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ECONOPHSICS Section

AN ECONOPHYSICS MODEL FOR THE CURRENCY EXCHANGE WITH COMMISSION

Ion SPÂNULESCU[*], Victor A. STOICA[*] and Ion POPESCU[**]

Abstract. *In this paper an econophysics model for the currency exchange operations with commission is proposed. With this purpose some analogies and similarities of the processes that take place in the frame of the electrochemical system made from electrodes sunk into a solution of electrolytes and the process of the currency exchange and determination of the international currency purchasing power have been used. Some contact phenomena at the electrode/electrolyte separation surface, the physical principles of an electrochemical source operation and the determination of the sale attractiveness or the "potential" of the currency that is to be exchanged are also introduced and analyzed.*

Keywords: *econophysics, electrochemical sources, contact phenomena, electrode potential, currency exchange with commission, official currency parity.*

1. Introduction

In last decade the methods of econophysics – a science recently appeared between the 20th and 21st centuries – have been largely applied in order to model different economic processes, especially from the financial area [1-10], the investments [11-14], or the social phenomena [11-15].

In this work an econophysic model for the illustration of currency exhange and the settlement of the international currencies purchasing power, on the basis of the analogy between the physical processes that takes place in the electrochemical systems and currency exchange operations with commission is proposed.

In order to substantiate and for the illustration of that analogy, in the section 2 there are made some physical considerations upon the electrochemical processes that take place at the contact between different metals, assimilated with the international currencies: Dollars, Euro, Japanese Yen, Pounds etc., and watery solutions with electrolytes assimilated

[*] Hyperion University of Bucharest, 169 Calea Călăraşilor, St., Bucharest, 030615
[**] Bucharest Spiru Haret University, 13 Ion Ghica, St., Bucharest, Romania

with economic environment in which different exchange currencies with commissions are practiced.

In the frame of this new econophysics model, the currency exchange is assimilated with the ionic exchangeable process between a watery solution with metallic electrodes which is in contact with, so that the potential of the electrode from the electrode – electrolyte contact represents the sale attractiveness or the economic power of the purchasing currency, from the economic point of view.

In sections 3 and 4, on econophysics model for the currency exchange and for the international currency purchasing power, and the influence of the physical and economic factors upon the currency exchange parameters are introduced and analyzed.

Finally in section 5, the main conclusions are summarized.

2. Contact phenomena. Physical processes in electrochemical systems made of electrodes and electrolytes solutions

2.1. Contact phenomena

Contact phenomena appear both between two solid bodies, which are two different conductors (or semiconductors), and to the contact between a metal (or semiconductor) and a watery solution in which certain substances (salts or acids), named electrolytes, have been put in. To the contact between two different substances appears a contact difference potential V_c as the result of the difference between the work function of the electrons from metals (or semiconductors) of a different type brought into an intimate contact.

As it will be shown afterwards, such a potential "leap" appears also to the contact between a metal (or semiconductor) characterized by the work function W_m and a solution with electrolytes with the work function W_l (Fig. 1,b). In this case the leap (the potential difference) is named as electrode potential. In the present work the electrode potential from an electrochemical system – assimilated with a circuit of a currency exchange – is assimilated with the "potential" of the exchangeable currency, or with the **sale attractiveness** of that currency.

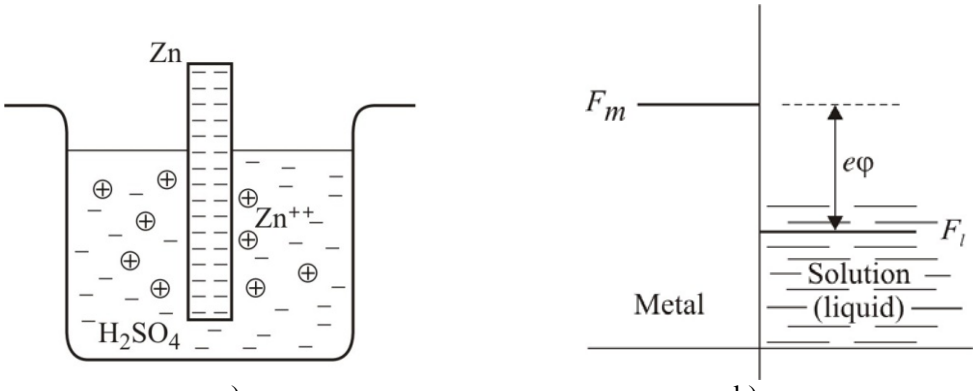
Electrolytes solutions (that contain electrolytes) are part of the category of so-called conductors of 2nd type at which the running electrical current is made with the help of the material ions in solutions, not through the electrons, like in the solid conductor bodies.

In the case of electrochemical piles (Volta cell, the Daniell's cell etc.) or the phenomena of electrolysis, galvanization etc., there are usually used pairs of solid conductor electrodes, partially sunk in acid or alkaline solutions, and between the two electrodes there appears a potential difference given by the difference between the electrode potentials of the two electrodes [16].

