of the associated periods with the cycles above. The upper part of the table shows the periods of the modulated cycles calculated in years while the lower part shows the periods of the short cycles given in months.

Table 3. Intersectorial cycles periods long [years] and short [months]

	fin	**ind**	**agr**	**com**	**ctr**	**srv**	
fin	1	17	79	31	3	10	years
ind	*9*	1	22	12	4	22	
agr	*9*	*9*	1	26	3	11	
com	*9*	*9*	*9*	1	3	8	
ctr	*7*	*7*	*7*	*7*	1	4	
srv	*8*	*8*	*8*	*9*	*7*	1	
	months						

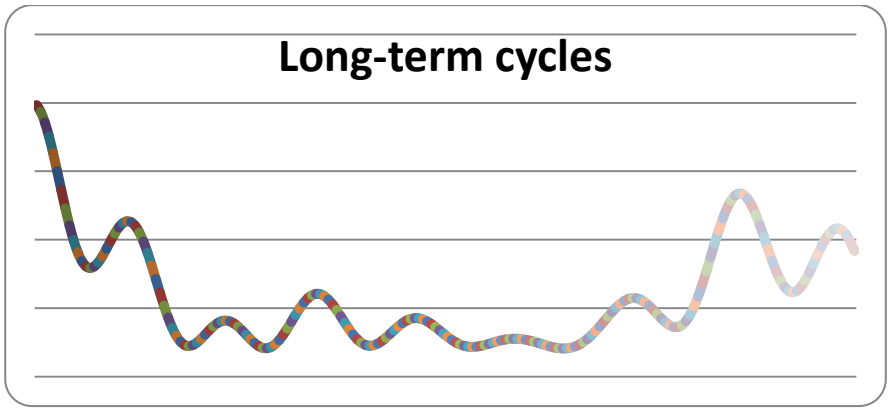
The modulated cycles are the ones with larger time constants that describe behavior that covers, in certain cases, tens of years. These long modulated cycles are the ones that supposedly generate the long-term variations that we normally perceive as crises, being different from the usual quarterly, or at most, yearly behavior.

The cycle's short term and long term periods may become a set of indicators for the expected behavior; for example, construction correlated with finance, services and commerce show similar values periods for short term behavior and also for long term one (also relatively

small). This high dynamic of the above correlations leads to caution related to the domain of constructions where a bubble situation may occur. Actually in the years following the interval we have analyzed (2000-2008) this situation has showed up in Romania.

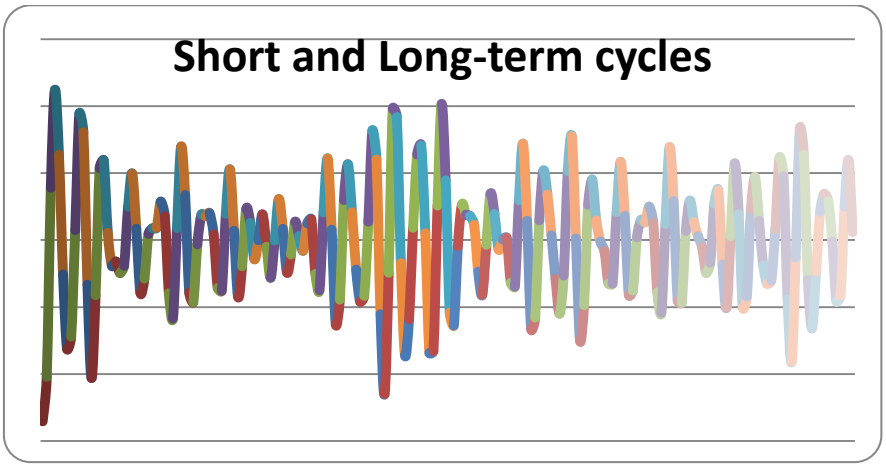
By contrast, in case of finance and industry correlation the difference between the short-term period and the modulated one are significant, the long-term behavior possibly describing the investment cycles associated with industrial development.

On a wider line of thinking the graph of the added cosines (long-term) modulations for all the correlations result in long term cycles with periods of 36 to 41 years. These time constants are similar to the Kondratieff cycles that span on very long periods.



Source: Author's calculations

If we consider the added full cycles (sine and cosine products) then the large cycles have periods of about 24 years. One may assume here that the short term dynamics has an effect of shortening the long term cycles i.e. the present days Kondratieff type cycles may be shorter.



Source: Author's calculations

3.4. Differential equations with external excitation

Based on the pair correlation we pass now to analyze the differential equations of each component considering, this time the evolution is done in a correlated environment described as a sum of sin.cos products of mutual influences as described above. The dynamics of this equivalent potential of correlation is producing a behavior that has more complex pattern.

Further on we will pass to assessing behavior that results from considering this more complex correlation of the specified GDP components. This may result in complex oscillatory behavior to be analyzed below.

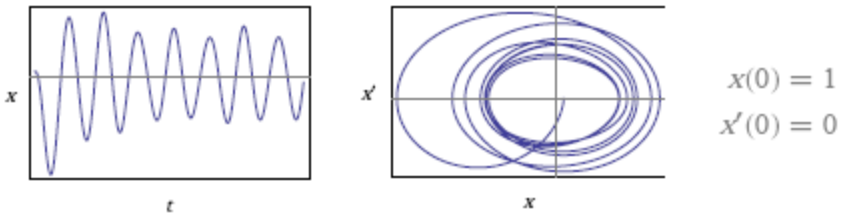
Let us determine the impact into the equations of the GDP components starting with the assumption that the modulated components are introduced in the equations. This is actually changing the character of second order differential equations by added excitation terms showing the interdependence analyzed above. The sum of oscillatory functions sin.cos products (modulated oscillations) resulting from the pairs of mutual influences is added to the equation of each component. This nonlinear term acts as an external excitation of the other components on the one whose behavior is described by the linear second order differential equation determined above. In this way the equations become more close to reality and the resulting behavior of their solutions is analyzed below. For each component the form of the equation will contain a function x(t) that, in each case, refers to the specific component and will have the coefficients and the periods determined above for the case of the natural frequencies (step excitation) and modulated frequencies resulting from combination of the given component with all the others.

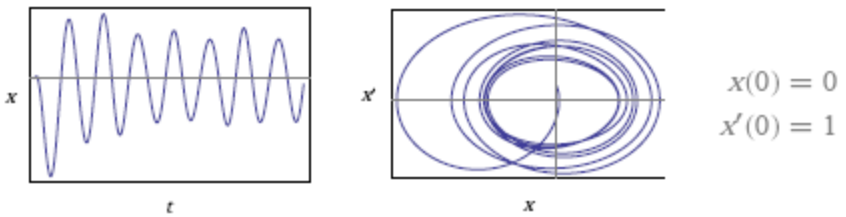
To solve these equations we have used Wolfram Alpha website and the results are presented below :

Finance: the equation and solution for this GDP component is given below:

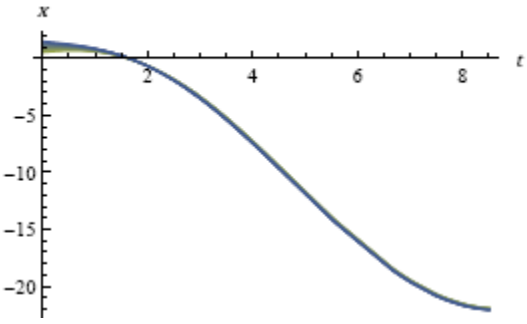
$$1.012\,x''(t) + 0.824\,x'(t) + 0.102\,x(t) + \sin\left(\frac{t}{2.4}\right)\cos\left(\frac{t}{11.8}\right) + \sin\left(\frac{t}{2.89}\right)\cos\left(\frac{t}{69.78}\right) + \sin\left(\frac{t}{2.99}\right)\cos\left(\frac{t}{314}\right) + \sin\left(\frac{t}{3.08}\right)\cos\left(\frac{t}{125}\right) + \sin\left(\frac{t}{2.8}\right)\cos\left(\frac{t}{39.25}\right) = 0$$

Plots of sample individual solutions:





Sample solution family:



(sampling $x(0)$ and $x'(0)$)

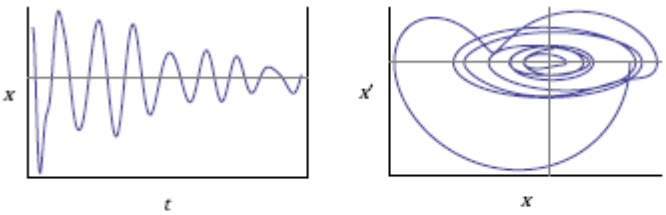
Possible Lagrangian:

$$\mathcal{L}(x', x, t) = \frac{1}{2}\left(-0.100791\, e^{0.814229\, t}\, x^2 + e^{0.814229\, t}\, x'^2 + 2\, e^{0.814229\, t}\, x\,(-0.988142 \sin(0.324675\, t)\cos(0.008\, t) - 0.988142 \sin(0.334448\, t)\cos(0.00318471\, t) - 0.988142 \sin(0.346021\, t)\cos(0.0143308\, t) - 0.988142 \sin(0.357143\, t)\cos(0.0254777\, t) - 0.988142 \sin(0.416667\, t)\cos(0.0847458\, t) + 0.)\right)$$