2.2. The metal-electrolyte contact. The electrode potential (the "potential" of currency or its sale attractiveness)

In our considerations, a foreign currency, that is under interaction with the financial economic environment, is assimilated with a metallic or semiconductor electrode placed in a system with electrolytes (watery solution) that represents the "economic environment" (Fig. 1,a).

As it has been mentioned, the difference of the contact potentials (currency sale attractiveness) and, respectively, of the potential difference (of the difference regarding the attractiveness of the exchanged currency) does not appear only at the contact between two solid bodies (it does not appear merely at the contact of two currencies), but also at the contact between a solid (a currency) and a liquid (an economic environment), between which certain chemical processes assimilated with processes of transformation or currencies exchange there are in progress (Fig. 1,b). For instance, if a zinc plate (assimilated with a hard currency: the dollar) sink in a watery solution of sulfuric acid (H_2SO_4) (that means that the currency is transformed in an investment, *I*, therefore, in an economic variable, (product or service etc.) and under the action of the acid solution zinc starts being corroded and dissolved in the electrolyte (Fig. 1,a), therefore, the currency starts being consumed and transformed in fix funds (see also Fig. 3).



a) b)

Figure 1. Transformation processes in an electrochemical system.

In the case of the figure 1, from physically point of view, under the action of the acid solution, the zinc starts being corroded and dissolved in the solution with electrolyte (Fig. 1,a). In that solution do not pass neutral atoms of Zn, but ions Zn^{++} only; therefore the solution shall be positively charged and the zinc electrode shall remain negatively charged. Thus, between the electrode of Zn and the solution there appears a difference of potential ε of which value is determined by the value of the "work functions":

$$W = e\varphi \tag{1}$$

that represents the difference between the chemical potential (the Fermi level, F_m) of the ions from the metallic network (of the Zinc) and chemical potential F_l of the ions from the solution (Fig. 1,b):

$$e\varphi = F_m - F_l. \tag{2}$$

The sign of the electrode potential depends on the nature of the electrolytic solution and electrodes which can have a chemical attractiveness higher or lower than the electrolytic solution, if the Fermi level, F_l (of the solution) is higher or lower than the level F_m (of the metal).

In the case of the zinc, in normal temperature and pressure conditions, for solutions of H_2SO_4 normally diluting, this potential is equal with –0,50V. For other metals, the values of this potential differ from metal to metal, being able to take also positive values in accordance with the type of the metal, electronegative or electropositive, in relation to the electrolyte solution. For instance, for a Cu electrode in a sulfuric acid solution the electrode potential is equal with + 0,61V [16].

The electrode potential can be measured only in comparison with the potential of another (metallic electrode) one that is necessarily to be sunk into solution in order to have a closed electrical circuit. This is achieved using an electrochemical chain known as an electrical pile (power source), formed from the electrode of which potential must me measured and a comparison electrode. As comparison electrode has been selected, the normal hydrogen electrode for which, conventionally, a zero value for its normal potential is taken. Thus, the electrode potentials determined in report with the normal electrode of hydrogen represent **relative values**, and they are displayed under this form in different tables (see Table 1) [16].

Table 1

The standard normal potentials for different electrodes in report with the standard potential of the hydrogen electrode (Source: [16])

Li/ Li^{+}	–3,04 mV	Co/ Co^{2+}	–0,28 mV
K/ K^{+}	–2,92 mV	Ni/ Ni^{2+}	–0,23 mV
Ca/ Ca^{2+}	–2,87 mV	Sn/Sn^{2+}	–0,14 mV
Na/ Na^{+}	–2,71 mV	Pb/ Pb^{2+}	–0,13 mV
Mg/ Mg^{2+}	–2,37 mV	**$H_2/ 2H^{+}$**	**±0,00 mV**
Mn/ Mn^{2+}	–1,18 mV	Cu/Cu^{+}	+0,34 mV
$2H_2O/ H_2+ 2OH^{-}$	–0,83 mV	$2Hg/ Hg_2^{2+}$	+0,79 mV
Zn/ Zn^{2+}	–0,76 mV	Ag/ Ag^{+}	+0,80 mV
Cr/ Cr^{3+}	–0,74 mV	Hg/ Hg^{2+}	+0,85 mV
Fe/ Fe^{2+}	–0,56 mV	Pt/ Pt^{2+}	+1,20 mV
Fe/ Fe^{3+}	–0,44 mV	$Cl_2/ 2Cl^{-}$	+1,36 mV
Cd/ Cd^{2+}	–0,40 mV	Au/ Au^{+}	+1,50 mV
Ti/ Ti^{2+}	–0,34 mV	$F_2/ 2F^{-}$	+2,87 mV

In the case of a chemical source largely used as there is the Volta cell or the Daniell's cell (Fig. 2,a) the two metallic electrodes are used, namely an electrode of Zn – which represents the anode, or the positive electrode – and a Cu electrode, which represents the cathode, whereto the positive ions from solution come.

The two electrodes are sunk into a watery solution of H_2SO_4 (the electrolyte), forming the electrochemical chain (Fig. 2,b):

$$Zn \left| H_2SO_4 \text{ (aqua)} \right| Cu \tag{3}$$

in which the straight bars from (3) represent the separation surfaces of the two phases: solid and liquid.

The electromotive force which is generated by the pile in open circuits is given by [16]:

$$\mathscr{E} = \varepsilon_{+} - \varepsilon_{-} \tag{4}$$

in which ε_{+} and ε_{-} represent the potential leap (contact potentials) from two electrodes, the positive one, of Cu, and the negative one, of Zn (Fig. 2,a) calculated in report with the standard potential (of the hydrogen electrode).

Taking into account the measured values for the electrode potentials of Cu and Zn (Fig. 2,c), the following value is given for the Volta battery voltage [16]:

$$\mathscr{E} = 0.61 - (-0.50)V = 1.11\,V \tag{5}$$

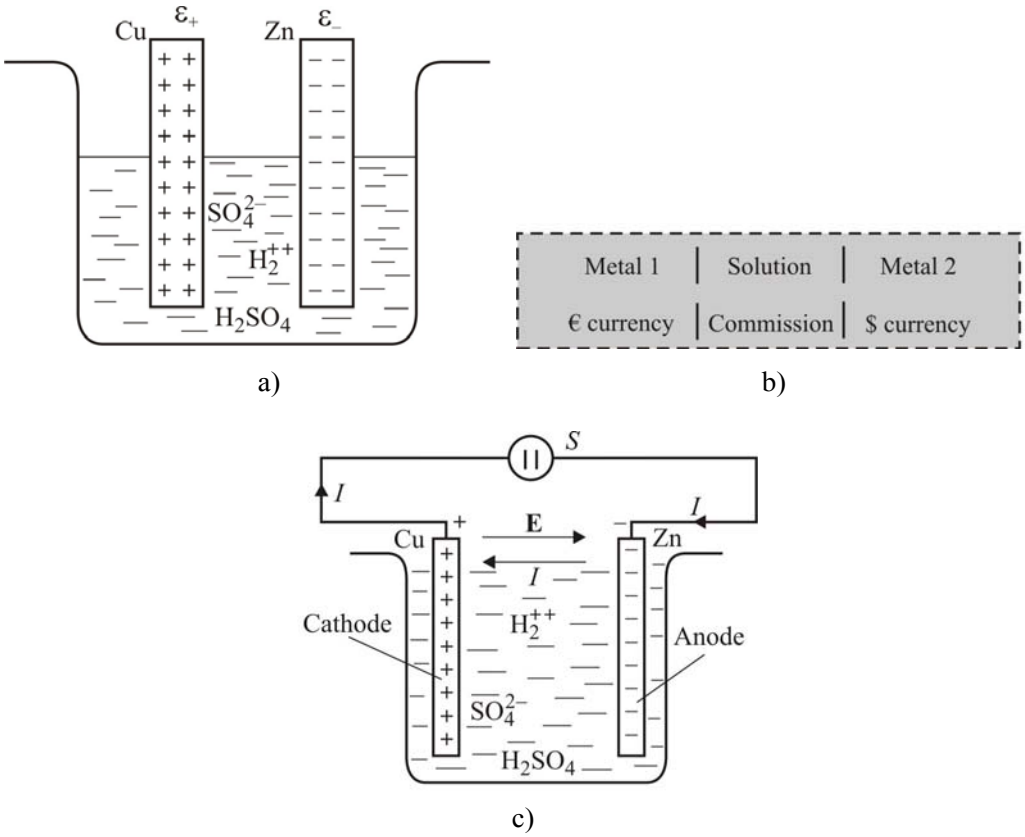


Figure 2. a) The electrochemical system with two metallic electrodes; b) The electrochemical chain representation; c) The scheme of an electrochemical pile.

3. The currency exchange operations modelling using the physical processes from an electrochemical system

The currency exchange is the financial operation through which a currency is exchanged with another one at an exchange office or at banks, for a commission accepted by both partners: the beneficiary, respectively, the clerk of the bank or of the exchange office. The exchange takes place starting from the official parity rate of currency established by the National Central Bank.

Starting from the convention that an electrochemical source or pile is in report of similitude with the currency exchange operation, the metal – electrolyte contact is assimilated with the assembly currency – commission, and potential of electrode with the sale attractiveness of the currency that is determined by the international purchasing power of that certain currency. Under this hypothetical situation, the contact potentials

differrence (the sale attractiveness of the currency) and, respectively, the potential difference (the difference between the attractiveness of the currency that is to be exchanged into another currency) do not appear only in case of a contact between two solid bodies (that means between two different currency) but also at a contact between a solid one (international, national currency) and an electrolyte solution one (an economic environment), in the frame of which certain chemical processes, or transformation, are recorded. As it has already been mentioned in the previous section, if a Zn plate (equivalent with a dollars amount) is sunk into a solution of sulfuric acid (H_2SO_4) (that is in an economic environment), then that is transformed in an investment, *I*, that is an economic value (quantity), and under the action of the acid solution (through the scroll of the investment process), the zinc (the amount of dollars) starts being corroded and dissolved in electrolyte (Fig. 1,a). Due to the fact that it has been corroded, the Zn electrode is consumed, so that the dollar amount being transformed in fix funds of which value is determined by the height of the potential barrier, $e\varphi = F_m - F_l$, that represents the investment efficiency as a result of currency (dollars) utilization in the economic process (Fig. 3 and Fig. 1,b).