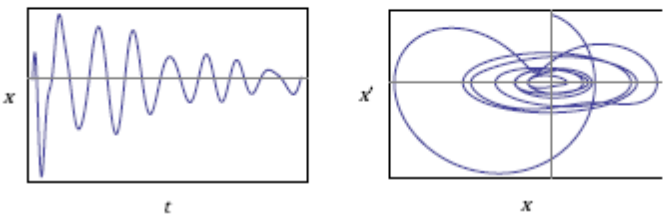
Industry

$$2.857\, x''(t) + 1\, x'(t) + 3.656\, x(t) + \sin\left(\frac{t}{2.89}\right)\cos\left(\frac{t}{69.78}\right) + \sin\left(\frac{t}{2.87}\right)\cos\left(\frac{t}{89.7}\right) + \sin\left(\frac{t}{2.33}\right)\cos\left(\frac{t}{14.3}\right) + \sin\left(\frac{t}{2.9}\right)\cos\left(\frac{t}{48.3}\right) + \sin\left(\frac{t}{2.7}\right)\cos\left(\frac{t}{89.7}\right) = 0$$

Plots of sample individual solutions:

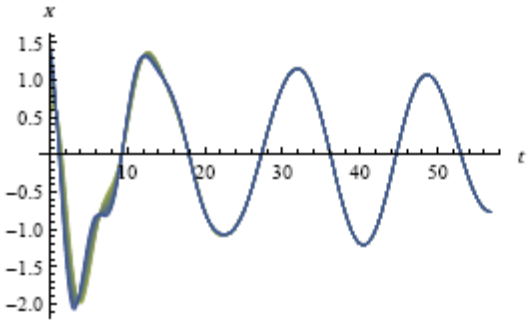


$x(0) = 1$
$x'(0) = 0$



$x(0) = 0$
$x'(0) = 1$

Sample solution family:



(sampling $x(0)$ and $x'(0)$)

Possible Lagrangian:

$$\mathcal{L}(x', x, t) = \frac{1}{2}\left(-1.27966\, e^{0.350018\, t} x^2 + e^{0.350018\, t} x'^2 + 2\, e^{0.350018\, t} x\,(-0.350018 \sin(0.344828\, t)\cos(0.0207039\, t) - 0.350018 \sin(0.346021\, t)\cos(0.0143308\, t) - 0.350018 \sin(0.348432\, t)\cos(0.0111483\, t) - 0.350018 \sin(0.37037\, t)\cos(0.0111483\, t) - 0.350018 \sin(0.429185\, t)\cos(0.0699301\, t) + 0.)\right)$$

3.5. Comments on stability and dynamics of GDP components

The above behavior of the GDP components, when we have considered the coupling among them, shows that except for finance the other components have a convergent dynamic toward some stable cycles. Some of these cycles are more complex while some are simpler but the families of solutions of these equations converge to stable oscillatory behavior. One exception – that was actually underlined earlier – is the behavior of the finance component where the solutions trend is toward increasing negative values i.e. toward instability.

An important thing to notice here is the existence of a Lagrangean for each component. These Lagrangean depend on the component value x, on its derivative x', and also on time t. The time dependence is actually seen at the level of the coefficients.

We may say that out of the three terms in the Lagrange function one is dependent on x^2, the other on x'^2, while the last on x. The literature on the Lagrangean mechanics is very rich and we will only mention a few titles of interest in the references. Let's make now some analogies with the Lagrangean mechanics and see how one may associate the notion of equilibrium for the dynamics of the GDP components, based on Feynman's path integral approach.

Considering the mechanical analogy, the term in x square represents a potential of elastic type – its coefficient could be an elasticity coefficient (not in the sense of the economic notion of 'elasticity'). The term in x'^2 may be associated to a kinetic energy defining the dynamic of each component. The term in x is measuring the influence of the other components having a time dependent coefficient that describes the mutual influence of the other components – this coefficient is a function of sums of sin.cos products depending on short period and long period cycles described above.

In order to analyze the dynamics described by the Lagrangeans we will consider the method introduced by Feynman where in the time dependence of the Lagrangean is eliminated by integrating on given time intervals the Lagrangean and then discussing the behavior described by the resulting Action functional resulting from the integration on each time interval.

If we integrate the Lagrangean (L) on a time interval (since we measure time in Quarters we may consider either one Quarter or 4 Quarters i.e. one year) we get the action associated to the process, in that time interval. Thus, we obtain a functional that has coefficients, which are not time dependent, because they are valid for one Quarter, as we have set the limits of integration.

We may find in each time interval the point of extreme (possibly least) action that is considered to be an equilibrium point for the process in that time interval. These equilibrium points may be different from one time interval to the other and the dynamic evolution of the specific component may be considered to go from one equilibrium, in a given time interval, to the equilibrium in the next time interval.

The evolution trajectory of the process is following the path of least action. The points of least action are the ones given by the annulment of the derivative of the action with x and, they are describing the equilibriums of the process. We stress that in this case we will not have one general equilibrium but, several i.e. one for each time interval of the process.

Thus, the idea of one general equilibrium in economics is only valid in the case the coefficients of the Lagrangean do not depend on time. We have seen in the above considerations that the moment one takes into consideration the reality of the oscillating components of the GDP and their mutual influence, the notion of general equilibrium remains valid only on given time intervals. Moreover, the fact that for each time interval the equilibriums are different, results in different dynamic behavior of the process. The theoretical evidence of this behavior is actually seen in real economic evolution where discontinuous changes occur in combination with smooth behavior and oscillatory periods.

The final analysis we will do here is related to the determination of the Lagrangean for the whole GDP as resulting from the sum of each component's Lagrangean. Then we will integrate the resulting Lagrangean for a series of time intervals to determine the respective action functional followed by a discussion of the type of interval stability and local equilibrium existence.

To determine the sum of Lagrangeans we will express the sin.cos products in each case as sums of sin functions of the determined periods given in table 1 above. Then we will sum all Lagrangean and obtain a possible Lagrangean for the GDP.

The sum of the component's Lagrangeans is presented below:

$$L(x,x',t) = x^2.\left(\frac{1}{2}\right).\sum_{i=1}^{6} c_i.e^{b_i t} + x'^2.\left(\frac{1}{2}\right).\sum_{i=1}^{6} e^{b_i t} + x.10.\sum_{i=1}^{6} e^{b_i t}.\sin(a_i t)$$

The values of the coefficients a_i, b_i, c_i are given in the following table.

Table 4. The values of the coefficients in the summed Lagrangian

i	**component**	**c_i**	**b_i**	**T_i (a_i=2p/T_i)**
1	fin	-0.1	0.81	6.02
2	ind	-1.28	0.55	5.55
3	agr	-1.12	0.84	5.93
4	ctr	-2.46	0.71	4
5	com	-0.99	0.51	6.3
6	srv	-1.44	0.56	5.24

Let us determine the formula for the Action (integrated Lagrangean over a time interval) that is the functional we will consider in order to determine the case of least action that may allow considerations on equilibrium in relation with GDP behavior.

Let's first consider that the time dependent coefficients of x' are actually applied to the values of x at the beginning and end of the time interval that are actually defining x', divided by the length of the time interval. If instead of the end values of the interval we consider the average value then we may introduce a variable noted y for each time interval that will actually be connected with x' in the Lagrangean.

Thus the coefficient of x^2 integrated over one quarter, i.e. t=(0,1), is:

$$A = \left(\frac{1}{2}\right).\sum_{i=1}^{6} c_i/b_i.e^{b_i t} = -5.21$$

The coefficient of y^2 is:

$$C = \left(\frac{1}{2}\right) . \sum_{i=1}^{6} \frac{1}{b_i} e^{b_i t} = 4.27$$

While the coefficient of x is:

$$B = \frac{1}{a_i^2 + b_i^2} \sum_{i=1}^{6} e^{b_i t} . (b_i sin\,(a_i\, t) - a_i \cos\,(a_i\, t) = 15.52$$

The final Action functional $\mathcal{A}$ is of the form:

$$\mathcal{A} = -5.21x^2 + 15.52x + 4.27y^2$$

Let's describe the surface of $\mathcal{A}$ in the phase space (x,y), considering the evolution for each time interval of 1Q from 0 to 16 (i.e. an interval of 4 years).

First the coefficients A, B, and C are given in the next table for the first 8 intervals and the surfaces are presented below.

Table 4. The values for the coefficients of the Action functional for 8 time intervals

Q	A	C	B
1	-5.2	4.3	15.5
2	-10.1	8.4	47.3
3	-19.8	17.0	20.4
4	-39.5	34.7	-119.9
5	-79.6	72.0	-271.1
6	-162.8	151.6	-134.5
7	-337.0	323.3	713.7
8	-706.0	696.9	2456.1

The surfaces of the Action functional are presented below for each time interval. The x values for the extreme values of the surface are in each case either positive or negative. Moreover, the surface is a saddle one that does not have a general equilibrium point but only a maximum for x that is actually a minimum for y. We present the figures for an x-extreme positive and an x-extreme negative value.