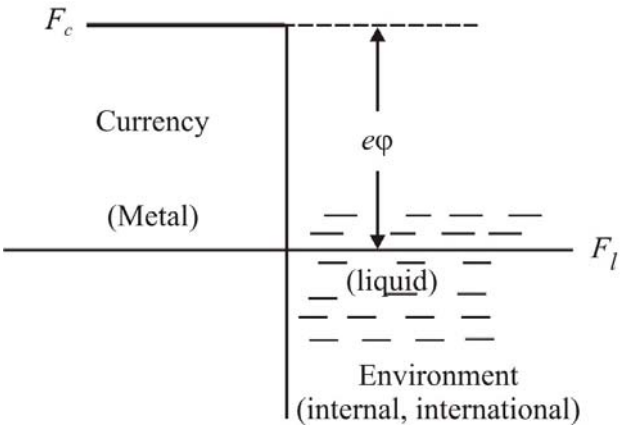


Figure 3. The evolution of the currency exchange operation.

As it has already been mentioned, the neutral Zn atoms (certain subdivisions of a currency) do not pass into solution, but only the positive ions Zn^{++} pass (that means discrete subdivisions of dollar, so, cents) and consequently, the solution (the economic environment), shall be positively charged (with fixed funds), and the Zn plate (the amount of dollars) remains negatively charged (it clears out, with the interests to be paid). Thus, between the electrode of Zn (the amount of dollars) and solution

(the economic environment) appears a potential difference (a difference between the investment profitableness and the interest rate – that is profit, *p*), respectively an electric field $\vec{\mathbf{E}}$ (investor-bank relations) orientated from liquid (investment) toward electrode (the dollar borrowed amount reconstitution and interest one) [16].

The "contact" electric field (investor-bank relations) shall stop further crossing of the metal ions (cents) in the economic environment (the investment being closed). Thus, a dynamic equilibrium is achieved, when for a certain potential difference ε (the difference between the investment profitableness and the interest rate – that is the profit, *p*), so that, for a certain value of the "field" (the loan to be repaid and the left interest mass), the number of metal ions (cents) that pass into solution (into the economic environment) becomes equal with the ones that turn back to metal (loan repaying plus interests) and the dissolving is stopped (the loan plus the interest are paid). The value of this potential, named electrochemical potential or electrode potential (assimilated with the international currency purchasing power, that means with its sale attractiveness) depends on the nature and properties of the metal (currency), of the solution (the economic environment which generates it) and of the initial concentration of the metal ions (the external debt of the currency issuing country) in solutions (the currency weight in the national economic Gross Domestic Product – GDP).

In the case of the zinc, in normal temperature and pressure conditions (in conditions of prices normal stability), for solutions of H_2SO_4 normally diluting (that means for normally developed economic environments), this potential (international currency purchasing power)is equal with –0,50V for the Zn electrode (see §.2.2 and (5) relation) and (conventionally) equal with 5% on a scale from 0% to 10%, for example, for the international currency purchasing power.

For other metals (currencies), the values of this potential (international currency purchasing power) differ from metal (currency) to metal (currency), being able to take also positive values in accordance with the type of the metal (that certain currency), electronegative (when the currency of a country is not in demand) or electropositive (when the currency of a country is highly in demand), in relation to the electrolyte solution (international economy).

For a Cu electrode (herein considered as Euro) in a sulfuric acid solution (international commerce), it has been shown that the potential of electrode (the equivalent of the international purchasing power) is equal

with + 0,61V, from the physical point of view (see §.2.2), but in the case of the currency exchange the international purchasing power is given by the currency parity modification between moments t_0 and t_1, and between the currency values v_1 and v_2, that means that the currency has a relative value, reported to the comparison currency.

The difference between of the two potential electrodes (the difference between the purchasing powers of two currencies) from the interface of the two phases metal/ solution (currencies / international commerce), appears due to the fact that the chemical potential (the Fermi level) (that means the variation of the international prices) of the ions from the metallic network (of the currencies monetary subdivisions) differs from the chemical potential of the ions in the solution, through the size $e\varphi$ (Fig. 1,b and Fig. 3). The ions (the subdivisions of the currency) from environment (intern or international) with a higher chemical potential (with the index of the higher prices) pass into the environment (intern or international) with a lower chemical potential (with the index of the lower prices).

In the case of figure 1,b, for the zinc electrode (dollar currency in the figure 2,b), the metal ions pass into the solution (the cents that pass into the internal market) and the metal (dollar) is negatively charged (it increases its purchasing power) in report with the solution (in report with the international or internal markets).

If pairs of metals-solutions are chosen (currencies – internal markets, pairs) so that the ions from the solution (the subdivisions of the currencies on the internal markets) are at the level of the higher chemical potential (it is on the markets with higher prices index), they shall leave the solution (internal markets) and deposit on the metal (that is the currency mass on the external markets is growing) and that is why the metal shall positively charged itself (the total currency mass grows) in report with the solution (on the international market). The metals (the currencies) with low chemical activity are part of this group (from the internal markets with low growths of the prices indexes) as there the metals with physical equivalent Au, Ag, Pt, Cu, Pa, Hg etc. or with the currencies: euro, pounds, dollar, Japanese yen, Australian dollar, rouble etc. [16]. Thus the sign of the electrode potential (the appreciation/ the depreciation of the currency) is caused of ions tendency whether to leave the metal or on the contrary, to pass from the solution on the metal, is determined by the tendency of the prices to depreciate the currency or to appreciate it [16].

From the ones previously mentioned we may conclude that it is obviously that the potential of the electrode (the international currency

purchasing power) is the consequence of a transfer reaction of the ions from the inner part of a phase into another one (that means that the purchasing power is the consequence of an index difference of the internal prices reported on the international market prices ones); On the other hand, as it has been shown, because the galvanic potential ε of a singular electrode cannot be measured, also the international purchasing power of a single currency cannot be measured. As the electrode potential may be determined making an ensemble as an electric pile from the electrode of which potential must be found, and a comparison electrode (Fig. 2,a,b,c); it is the same situation for the international currency purchasing power that can be determined making an ensemble of **two currencies**, one of which international purchasing power must be found, out and one of comparison.

As electrode of comparison (comparison currency) it has been convened that the normal hydrogen electrode (up to the present, the dollar currency), which the 0 value was given to (the value of 5 for dollar, in the convention made by us for currencies), as its normal potential (for its normal international currency purchasing power).

As it has been shown, the normal potentials determined in report with the normal electrode of hydrogen are not absolutely potentials, but **relative values**, E_0, that are also displayed in different tables similarly to Table 1 for the electrode potentials of some physical electrodes. In the same way there is concluded that the values of the international purchasing powers of the currencies in report with the dollar, are not international purchasing powers of the singular absolute values, but relative values, being also shown in different financial tables (similar to Table 1).

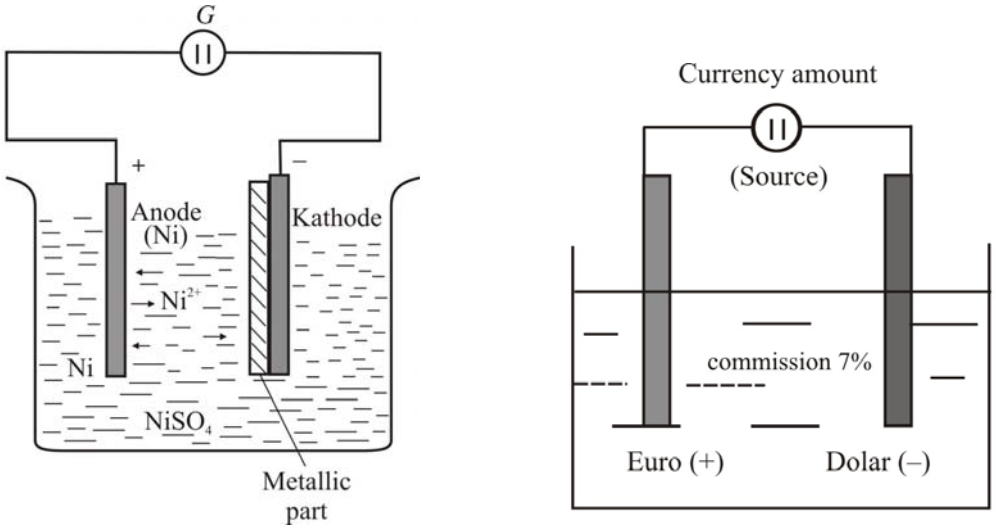
4. The currency exchange modelling through electrolysis process and galvanization with a power generator (an equivalent of a currency source)

The act of currency exchange can be assimilated also with the process of electrolysis, in the case when currency resources supplying, taken from a generator (currency source) similar to the electrolysis process. The electrolysis represents an exchange process (exchange currency) during which the electric power that is supplied by an external source *G* (Fig. 4,a) is transformed in chemical power that brings contributions to the electrochemical reactions [16].

The reaction takes place in watery solution (economic environment) with electrolytes, (the parity of the two currencies being fixed by the

Central Bank). The ions (the flux of the currencies) must circulate free (in accordance with the request-offer report of curency), in the solution with electrolytes (the economic environment). The two electrodes (the currencies) must be tied through an electrolyte with salts (the commission) and a power generator (Central Banks, the issuing authority of the two currencies) assimilated with the stocks of euro and dollars (Fig. 4,b). In this case, the exchange currency operation results may be evaluated through the assimilation of this exchange with the exchange processes that takes place in a system in which the electrolysis takes place, that means in an electrolytic bath that may be with passive electrodes (for example Pt) for the electrolysis of water or of another solution, or with "soluble" anode used in the processes of mettalic covering (galvanization) like nickel coating or chromium plating etc.

In the case of nickel plating, in an electrolytic bath, Ni sulphate as electrolyte is used, the anode is a nikel plate, and to the cathode the metallic part (or piece) that must be nickel plated is attached (Fig. 4,a).



a) b)

Figure 4. Equivalent structures in the case of currency exchange modelling as currency source (currency salvo).