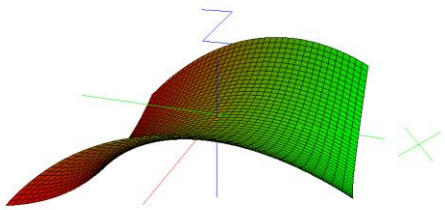


Fig.1.Action functional of GDP for time interval (0,1) – x extreme positive

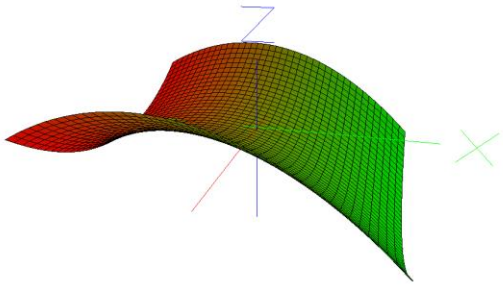


Fig.2. Action functional of GDP for time interval (3,4) – x extreme negative

As we have seen how the Action functional surface is evolving it is clear that the x-extreme values are oscillating from positive to negative and back, this being a representation of the fact that the GDP is not having one general equilibrium but, several dynamical ones. It is also important to note that the surface of the action is a saddle where the extreme point for y is a minimum while the one for x is a maximum.

In order to have a single equilibrium the coefficients of x^2 and of y^2 should have the same sign (negative for an instable equilibrium point and positive for a stable one.

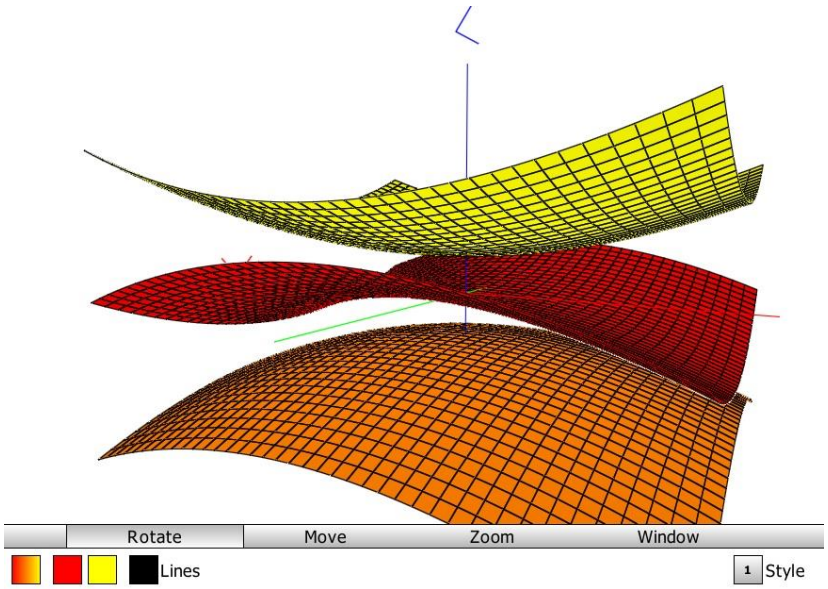


Fig.3. Stable, saddle and unstable equilibrium, Source: Author's calculations

Anyway the situation under consideration is presenting a surface where the behavior may be more complex and crisis could set in more easily. We have only tested the methodology for the set of data from the Romanian economy; it should be logical, though, to launch a wider program for various other economies and various other periods of time, such as to check whether a general stable equilibrium point may show up and what are the conditions for that to happen and to remain constant with time.

4. Conclusions

In the above we have analyzed the oscillatory behavior of the GDP and its components. The data series used for calculations was the one for Romania having a quarterly disaggregation. The components considered were finance, industry, agriculture, commerce,

constructions and services. The oscillatory data for each of them was analyzed first by the Fourier transform determining the spectrum of frequencies for each component. Representation of the amplitudes in the complex plane gave important indications on the stable or unstable behavior of each component. In this case finance resulted to have an unstable behavior that may be the prelude of a potential crisis.

Further on we have determined, using an algorithm in MathCad, the coefficients of the second order differential equations associated to these oscillatory data series. The natural frequencies as well as the transient frequencies, for each component, were determined using a step function excitation method. Having determined these frequencies (i.e. the periods of each component's oscillation) we have analyzed the effects of each pair of components. The resulting behavior is similar to the modulated waves in Physics that produce the so called 'beats'. The results of this approach have identified two types of oscillations: (i) one short period process and (ii) a long period one. The long period processes, regrouped into the GDP, are matching the Kondratieff cycles periods while the complete combination of short and long period processes show that the effect of short periods is to shorten the period of the Kondratieff cycles from more than 40 years to les than 30 years for the economic case considered.

All these combinations of oscillations represented under the form of sin.cos products summed for all components, are creating an external excitation potential that is introduced in the differential equations of each component. Solving these equations (by means of Wolfram Alpha website) gives, along with the complex representation of the dynamics in the phase space, the Lagrangean of each component. The sum of the respective Lagrangeans is associated to the GDP total Lagrangean. The analysis of this Lagrangean is aimed at determining the existence of equilibrium points for the behavior of the process. Since the coefficients of the Lagrangean are time dependent and not only dependent on the x and x' (as coordinates associated to the GDP phase space). We have used the Feynman technique of determining the Action functional resulting from the integration of the Lagrangean function on successive time intervals. The existence of equilibrium points is associated to the extreme values of the surface of the Action functional. The representation of the surfaces resulted from the successive time intervals integration of the Lagrangean gives a saddle type of surface having a saddle extreme point (i.e. maximum for x and minimum for x'). The basic results from this approach show that there is not only one equilibrium point (a general equilibrium) for the process but, a dynamic evolution from one time interval equilibrium to the next (as shown by a path integral approach). Moreover, it results that the saddle point behavior is as real as the potential existence of a general equilibrium – be it a stable or an instable one. Further analysis is proposed, on various other economies oscillatory behavior, in order to identify the conditions required for a general equilibrium as well as the requirements for this unique equilibrium point to last.

Finally, we stress that by taking a different view – more nonlinear – to analyze the behavior of the GDP components, leads to the identification of important results related to the existence and types of equilibrium associated to the dynamic of the process. The general equilibrium is but an exception in a process where there are different equilibria for each successive time intervals of the process dynamic evolution. The types of equilibriums encountered may be stable (the usual general equilibrium), unstable, as well as saddle points. The analyzed economy case showed saddle type of successive equilibriums that suggest potential occurrence of unstable behavior. We think this approach is opening the way to more extended research that should cover data series from various types of economies and various periods, in order to identify the conditions for the existence of a general equilibrium and for its persistence.

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Export and FDI in Asian Countries: Panel Causality Analysis

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Abstract

The FDI of Multinational Companies (MNCs) can be export-oriented or market-oriented, intended to capture the international or local markets respectively. Since the MNCs have better export performance than local firms, in case of export-oriented FDI, this would lead local firms to mimic foreign firms in the same way. On the other hand, the reverse causality running from exports to FDI can also exist. It is argued that FDI is attracted to countries with a higher trade potential both in terms of imports and exports. This paper investigates the causal relationship between Foreign Direct Investment (FDI) and exports in 40 Asian countries by using panel unit root tests and panel cointegration analysis for the period 1970-2010. The results show a strong causality from exports to FDI in these countries. Moreover, FDI does have significant effects on export in short- and long-run. So, the findings imply bidirectional causality between foreign direct investment and export in these countries.

Keywords: Panel Unit Root, Panel Cointegration, Granger Causality, Foreign Direct Investment (FDI), MENA region countries

JEL classifications: F39, O40

1. Introduction

FDI plays a vital role in promoting export and economic growth of an economy. It is argued that FDI promotes exports of the host countries by increasing the productivity and productive capacity of the host country by increasing capital stock, transfer of technology, managerial skills and upgrading the skills of the local workforce through training. Further, FDI also increases the opportunity for the host countries to export by facilitating access to the new and large foreign markets and plays an important role as a major economic engine of globalization. For many developing countries, FDI is a vital item in their strategy for economic development. FDI helps ease the transfer of technological and business know-how that are needed for growth in these countries. Moreover, FDI increases Career Opportunities, improves labor productivity, and provides developing countries access to foreign capital. To obtain the aforementioned FDI benefits, many developing countries implemented policies and strategies aimed at promoting and attracting FDI while other countries abolished trade and investment costs, improved human capital and infrastructure facilities (Romer 1993). The inflow of FDI increased rapidly during the late 1980s and the 1990s in almost every region of the world revitalizing the long and contentious debate about the costs and benefits of FDI

inflows. On one hand many would argue that, given appropriate policies and a basic level of development, FDI can play a key role in the process of creating a better economic environment.

The theory of FDI seeks to explain the existence and growth of foreign investments. It also aims to identify the determinants of FDI flows and the impacts of such flows on the host and home country economies, as well as on world welfare. It is widely believed that FDI in host countries has a very vital role in boosting the economic growth through the employment impact, technology spillover, etc., especially in the case of developing countries. Compared to indirect investment, foreign direct investment has the potential of being a much better tool that offers sustainable economic development.