Under the action of the electric power supplied by the power source *G*, the Ni sulphate is dissociated in Ni^{2+} and SO_4^{2-}, and the resulted ions lead for the electrodes from the bath where the following chemical reactions are in process [16]:

To cathode:

$$Ni^{2++} + 2e = Ni. \quad (6)$$

Nickel is deposited (until the process ends);
To anode:

$$Ni(plate) + SO_4^{2-} = NiSO_4 + 2e^- . \quad (7)$$

Two electrons ($2e^-$) are given in and the nickel sulphate $NiSO_4$ is recuperated and it passes in the solution of which concentration stays thus constant.

In the case of a currency exchange between two currencies (Euro and Dollar, for example) there may be noticed some considerations similar to the ones of galvanization (chromium and nickel plating etc.). Thus, if an electric power (a stock of currencies) is applied between two electrodes (the currencies of euro and dollars), the positive ions (eurocents) migrate to the cathode (the petitioner of euro), while the negative ions (the American cents) shift to the anode (the petitioner of dollars). The positive ions (eurocents) are named cations (euro) while the negative ions (the American cents) are named anions (dollars). The cations (euro) are able to capture electrons (a growth of the official quota), on the power of their valence (the official quota) similar with the relation (6) for the reaction from cathode where the metal deposit is achieved (Ni, in the case of the figure 4,a). The anions (the dollars) react oppositely (they depreciate); in case of contact (exchange) with the anode (euro) they shall give in their electrons (they suffer a diminution of the official quota) in order to take a steady position and become a stable element (a stable dollar) similar to the relation (7), for the reaction from the anode (Fig. 4). To the cathode (currency – that is the dollar) the cations (euro) are reduced (they diminish the exchanged quantity) and the anions (the dollars) oxidize (they depreciate). In accordance with the ions nature (eurocents or American cents), the resulted product (the exchange) can be released (the exchange takes place) or can be stored on the electrode (the exchange does not take place).

In order to check up the reactions (the currency exchanges) in the electrolysis installation (in the economic environment) different pairs of materials may be chosen (between different currencies) for electrodes (currencies that suffer a currency exchange). In the same way, the type of the salt in the electrolyte may be selected (a certain commission percentage) in order to promote (to facilitate a certain currency exchange: euro vs. dollar) instead of another one (euro vs. rouble). The electrolyte with salts (the commission) contains ions (percentages) that conduct the electrical current (that establish the currencies stock).

In conclusion, the galvanization of the metallic parts (the settlement of the official quota of the currencies units) settled against the corroding process (against monetary depreciation) is equivalent with the protection of an alterable metal (a volatile currency) against the corroding process (against depreciation) due to a deposit through the electrolysis (currency exchange) of an inalterable metal (a stable currency). The object (the currency) to be covered (to be stabilized) is connected on the negative pole of a generator (currency stock) and put in a electrolytic bath (Fig. 4), the electrochemical process (that means the currency exchange) carrying out the role of purification ("stabilizer"), as it is the case of galvanic "covering" of an electrode (or the part to be covered) (Fig. 4,a).

The determination of the official currency parity (O.C.P), taken by twos expresses how many unities from the Y currency may be bought with a unity from the Z currency. The calculation formula is the following (for X = euro, Y = RON and Z = dollar):

$$1\ X_{€} = aY_{RON}$$

$$1\ X_{€} = bZ_{\$}$$

$$OCP_{RON} = \frac{aY_{RON}}{bZ_{\$}} = cY_{RON} / 1Z_{\$} \qquad (8)$$

where: X, Y, Z are currencies, and a, b, c are the proportion of the currencies.

In order to foresee the electrochemical reactions (the currencies quotations) the standard potential (the international currency purchasing power) is used. The standard potential for the currencies shall be determined starting from the official currency parity, calculated by the formula (8). In the Table 1 there are displayed some examples of standard potentials of the chemical elements (equivalent with the international currency purchasing power starting from the currencies official quotations) at 25°C (in the area of monetary stability). Practically, the elements that form the electrodes (the currencies) are classified (quoted) in accordance with their standard potential E_o (international currency purchasing power) like of the normal hydrogen electrode potential in the case of elements (Table 1).

The standard potential (the currency purchasing power in the conditions of international monetary stability) gives the capacity (quotation) in report with Euro that corresponds to the hydrogen from the physically reference electrode potential (Euro is taken as reference) of giving in electrons (in order to become a liquid currency – that has an ample quantity

for the currency exchange). The other elements (currencies) have a positive (higher) standard potential (a purchasing power) or a negative one (lower than euro).

In conclusion, the elements with negative standard potential (currencies with a purchasing power under euro) are more exposed to be oxidized (to be depreciated) than the elements with a positive E_0 (having a higher purchasing power).

5. Conclusions

The currency exchange process with commission may be modeled on the basis of its analogy with the process of ionic exchange between a solution with electrolytes and metallic electrodes which are into contact with the solution within an electrochemical system of the type of power chemical source or electrolysis with metal deposit (galvanoplastics).