During the last decade a number of interesting studies of the role of foreign direct investment in stimulating economic growth has appeared. There are two main channels through which FDI may be growth enhancing. First, FDI can encourage the adoption of new technology in the production process through capital spillovers. Second, FDI may stimulate knowledge transfers, both in terms of labour training and skill acquisition and by introducing alternative management practices and better organizational arrangements (De Mello 1997). The developing countries having shortage of capital for their development process; the marginal productivity of capital is higher for these countries. Recently, FDI has gained renewed importance as a vehicle for transferring resources and technologies across the national border. With recognition of technological progress as the major source of economic growth, especially in the endogenous growth literature, the role of FDI has again come on the forefront. It is argued that foreign investment not only provides an initial capital inflow, which assists in the balance of payment of the host country, it is also an important mean of obtaining capital, technology, skilled management, improved marketing know-how and outlets for non-traditional exports. However, the role of FDI in promoting export is a controversial topic and basically depends upon the motive for such investment.

The focus of the paper is, therefore, to examine the relationship between FDI and exports in sample 40 Asian countries for the period 1970-2010. The direction of causality between these two variables is examined by utilizing a cointegration and error correction modeling framework. The paper is organized in four sections. Section 2 reviews the relevant literature. Section 3 discusses the methodology, data and empirical results of the study. Section 4 concludes.

2. Literature Review

The recently literature on FDI believes that FDI's positive effect on growth depends on local conditions and absorptive capacities. Essential among these capacities is financial development. These results argued that countries should reform their domestic financial system before working on attracting FDI. Extensive literature on the determinants of FDI in developing countries clearly indicates the importance of infrastructure, skills, macroeconomic stability and sound institutions for attracting FDI flows. There is an extensive belief among policy makers that FDI generates positive productivity impacts for host countries. The main mechanisms for these externalities are the adoption of foreign technology and skill, which can happen via licensing agreements, imitation, employee training, and the introduction of new processes, and products by foreign firms; and the creation of linkages between foreign and domestic firms. These benefits, together with the direct capital financing it provides, suggest that FDI can play an important role in modernizing a national economy and promoting economic development.

As mentioned by Chowdhury and Mavrotas (2005), a large number of empirical studies on the role of FDI in host countries suggest that FDI is an important source of capital,

complements domestic private investment, is usually associated with new job opportunities and enhancement of technology transfer and spillover, human capital enhancement, and boosts overall economic growth in host countries. Technology diffusion can take place through a variety of channels that involve the transmission of ideas and new technologies. Imports of high-technology products, adoption of foreign technology and acquisition of human capital through various means are certainly important conduits for the international diffusion of technology.

Besides these channels, foreign direct investment by multinational corporations (MNCs) is considered to be a major channel for the access to advanced technologies by developing countries. MNCs are among the most technologically advanced firms, accounting for a substantial part of the world's research and development investment.

Findlay (1978) postulates that foreign direct investment increases the rate of technical progress in the host country through a 'contagion' effect from the more advanced technology, management practices, etc. used by the foreign firms. Wang (1990) incorporates this idea into a model more in line with the neoclassical growth framework, by assuming that the increase in 'knowledge' applied to production is determined as a function of FDI. MacDougall (1960) showed in his neoclassical trade model that Host countries could benefit through production expansion and positive externalities related to technology diffusion. Das (1987) showed that MNEs always benefited from setting up subsidiaries through increased profits and outputs because of their monopoly power, while the effect on profits and output of Host firms was ambiguous, depending on demand and supply elasticity. Even when Host firms did not gain in terms of profits, they did gain in terms of efficiency. Overall, the Host country was assumed to benefit from MNE activity, as prices declined due to improved technology and efficiency. Hossain and Hossain (2012) examined co-integration and the causal relationship between Foreign Direct Investment (FDI) and GDP in the both short and long run of Bangladesh, Pakistan and India over the period of 1972-2008. The results suggest that there is no co-integration between FDI and GDP in the both long and short run in Bangladesh and India. However, we find the co-integration between them in the both short and long run in Pakistan. Conversely, Granger Causality results suggest that there is no causality relationship between GDP and FDI for Bangladesh and one way or unidirectional relationship found for Pakistan and India, which means FDI caused economic output in Pakistan.

3. Data and empirical results

We apply a two variable model to examine the causal relationship between FDI and GDP. Data used in the analysis are annual time series during the period 1970-2010 on (logarithm of) real Foreign Direct Investment (FDI) and real export (EXPORT) in constant 2005 prices in local currency units for 40 Asian countries. The data are obtained from Asian Development Bank (ADB) and World Development Indicators (WDI) 2010, published by the World Bank. The choice of the starting period was constrained by the availability of data. The countries considered in this study are Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyz Republic, Pakistan, Tajikistan, Turkmenistan, Uzbekistan, China People's Rep. of, Hong Kong; China, Korea Rep. of, Mongolia, Bangladesh, Bhutan, India, Maldives, Nepal, Sri Lanka, Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Singapore, Thailand, Viet Nam, Fiji Islands, Kiribati, Marshall Islands, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu, Australia, Japan, New Zealand.

To test the nature of association between the variables while avoiding any spurious correlation, the empirical investigation in this paper follows the three steps: We begin by testing for non-stationarity in the variables of FDI and EXPORT. Prompted by the existence of unit roots in the time series, we test for long run cointegrating relation between variables at

the second step of estimation using the panel cointegration technique developed by Pedroni (1995, 1999). Granted the long run relationship, we explore the causal link between the variables by testing for granger causality at the final step

3.1. Panel Unit Roots Results

The panel data technique referred above has appealed to the researchers because of its weak restrictions. It captures country specific effects and allows for heterogeneity in the direction and magnitude of the parameters across the panel. In addition, it provides a great degree of flexibility in model selection. Following the methodology used in earlier works in the literature we test for trend stationarity of the variables of FDI and EXPORT. With a null of non-stationary, the test is a residual based test that explores the performance of four different statistics. Together, these four statistics reflect a combination of the tests used by Levin-Lin (1993) and Im, Pesaran and Shin (1997). While the first two statistics are non-parametric rho-statistics, the last two are parametric ADF t-statistics. Sets of these four statistics have been reported in Table 1.

The first three rows report the panel unit root statistics for FDI and EXPORT at the levels. As we can see in the table, we cannot reject the unit-root hypothesis when the variables are taken in levels and thus any causal inferences from the series in levels are invalid. The last rows report the panel unit root statistics for first differences of FDI and EXPORT. The large negative values for the statistics indicate rejection of the null of non-stationary at 1% level for all variables. It may, therefore be concluded that the variables of FDI and EXPORT are unit root variables of order one, or, I (1) for short.

Table 1: Test of Unit Roots for FDI and EXPORT

Variables	Levin-Lin Rho-stat	Levin-Lin t-Rho-stat	Levin-Lin ADF stat	IPS ADF stat
FDI	0.38	-0.61	-0.80	-1.10
EXPORT	-0.89	-1.12	-0.84	-1.32
ΔFDI	-11.54***	-8.91***	-8.90***	-16.91***
ΔEXPORT	-12.51***	-7.98***	-9.76***	-12.09***

***significant at 1%

3.2. Panel Cointegration Results

At the second step of our estimation, we look for a long run relationship among FDI and EXPORT using the panel cointegration technique developed by Pedroni (1995, 1999). This technique is a significant improvement over conventional cointegration tests applied on a single country series. While pooling data to determine the common long run relationship, it allows the cointegrating vectors to vary across the members of the panel. The cointegration relationship we estimate is specified as follows:

$$EXPORT_{it} = \alpha_i + \delta_t + \beta_i FDI_{it} + \varepsilon_{it} \qquad (1)$$

Where α_i refers to country effects and δ_t refers to trend effects. ε_{it} is the estimated residual indicating deviations from the long run relationship. With a null of no cointegration, the panel cointegration test is essentially a test of unit roots in the estimated residuals of the panel. Pedroni (1999) refers to seven different statistics for this test. Of these seven statistics, the first four are known as panel cointegration statistics; the last three are group mean panel cointegration statistics. In the presence of a cointegrating relation, the residuals are expected to be stationary. These tests reject the null of no cointegration when they have large negative values except for the panel-v test which reject the null of cointegration when it has a large

positive value. All of these seven statistics under different model specifications are reported in Table 2. The statistics for all different model specifications suggest rejection of the null of no cointegration for all tests except the panel and group $\rho-$tests. However, according to Perdroni (2004), ρ and PP tests tend to under-reject the null in the case of small samples. We, therefore, conclude that the variables FDI and EXPORT are cointegrated in the long run.

Table 2: Results of Panel Cointegration test

Statistics	
Panel v-stat	9.95***
Panel Rho-stat	-1.01
Panel PP-stat	-7.90***
Panel ADF-stat	-5.36**
Group Rho-stat	-0.72
Group PP-stat	-7.46***
Group ADF-stat	-8.02***

***significant at 1%

3.3. Panel Causality Results

Cointegration implies that causality exists between the series but it does not indicate the direction of the causal relationship. With an affirmation of a long run relationship among FDI and EXPORT, we test for Granger causality in the long run relationship at the third and final step of estimation. Granger causality itself is a two-step procedure. The first step relates to the estimation of the residual from the long run relationship. Incorporating the residual as a right hand side variable, the short run error correction model is estimated at the second step. Defining the error term from equation (1) to be ECT_{it}, the dynamic error correction model of our interest is specified as follows:

$$\Delta EXPORT_{it} = \alpha_{yi} + \beta_{yi} ECT_{i\ t-1} + \gamma_{y1i}\Delta FDI_{i\ t-1} + \gamma_{y2i}\Delta FDI_{i\ t-2} + \delta_{y1i}\Delta EXPORT_{i\ t-1} + \delta_{y2i}\Delta EXPORT_{i\ t-1} + \varepsilon_{yit} \quad (2)$$

$$\Delta FDI_{it} = \alpha_{hi} + \beta_{hi} ECT_{i\ t-1} + \gamma_{h1i}\Delta FDI_{i\ t-1} + \gamma_{y2i}\Delta FDI_{i\ t-2} + \delta_{h1i}\Delta EXPORT_{i\ t-1} + \delta_{h2i}\Delta EXPORT_{i\ t-1} + \varepsilon_{hit} \quad (3)$$

Where Δ is a difference operator; ECT is the lagged error-correction term derived from the long-run cointegrating relationship; the β_y and β_h are adjustment coefficients and the ε_{yit} and ε_{hit} are disturbance terms assumed to be uncorrelated with mean zero.

Sources of causation can be identified by testing for significance of the coefficients on the lagged variables in Eqs (2) and (3). First, by testing $H_0 : \gamma_{y1i} = \gamma_{y2i} = 0$ for all i in Eq. (2) or $H_0 : \delta_{h1i} = \delta_{h2i} = 0$ for all i in Eq. (3), we evaluate Granger weak causality. Masih and Masih (1996) and Asafu-Adjaye (2000) interpreted the weak Granger causality as 'short run' causality in the sense that the dependent variable responds only to short-term shocks to the stochastic environment.

Another possible source of causation is the ECT in Eqs. (2) and (3). In other words, through the ECT, an error correction model offers an alternative test of causality (or weak exogeneity of the dependent variable). The coefficients on the ECTs represent how fast deviations from the long run equilibrium are eliminated following changes in each variable. If, for example, β_{yi} is zero, then EXPORT does not respond to a deviation from the long run

equilibrium in the previous period. Indeed $\beta_{yi} = 0$ or $\beta_{hi} = 0$ for all i is equivalent to both the Granger non-causality in the long run and the weak exogeneity (Hatanaka, 1996).

It is also desirable to check whether the two sources of causation are jointly significant, in order to test Granger causality. This can be done by testing the joint hypotheses $H_0 : \beta_{yi} = 0$ and $\gamma_{y1i} = \gamma_{y2i} = 0$ for all i in Eq. (2) or $H_0 : \beta_{hi} = 0$ and $\delta_{h1i} = \delta_{h2i} = 0$ for all i in Eq. (3). This is referred to as a strong Granger causality test. The joint test indicates which variable(s) bear the burden of short run adjustment to re-establish long run equilibrium, following a shock to the system (Asafu-Adjaye, 2000).

The results of the F test for both long run and short run causality are reported in Table 3. As is apparent from the Table, the coefficients of the ECT and EXPORT are significant in the FDI equation which indicates that long-run and short-run causality run from EXPORT to FDI. So, EXPORT strongly Granger-causes FDI. The interaction terms in the FDI equation are significant at 1% level. These results imply that, there is Granger causality running from EXPORT to FDI in the long-run and short run. Moreover, FDI have strong effects on EXPORT in both the short- and long-run. In other words, we find bidirectional causality between EXPORT and FDI in these countries, so that whenever a shock occurs in the system, both FDI and EXPORT would make short-run adjustments to restore long-run equilibrium.

Table 3:Result of Panel Causality Tests

	Source of causation(independent variable)				
Dependent Variable	Short-run		Long-run	Joint (short-run/long-run)	
	ΔGDP	ΔFDI	ECT(-1)	ΔGDP, ECT(-1)	ΔFDI, ECT(-1)
ΔGDP	-	F=6.43***	F=6.63**	-	F=8.76***
ΔFDI	F=6.86***	-	F=7.97***	F=8.94***	-

***significant at 1%

3. Conclusion

The objective of this study is to examine Granger causality between FDI and exports for 40 Asian countries over the period 1970-2010. The panel integration and cointegration techniques are employed to investigate the relationship between the variables: FDI and exports. The empirical results indicate that we cannot find enough evidence against the null hypothesis of unit root. However, for the first difference of the variables, we rejected the null hypothesis of unit root. It means that the variables are I(1). The results show that there is a long-run relationship between FDI and export. Utilizing Granger Causality within the framework of a panel cointegration model, the results suggest that there is strong causality running from export to FDI with strong feedback effects from FDI to export in the Asian countries. So, the policy makers should make environment attractive to FDI by decreasing the cost of doing business and developing the infrastructures like power, roads, education and so on. Providing the higher political stability in the countries and increasing the war on corruption are some other recommendations.

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Making public offers in the European Union

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Abstract

If a couple of decades ago, the external capital of the European corporations was obtained almost entirely by bank loans, in the present, the situation changed and the finance obtained by issuance of securities is more important. The most significant increase took place on the stock exchange where, in the last few years, the average annual increase of the volume of transactions was major. In these conditions, the problem of creating a standard framework and, consequently, more efficient at the level of the European Union became more stringent because it facilitates for the European corporations the access to the capital with lower costs. The European Commission regulated through some Directives the access to the capital markets and through the MiFiD Directive, major changes were brought with regards to the whole image of the financial markets. It is difficult to estimate accurately the impact that it will be brought by these changes. Maybe the "Bing Bang" notion, used already by part of the analysts, it is not the most suited, but surely the MiFiD Directive will form the catalytic agent of the significant changes of the markets.

Keywords: Directive, European Union, Public offer, Issuer, Shares, Prospectus

JEL Classification: G15

Introduction

The essential, historical difference between the majority of the West European countries and further, of the European Union and U.S.A. - the participation on the real estate market of the big capital owners - trading banks - determined evolutions, until the recent evolution, different in respect that in Europe, the corporative sector was more dependent to the banking loans (which it could obtained in better conditions than the American companies) than by the external financing (by the capital market). At the beginning of year ’80, approximate 80% of the external capital of the European corporations was obtained by banking loans. Currently, the situation changed, the financing by issuance of real estate values acquiring a significant importance, although is yet under the U.S.A. level.

The most significant increase produced on the share market, when, during the last years, the annual average increase of the volume of transactions was a significant one.

In these circumstances, the problem of creation of a uniform frame, and, consequently, more efficient at the European Union level becomes more and more pressing, it facilitating the capital access of the European corporation with lower costs. There are two possible ways for the issuance of real estate values in the European Union countries.

The first one starts from the premise that it has been issued a primary listing in one of the EU countries, and, based on the approved documentation, where the primary listing was issued, it may be obtained a secondary listing, on one or several European capital markets. This approach is based on the principle of mutual recognition, a principle included in the EU legislation, which makes the public tenders within EU more attractive.

It must be remarked that the principle of the mutual recognition is only applied to the tender documentation itself, the company must satisfy the admission requirements of each

stock market. These requirements attained a significant degree of harmonization, due to the Directive regarding the Admission adopted in 2003.

A second possibility would be that, in each country where the primary tender takes place, the company follow the entire procedure, in accordance with the local requirements, regarding the issuance prospectus, approval of issuance, etc.

EU, by its status, also grants other advantages for an issuance of real estate values, between these being the information obligations imposed to a company by the stock markets where it has a secondary listing. In the countries where a public tender is made without listing, the information obligations are less strict due to the fact that the relevant company is already subject to the continuous disclosure obligation, imposed by the stock market where the company issued the primary listing. The mutual recognition rules are also applied to the documents of the public tender, when it does not follow the listing. Consequently, the prospectuss of the public tenders, which fulfill the conditions of the EU directives, they must be recognized as prospectuss of the public tender in all the EU member states (after the prospectuss or their summary have been translated and information with a local character have been added).

Despite the harmonization in a great extent of advertisement by prospectus, the restrictions regarding the advertisement that precedes the issuance are different in the different EU countries. Also, there are big differences between the national regimes, in respect to the market stability.

EU directives in the domain of issuance of the real estate values

For the issuance of a sole market for the real estate values at the EU level, there have been adopted a series of directives. They establish:

1. the minimal common standards for listing of the real estate values in the values stock markets of the member states for the supplied information by the initial issuers (the prospectus) and further, permanently, both for those who listed the real estate values in the stock market, and for those who did not list them, but issued them by public tender;
2. insider dealing;
3. the harmonized investment rules for the investment funds.

The EU member states are discouraged to impose more rigorous requirements by the additional principle of the mutual recognition. The two principles – harmonization and mutual recognition – are completed one another by the fact that the harmonization of minimal standards makes easier the acceptance of the mutual recognition.

According to these principles, the elements of listing that have been approved by a competent authority of one of the EU member states, after these have been translated and the relevant information imposed by the local market have been possibly added, must be accepted as adequate in the other EU member states.

To maximum benefit of the application of these principles, the admission requests to listing to be made all within up to three months, for all the European stock markets of the EU member states.