In the present work it is shown that the electrode potential E_o from the electrode-electrolyte contact represents, from the economic point of view, the sale attractiveness of the currency (assimilated with the metallic electrode) – therefore with its international purchasing power.

Considering the currency euro as the reference electrode, a classification of currencies can be achieved in accordance with the international currency purchasing power, similar to the classification of the electrode potentials E_o of the chemical elements (metals) used as electrodes in the electrochemical systems taken into report with the standard potential of the hydrogen chosen as a reference element (with $E_o = 0$). As in the case of the elements used as electrodes in electrochemistry, the currencies may have a positive potential (a higher purchasing power) or a negative one (with a purchasing power lower) that a quntity of *a* Euro that can to be "oxidyzed" or to suffer "reducing" reactions (that means it suffers depreciation), in comparison with the currencies that have a positive potential E_o.

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INFORMATION AND COMPUTATION SYSTEMS IN SUPPLY CHAIN NETWORKING OF MERCHANDISE-MATERIALS WITH ECONOMIC INTERPRETATIONS

S. S. MISHRA*

Abstract. *Supply chain networking is a multi-objective oriented operations strategy for achieving the organizational goals. Multiojectives include cost efficiency as a prime goal and organizational competitiveness, flexibility and responsiveness as other goals. But, for any quality conscious organization, cost efficiency and other variables are equally focused for an effective trade-off in between them. Information and computation systems are vehemently understood to very closely affect various operations of supply chain networking of merchandise-materials right from manufacturing to distribution of such materials. In this paper, a fresh approach is made to develop a frame work and methodology of information and computation systems that in turn can augment and strengthen the effectiveness of supply chain networking in an economic manner.*

The paper has been categorized in two sections. First section is devoted to the conceptual development and implementation of the information embedded supply chain networking in the business of merchandise-materials and second section is focused on the development of some of computation systems which can be used in the cost, revenue and profit analysis of supply chain networking. This research is presumably assumed to provide a better insight to professionals engaged in this field.

Keywords: *supply chain networking, merchandise-materials, cost efficiency SCN models.*

1. Introduction

Presently, organizations are working hard for improving their organizational cost efficiency and competitiveness in a cut-throat competitive global market. Suppose that if market is electronically connected, what will

* Department of Mathematics and Statistics, Dr. Ram Manohar Lohia Avadh University, Faizabad-224001, UP, India.

be competitive and responsive scenario in terms of their dynamism. Virtual organizations, outsourcing and electronic data interchange, enterprises resource planning, SAP, e-commerce, e-business and business-to-business procedural developments have revolutionized the marketing and business dynamics. All above activities involved in right from acquiring the raw materials, searching the suppliers, distributors, warehouses and distributions to satisfy the demands of consumers are closely associated with information system and networking of suppliers, warehouses and distributions of merchandise materials is designated as supply chain networking. Merchandise materials refer to man, machine and materials which can be bought and sold as per requirement of users in the markets. At the very outset, these materials are idle and at later stage, they are dynamic for reaching the market for the end users.

Supply chain networking (SCN) is an approach that has evolved out of the integration of these considerations. SCN is an exceedingly applied operations paradigm for enhancing overall organizational competitiveness and cost efficiency. A recent survey of more than 300 supply chain-related executives found that 92% of those surveyed were planning to implement one or more supply chain initiatives. Prominent literature are Bradley, 1999, Levi et al. (2000), Tan, 2001). However, it is impossible to achieve an effective supply chain without IT. Since suppliers are located all over the world, it is essential to integrate the activities both inside and outside of an organization. This requires an integrated information system (IS) for sharing information on various value-adding activities along the supply chain. IT is like a nerve system for SCN. There are many articles on IT in supply chain. Most of the literature discusses only the implications of one or two aspects of supply chain, for example, strategies, tools and techniques, but not in an entirety. However, a comprehensive survey of IT in SCN will be useful to identify the critical success factors of IT for an integrated supply chain. Unfortunately, design and implementation of IT system for an effective SCN have not received adequate attention from both researchers and practitioners, in particular, business to business (B2B) e-commerce (EC) and SCN. There are lots of debates around the applications of IT in SCN concerning business to business e-commerce model, matching to business model etc. (Watson et al., 1998). Graham and Hardaker (2000) highlight the role of the Internet in building commercially viable supply chains in order to meet the challenges of virtual enterprises. Philip and Pedersen (1997) attempt to study the ways in which the business community harnesses EDI with the help of a literature survey based on the