The main directives in force in the domain of real estate values are:

a) Directive regarding the admission of titles (Directive 2001/34/EC OJ- 6.7.2001 L 184/1). This directive was approved starting from the encoding need of legislation in the domain of real estate values and replaces the Directive 79/279/EEC of 5.03.1979 of coordination of the admission conditions of the real estate values at the official quote of a stock market of values, Directive 80/390/EEC of 17.03.1980 of coordination of the issuance, control and distribution conditions of the prospectus that must be published for the admission

of the real estate values at the official quote of a stock market of values, Directive 82/121/EEC of 15.02.1982 regarding the information that must be periodically published by the companies of which shares have been issued at the official quote of a stock market of values and Directive 88/627/EEC of 12.12.1988 regarding the information that must be published at the acquisition or transfer of an important partnership in a stock quoted company. The Directive regulates the conditions that must be fulfilled for the admission to listing of the recouped real estate values on categories – shares, titles of credit and certificates that represent shares. Also, it institutes a standard model of prospectus of issuance and regulates the exception situations in which the regulation authorization may accept the publishing of a simplified prospectus.

In case that, for the same real estate values, it is required, simultaneously or on close dates, the admission to the official quote of stock markets that are situated or that operate in two or several Member States, including the member state where it is located the headquarters of the issuer, the prospectus must be elaborated in the member state where the issuer has its headquarters and approved by the competent authorities of that state; in the case that the headquarters of the issuer is not situated in one of these member states, the issuer must choose a state from them, according to the legislation, to which the prospectus will be issued and approved. The prospectus must be recognized, under the reserve of its translation, by the other member states where the admission to the official quote was required, without being necessary any more the procurement of the approval of the competent authorities of these states, and without these be able to request the inclusion in the prospectus of additional information, except for the inclusion of specific information for the market in the admission country, especially regarding the income taxation system, to the financial organization that insure the financial service of the issuer in that country and in the manner in which the notifications designed for investors.

According to the Directive, the issuer of the real estate value has the obligation to send a copy of each financial bi-annual report, simultaneously with the competent authorities of each member state in which its shares are allowed at the official quote. This shipment must be performed until the bi-annual report is published for the first time in a member state.

Each member state had to appoint the competent authority in the domain of admission to listing of the real estate values; these authorities undertake to insure the observance of the provisions of this directive.

The competent authority of each EU member state may change or cancel the conditions or obligations they impose and which are additional to those specified in the directive, but it has a limited power to issue the specifications of the directive. Each member state may impose additional conditions or more restrictive obligations for the issuers selected for listing, but they must be applied in a non-discriminatory manner.

b) Directive regarding the elements specific to listing (Directive 2003/71/EC, regarding the prospect that must be applied in the case of a public tender of real estate values or for the admission of the real estate values at transaction and amendment of Directive 2001/34/EC O.J.31.12.2003 L 345/64). The directive treats the prospect that must be published in the case of a public tender of real estate values or for the admission of the real estate values at transaction and constitutes an amendment of Directive 2001/34/EC, previously presented. At European level, it has been drawn the conclusion that the provisions of Directive 2001/34/EC regarding the issuance prospect, taken over from the previous relevant Directive – Directive 80/390/EEC, as well as the provisions included in the Directive 89/298/EEC regarding the coordination of conclusion, control and diffusion conditions of the prospect that must be published in the case of a public tender of real estate values, provide a mutual recognition mechanism, partial and complex, which does not allow the issuance of the

introduction objective of a "unique passport" in respect to the issuance prospect. It imposed that these directives to be improved, updated and reformulated in a unique text.

The purpose of Directive is the recognition without additional formalities of the issuance prospectus, issued in one of the member states and approved by the competent regulation authority. The regulation starts from the premise that the granting of a "unique passport" valid in the whole Community to the issuer, imposes that the origin country (member state) to be appointed as being the most indicated to regulate the operations of the relevant issuer.

The prospectus must include information regarding the issuer and the real estate values that must be publicly granted or that are proposed to the transaction on a regulated market. The prospectus will also include a summary, where there will be briefly presented, in a language that is not technical, the main characteristics of the issuer, of the possible warrantors and of the real estate values and the main risks presented by them, in the language in which the initial prospect was issued.

Also, it will be specified in the prospectus who owns the liability towards the supplied information, in the conditions that this liability comes at least to the issuer or its administration, management or supervisory organs, to the tenderer and person who requires the admission in transaction on a regulated market or the warrantor, as the case may be. It is necessary that the prospectus clearly identify the liable persons upon their name and title or, in case of the legal persons, upon their denomination and headquarters, and will contain a statement, from their part, by which it is certified, according to their competence, that the data of the prospect are according to reality and do not contain omissions that could alter their value.

The prospectus will rest valid for twelve months since its publishing, to cover other public tenders or other admission to transaction on a regulated market. The prospectus is subject to a prior procedure of approval from the authority of the issuer state. After the approval of prospectus, it is deposed to the competent authority of the origin member state and it is made available for the public by the issuer, tenderer or the person who requests the admission to transaction on a regulated market, as soon as possible, and, at any rate, within a reasonable term before the commencement, or at least, at the beginning of the public tender or the admission to transaction of the real estate values. In addition, in the case of the first public tender of a category of not yet admitted shares for transaction on a regulated market and which must be accepted for the first time, the prospectus will be valid in at least six business days before closing of the tender.

The competent authority of the member origin state supplies the competent authorities of the host member states a certificate of approval, certifying that the prospectus was issued in accordance with the community legislation, as well as a copy of the mentioned prospectus. As the case may be, this notification will be accompanied by the translation of the summary, issued under the liability of the issuer or of the person in charge with the conclusion of prospectus. In case that it is provided a public tender or an admission to transaction on a regulated market in one or several member states or in a member state, other than the origin member state, the approved prospectus in the origin member state is valid in respect of the public tender or of an admission to transaction in a number whatsoever of host member states, as long as the competent authority of each host member state receives the above mentioned notification from the competent authority of the origin state.

In respect to the lingvistic regime, in the case that a public tender is made or when it is required the admission to transaction on a regulated market only in the member origin state, the prospectus is issued in a language accepted by the competent authority of this member state. In the case that it is made a public tender or when it is required the admission to transaction on a regulated market in one or several member states, except for the origin

member state, the prospectus is either issued in an accepted language by the competent authorities of these member states, or in a current language of the international financial domain, accordingto the option of issuer, of tenderer or of the person who requires the admission to transaction, as the case may be. The competent authority of each host member state may request the translation of the summary of the issuance prospect, only in its official language or languages.

c) Directive 85/611/EEC (OJ L 375, 31.12.1985) regarding the coordination of legislation, regulations and administrative provisions regarding the initiatives for collective investments in transferrable real estate values establishes the frame for the supervisory, structure, activities and information requests in the case of investment funds, allowing, the same time, their marketing in all the countries after the authorization in one of the member states.

d) Directive regarding the financial documents (Directive 2004/39/CE JO L 145 30.4.2004). The initial directive, D 93/22/EEC regarding the investment services in the domain of real estate values, followed the establishment of an environment in which the investment companies and the authorized banks could, based on the authorization issued and on the supervisory exercised by the competent authorities of their origin member state, to supply certain services or establish branch offices in other member states. In this respect, the directive D 2004/39/EC tries to harmonize the initial conditions of authorization and operation, applicable to the investment companies, including the conduct norms.

It was necessary the establishment of a global regulation frame, which regulate the performance of transactions with financial documents, no matter what the transaction methods used for this purpose would be, to warrant a higher quality of performance of the operations of investors and to keep the integrity and global efficiency of the financial system, by adoption of a coherent regulation frame and adapted to risks, applicable to the main types of observance systems of the currently valid orders on the European financial market.

The directive institutes a unitary system of the authorization regime of an investment company, designed to allow it to supply the services or exercise the activities for which it has been authorized in the whole Community, either by establishment of a branch office, or by the free provision of services on the whole territory of Community.

For the authorization, the investment companies are obliged to supply all the required information by the competent authorities, including a program of activity that presents especially the type of operations taken into account and the retained organizational structure, as well as the communication of the identity of shareholders and associates, direct or indirect, natural and legal persons, who own a qualified participation, and the value of this participation.

The directive institutes under the charge of regulation authority a term of response of 6 months, within which the solicitor of authorization will be informed with respect to the granting or rejection of authorization.

The directive generally applies to any company, supplying investment services – brokerage, dealing, portfolio management, underwriting and distribution of real estate values, account administration and investment consultancy. The directive includes provisions regarding the authorization in the status of origin and business behavior rules. According to this directive, any company that is authorized in a EU member state for the supplying of the above mentioned services, fulfilling the minimum criteria of capital and information, regarding the partnerships of shareholders, having a management with a good reputation and sufficient experience, may develop the same type of activities in another EU member state. The same time, this directive provides internal organization rules of these companies, for the insurance of the safety of transactions and allows them to become members of the stock markets in the relevant country.

e) Directive regarding the insider – dealing-ul and market manipulation (D 2003/6/EC OJ L 96, 12.4.2003). This directive consolidates the integrity of the market, establishing a clear engagement of the EU countries to transparency and an equal treatment of the actors of the capital market, regarding all the real estate values admitted to transaction on at least one of the markets of the European Union countries. Also, this directive establishes clear transparency standards for all the persons who recommend investment strategies to the public, obliging them to present, if any, their relevant interests in the respective transactions.

This frame directive is the first one adopted after the resolution of the European Council of March 2001 at Stockholm on the legislation in the domain of real estate values that adopted a new regulation frame, based on the Report of the Committee of Discreets of 15.02.2001 on the regulation of the European market of real estate values, issued under the management of Alexandre Lamfalussy.

According to this report, the new approach frame of the unification process of the capital markets at the EU level will be developed on 4 levels:

level 1 - the level of the frame Directives that will allow the European Commission, the European Parliament and the Council to focus on the essential principles of the regulations in domain;

level 2 – a level of the necessary technical details for the implementation of these principles and which are in the responsibility of an European Commission for Real Estate Values and of an European Committee of the Regulation Organs;

level 3 – consolidation level of cooperation for the harmonization of differences in each EU country – in the responsibility of the European Committee of the Regulation Organs;

level 4 – pursuance level of application of the regulations in the responsibility of the European Commission.

The major advantage of this system is constituted by the increase of speed in the adoption of the European legislation in domain and the increase of flexibility of the decision process at the European Union level.

Effect of Directives

The purpose of these directives is the insurance of protection of the potential investor in real estate values, by establishment of a minimal set of information, which must be supplied, as well as the simplifying of the issuance process of the real estate values within EU.

The main effects are:

1. The issuers who pursue the listing of their real estate values must fulfill a minimum set of conditions for their admission to listing, as well as a minimum set of obligations, in respect to the information of investors and competent authorities, all these being specified in the admission Directive. In addition to these, they must fulfill the additional obligations imposed by the country where the listing is pursued;
2. The tenders for the public without a further listing in the stock market must be made by fulfillment of the conditions of Directive regarding the prospectus;
3. The specific elements to listing, in case that it is pursued to listing in the stock market, it must be in accordance with the minimal requirements imposed by the Directive regarding the specific elements to listing;
4. The specific elements to listing, issued in a state, in accordance with the provisions regarding them and approved by the competent authorities of the relevant state, must be recognized in all the EU member states where the request for listing is made concomitantly or after a short period of time after the translation and adding of

elements with local specific. There does not exist any specification regarding the recognition of specific elements to listing as a prospectus for the public tender in another state;

5. The prospectuses for the public tender, which fulfill the conditions of the Directive regarding the specific elements to listing and that have been approved by the competent authorities of a state, must be recognized, both as prospectuses of public tender, as well as specific elements to listing in any other EU state.

According to the provisions of these directives, it is possible to perform a simultaneous listing in the stock markets of different EU member states, based on a single set of documents. Also, it is possible to be made the simultaneous public tender of real estate values in several states based on a single document.

Despite the progresses made by the adoption of these directives, there are still remarkable differences between the regulations and business practices on the capital markets of the EU member states, their integration process being still far to be finished. Therefore, it is necessary the implementation of measures of level 2, 3 and 4, foreseen in the report of the Committee of Descreets, presided by Alexandre Lamfalussy.

Mainly, according to the legislation in force this moment, it is practically impossible that an event use a single prospectus of issuance to issue real estate values in the EU member states. Each country may require the translation of prospectus or of its summary, additional information regarding the issuer and its financial statements, as well as their presentation according to the accountancy standards, required on the relevant market.

Also, there are still important differences regarding the public tenders depending on the countries, in respect to the advertisement before the issuance, the possibility of managing a tender with open price on each national market and the possibility that the members of the intermediation sindicate to develop market stability activities, the associated responsibilities to the prospectus, reporting requirements for the issuers, both for the issuance of tender, as well as the further obligations of permanent information, the local authorization for the intermediaries implied in a global tender.

The advertisement before the issuance difference depends on different states of EU. Therefore, while in the Great Britain, the investment announcements like the preliminary prospects may be supplied for certain categories of "investment professionals" without being necessary that these be approved or issued by an authorized person (Art. 9 of FSA 1986 - 93 - financial journalists, governmental authorities, local authorities and public organs, as well as certain categories of companies), in France, as a general rule, it is not allowed any kind of advertisement before the prospectus approval by COB2 and its publishing in the Bulletin of Legal, Obligatory Announcements - BALO. In Luxembourg, it does not exist special provisions regarding the advertisement that precedes the issuance. All the materials of this kind must be subjected to the joint stock of Luxembourg, applying the legal regulations regarding the use of different forms of advertisement, as well as regarding the consumer protection and interdiction of the un-required tenders. In Germany, it does not exist the practice of an extended marketing advertisement that precedes the public tender. It neither exist any approval regime of the marketing company. Instead, all its components must refer to the prospectus that will be published. All the announcements and advertisement ads, which are made, must be subjected to the office for admissions.

Also, the placement methods are different depending on the market. Therefore, the unerwritting at open price (establishment of the tender price at the end of the tender period) is not allowed in Germany, nor in the Great Britain. In the countries like the Netherlands or Luxembourg, it is not used, while in the countries like France or Spain, it is allowed by the condition of publishing of sufficient information for the investors act learnedly. In these

conditions, the risks for the intermediary increase very much in the countries where this method is not allowed, appropriately leading to the increase of the costs of transactions.

The stability of market, immediately after listing of a public tender, is differently regulated in the EU states. Therefore, while in the most of the EU states, this activity may be developed without the prior notice of the regulation authorities, by the condition of observance of the regulations regarding the insider—trading and the fraudulent manipulation of the market, for others, (i.e. France), it must be previously announced at the regulation authority and may be developed during a limit period of time.

As a general conclusion, at the European Union level, there have been made important steps regarding the establishment of the integrate capital market (as a component of the integrate financial market) a series of factors and obstacles still impede the aiming of this objective. Among them, we remember:

- the unappropriate implementation of the existent regulations;
- the cultural differences regarding the corporative management;

The consequence of these inconsistencies is the market fragmenting, increase of the transaction costs and access limitation of the issuers to the external financing sources, which may be mobilized by the capital markets. All these lead, normally, to a relative rest behind of the European markets (for shares and associated titles) compared to the U.S.A. market.

The future evolution of the European Union market

There is currently a normative act that confers a larger opening of the European financial market than the prior documents. We are talking about the Directive regarding the financial market documents MiFID (Directive 2004/39/EC regarding the financial documents markets, of amendment of the Directives 85/611/EEC and 93/6/EEC of the Council and of the Directive 2000/12/EC of the European Parliament and of the Council and abrogation of the Directive 93/22/EEC of the Council). This document occurred as consequence of the fact that the idea of the “European passport” did not operate in the foreseen manner. It was necessary an update and a so-called “freshness injection” within the financial investment services, a vital industry in respect to the “delayed effect bomb) of pensions at the European level. The same time, the investment protection was necessary to be updated for the drawing of new investors on the financial market of the European Union. Also, new financial services like the consulting in investments, as well as new derived financial documents needed to be introduced in the regulation domain.

MiFiD Directive abrogated the so called “concentration rule". It means that in several Member States, the stock markets of values will be exposed to competion for the first time in respect to the multilateral exchange facilities of systematic insiders. The same time, the MiFiD Directive updates and extends the “unique passport” for the investment companies that have been introduced in 1993 by the Directive regarding the investment services. This directive allows the issuance of investments in the Member States, based on a single authorization received from the regulation authority of the origin member state. In exchange of this facility, the protection rules of investors follow to be harmonized at European level, for them to benefit by warranties, regarding the conduct standards, when they call the investment companies, independently where they had the headquarters.

In these conditions, the MiFiD Directive will be important not only for the industry of financial services, but also for Europe as a whole. While other Directives of the Commission regulated the access means on the capital markets (as for example, the Directive regarding the issuance prospectus, the Directive regarding the information obligation, etc.), The MiFiD Directive brings deep changes with respect to the image as a whole of the financial markets.

It is difficult to appreciate exactly the impact that these changes will bring. Maybe the notion of “Big bang”, already used by certain analysts, is not the most appropriate. But one

thing is clear, the MiFiD Directive will constitute the catalyser of significant changes of the markets. We will assist to an increase of the trans-border competion level and to a true war of low costs, both in respect to the issuers of real estate values, as well as regarding the investors who enter on the capital market.

The MiFiD Directive attained a crucial phase. Also known as the "Lamfalussy Directive", this directive transposes into practice the measures of "Level 1", consisting in the establishment of the basic principles of regulation of the capital markets. The implementation measures – the so called "level 2" is still in the Commission debate.

If the barriers that rest against the opening of a common market are removed, if the unique market and the "unique passports" are available, it may go further to the adoption of the measures of Level 2. It is not an easy process. Like any other process at European level, the Lamfalussy process supposes a complex system of inspections and approvals. And this is the way it should be in the context of imperative, as a substantial number of institutions and authorities to be implied in the decisional process.

The measures of Level 2 will rigorously follow the compromises and agreements that made possible the attainment of level 1. The establishment of a common space in the real estate values domain, which also include all the Member States, is certainly a hard attainable desiderate, but not impossible to attain. The European Committee for Real Estate Values (CESR) has already offered a specialty approval regarding the foreseen measures. At the European level, a series of issues included in this approval have been accepted. Another part needs still the attainment of a consensum at European level. But a fact is sure, the European investment companies are already meeting the actors who act on the global financial markets. And it is foreseen the occurrence of new such actors on this market of the financial services, like India and China, countries that compete with the European competitors, not only regarding the industries that need a cheap labor force, but also in domains regarding the high technology. It is only a matter of time that these competitors to become major actors also on the financial markets. And in these circumstances, it is necessary the establishment of a legal frame, which allow the European companies of financial services to act both on the common European market, and on the emergent capital markets.

And this legal frame must be clear, without ambiguities, and, as possible, pan-European.

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- *Law no.297/2004 regarding the capital market*
- *Law nr. 514 / 2002 for the approval of GEO no.25 / 2002*

INTERNET

- *http://www.cnvmr.ro* – The official site of the Romanian National Securities Commission
- *http//www.bvb.ro*- The official site of the Bucharest Stock Exchance
- *http//www.RoClear.eu*- The official site of the Depozitarului Central
- *http://www.kmarket.ro* – The official site of the capital market in Romania;
- *http://www.mfinante.ro* - The official site of the Ministry of Finance
- *http//www.iosco.org*- The official site of the IOSCO
- *http//www.cesr-eu.org*- The official site of the CESR
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Institutional System Response Mechanism towards Corruption: A Point of View

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Abstract

In Romania, a lot of practices proper to corruption became widely common and are integrated in a real national bureaucratic culture. Romanian citizens seem to accept and tolerate informal payments in order to obtain the desired or the necessary services. Public officials are doing well, impersonal and they don't realize they affect social welfare. That's why fight against corruption must involve complex actions performed on many areas. Such action must be focused on measures that reduce the opportunities for corruption and increase the probability of detection and punish the offences.

Key words: corruption, corruption mechanism, institutional system, illegal behaviour

JEL Classification: H50, K42

1. Corruption sources

First, it is important to understand the complexity and the mechanisms of corruption itself. Corruption does not comply with the fundamental principle of not involving personal business with public affairs. "Corruption in the public sector can be viewed as occurring when politicians and/or public servants improperly and unlawfully enrich themselves or those close to them by the misuse of the public power entrusted to them - the misuse of public power for private profit"[6]. This definition may refer to many corruption sources because public officials are doing well, impersonal and they don't realize they affect social welfare. That's why corruption approaches divide this area in two main categories:

- *Street, little or tolerated corruption*: It is practiced by underpaid public officials whose living is depending of gifts and bribery given by individuals who want to accede easier to public services (medical, educational etc.), to use some opportunities (concerning a job, for example), to avoid a penalty and many others like these.

- *Political or grand corruption*: It is practiced by public officials who are involved in the process of public political decisions and are driven by the desire to obtain important economic values from public contracts as "percentages" from governmental sales, often paid into foreign bank accounts. The political corruption affects many areas of government activity:

- Contracting and procurement services;
- Import and export licenses;
- Fiscal system and personal duties collection;
- Infrastructure agreements;
- Local police and services.

[6] Tanzi V. (1994), Corruption, Government Activities and Markets, IMF Working Paper, August.

These types of corruption are proper to many countries, independently of its population, economic development level or social needs. The only different matter is referring to degrees and dynamic of corruption. Corruption opportunities are given by lack of judicial system, inaction of notified bodies, political opportunism and many others. The inclination to a corruptible behaviour is increased by low income levels, civic attitude, individual perception and country tolerance of such practices.

In Romania, all these practices became widely common and are integrated in a real national bureaucratic culture. Romanian citizens seem to accept and tolerate informal payments in order to obtain the desired or the necessary services.

2. What are the costs of corruption?

Corruption distorts individual choice. It affects public decisions regarding public goods and services. The main corruption effects on population welfare are the following:

- Inappropriate financing of public projects leading to a huge resources waste that could be used to improve social services;
- A diminish of the total amount available for public purposes;
- An increase of goods and services costs and a decrease of their quality;
- Promoting not sustainable projects concerning unproductive investments;
- A loss of productive efforts;
- An increase of transactions and administration prices;
- Inflated prices for goods and services;
- Imposed monopolies;
- Purchasing of unusual, unnecessary and expensive goods through governmental contracts prevailing money and not real human needs;
- An increase of foreign banks gains and a failure of public political objectives;
- A loss of governmental respect, authority and legitimacy.

We have to underline that where the corruption benefits are significantly, the consequences are huge.

3. The main causes of institutional corruption

There are many causes that generate the corruption behaviour. We want to mention only a few of them including:

- Wide discretion and little accountability of public officials.
- Inappropriate policy environment (distorted prices).
- Lack of checks and balances (weak “watchdog” agencies and institutions, including Parliament).
- Weak enforcement mechanisms (lack of judicial independence; weak prosecutorial institutions).
- Low salaries in public sector[7].

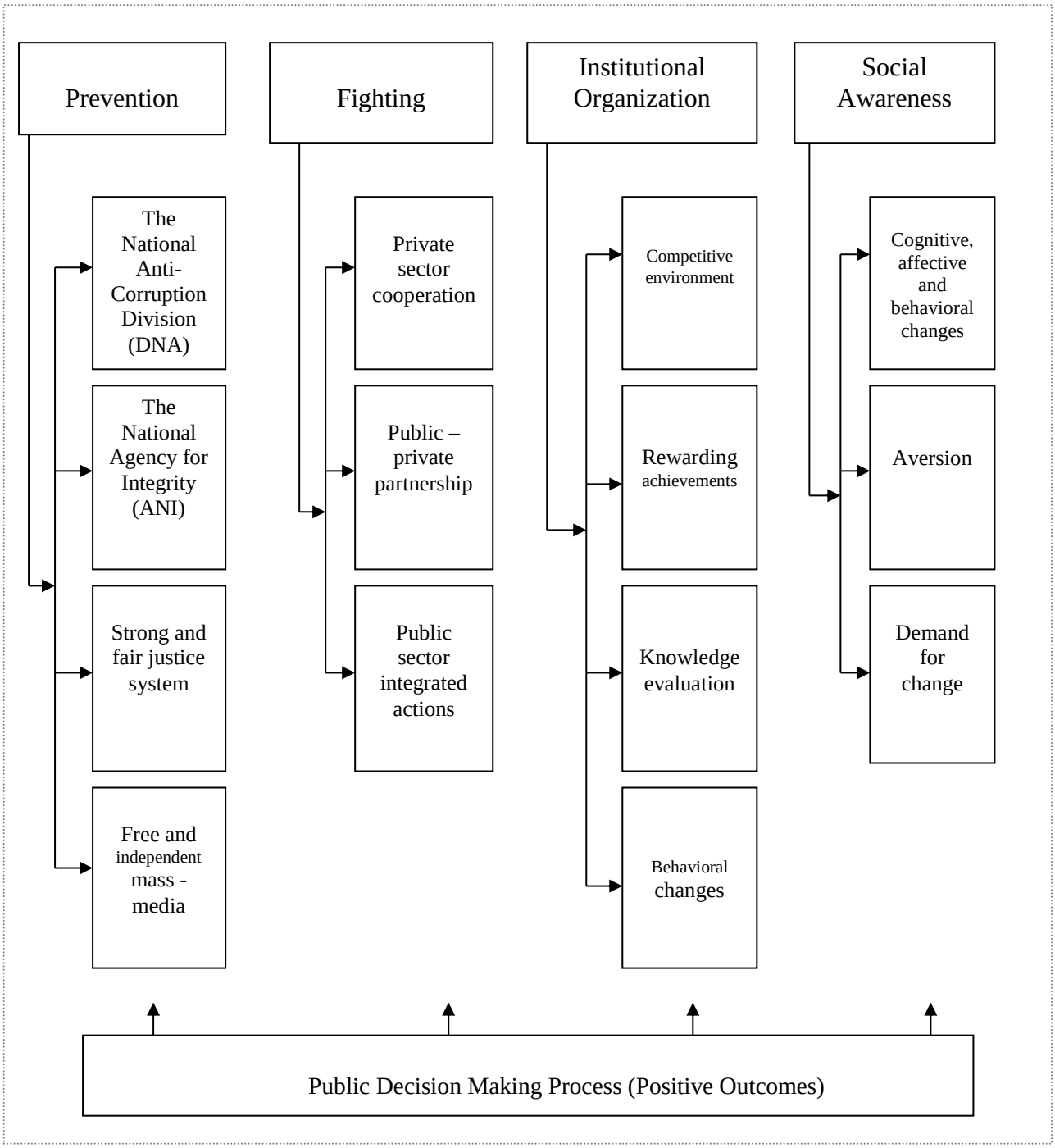
4. Institutional System Response Mechanism towards Corruption

Fight against corruption must involve complex actions performed on many areas (Figure 1). Such action must be focused on measures that reduce the opportunities for corruption and increase the probability of detection and punish the offences.

Systemic corruption needs a special attention because it involves huge economic and social costs as wastage of public resources, inefficient public expenditures, governmental legitimacy reduction, values distortions, inappropriate and non-conforming public

[7] World Bank’s 1997 World Development Report

procurement, low competition, low economic growth and trade, non - efficiency and lack productivity of labour force, an important life quality decline, low level of incomes, no welfare and poor morale.



Any anti – corruption strategy could not succeed without the whole nation support. We refer to civic attitude changes that could be obtained only involving social awareness and civil organizations. Social awareness strategies must emphasize the problems generated by acting corruptibly and civil organizations monitories, detects and publishes their expertise.

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