application. Armstrong and Hagel (1996) argue that there is beginning of an evolution in supply chain towards online business communities. For example, General Electric trading process network is an online business community that allows the company to transact about $1 billion dollar worth of business with their suppliers located all over the globe. Big three auto makers in the US are in the process of launching the automotive network exchange (ANX) to further understand the impending effects of electronic business communities. ANX will establish a standard method for parts suppliers to communicate with and obtain order information from the auto manufacturers (Graham and Hardaker, 2000). Supply chain networking emphasizes the overall and long-term benefit of all parties on the chain through co-operation and information sharing. This signifies the importance of application of IT in SCN. This is largely caused by variability of ordering (Yu et al., 2001). Information sharing between members of a supply chain using EDI technology should be increased to reduce uncertainty and enhance shipment performance of suppliers and greatly improve the performance of the supply chain system (Srinivasan et al., 1994). Companies need to invest large amount of money for redesigning internal organizational and technical processes, changing traditional and fundamental product distribution channels and customer service procedure and training staff to achieve IT-enabled supply chain (SC) (Motwani et al., 2000). The following are some of the problems often cited in the literature both by the researchers and practitioners when developing an IT-integrated SC: lack of integration between IT and business model, lack of proper strategic planning, poor IT infrastructure, insufficient application of IT in virtual enterprise, and inadequate implementation knowledge of IT in SC. There is no comprehensive framework available on the application of IT for achieving an effective SC. Considering the importance of such a framework, an attempt has been made in this paper to develop this framework and suggestion to work IT as an powerful operating tools in supply chain networking. For maintaining the cost efficiency in particular and other efficiencies in general, we adopt the following key factors such as electronic data interchange, ecommerce and internet trading etc.

2. Economic Interpretations

Organizations need to be capable of reconfiguring its resources to meet the fast changing requirements. This requires organizations to have an

effective supply networking to solve the problem of alignment between operations strategy and IT strategy. A strategic alignment model for a manufacturing information system that specifically addresses the requirements of leveraging the emerging developments in information technologies would be useful. We inculcate the new values of advance technologies within the sociology of technology, in which innovation is not simply a technical-rational process of solutions and it also involves economic, social and political processes in articulating interests, building alliances and struggling over outcomes. The market is the driving force for any changes in an organization and market factors such as customer requirements, competitors and price always force organizations the way they manage their operations. For example, companies select to for IT enabled SCN in order for companies to compete in a networked economy wherein we have to compete in a global market by multiple competitive performance objectives such as price, quality, flexibility, responsiveness and dependability. The economic reasons here is the cost reason. IT helps to improve the accurate information flow and in turn accurate decisions to support the business process in an effort to meet the changing market requirements.

3. Some SCN Models with Computation Systems

We discuss computational techniques and their modern economic interpretations of cost and profit analysis of certain Supply Chain Networking Systems under following titles such as (Mishra and Yadav, 2008):

i. Model Introduction;
ii. Computational approach;
iii. Applications with Economic Advantages.

Model I: Computational approach to profit optimization of a loss-Supply Chain Networking System

a) *We have the following features of the model:*

i. M/M/1/K of supply chain network with finite capacity K
ii. The inter arrival of merchandise-materials and supply rate follows the exponential distribution;
iii. No reneging and balking;
iv. The arriving merchandise-materials go for their supply elsewhere permanently without waiting, when SCN is busy. This condition

constitutes the case of loss of merchandise-materials in the supply chain system;

v. Total expected cost (TEC) of SCN;
vi. Total expected revenue (TER) of SCN;
vii. Total optimal profit (TOP) of SCN;
viii. Developing Computing algorithm;
ix. Fast converging N-R method;
x. Least computing time;
xi. Lesser memory space;
xii. Sensitivity analysis and its observations based on graphics have added a significant value to this model.

b) *Computing Algorithm*

The following computing algorithm has been developed to compute the optimal service and total optimal expected profit of the system under consideration.

- Step 1: begin;
- Step 2: input all variables;
- Step 3: compute all derived variables which are needed;
- Step 4: compute derivative of some required functions of derived variables;
- Step 5: compute derivative of function of supply rate;
- Step 6: $t \leftarrow$ initial guessed supply rate;
- Step 7: iterating initial guess of supply rate;
- Step 8: while (error = 0.0000000001);
- Step 9: compute optimal supply rate in nonlinear equation;
- Step 10: compute total optimal expected profit;
- Step 11: data output;
- Step 12: end.

Model II: Cost and Profit Analysis of Markovian Supply Chain Networking System with Two Priority Classes: A Computational Approach

a) *We have the following features fro this SCN:*

i. A single server supply chain system with Poisson arrival and exponential supply pattern;
ii. First class has high priority;
iii. Second class has low priority for getting supply;
iv. A novel performance measure of cost and profit analysis;

v. Two priority classes;
vi. A computing algorithm has been developed;
vii. Fast converging numerical method system of non linear equations;
viii. The number of the first class MM are restricted to a finite number N ;
ix. λ_1 and λ_2 are the arrival rates for two classes;
x. μ_1 and μ_2 be the supply rates for two classes;
xi. Traffic intensities are given as $\rho_1 = \lambda_1/\mu_1$ and $\rho_2 = \lambda_2/\mu_2$;

b) *Total Cost Function:*

We construct the following cost function to analyze the cost investment in the system,

$$T(C) = C_1\mu_1 + C_2\,\mu_2 + C_h\,L_H + C_l\,L_L$$

i. L_H = expected lot size of high-priority class.
ii. L_L = expected lot size of low-priority class.
iii. C_1 = cost per supply per unit time associated with high-priority class.
iv. C_2 = cost per supply per unit time associated with low-priority class.
v. C_h = holding cost per MM per unit time of high-priority class.
vi. C_l = holding cost per MM per unit time of low-priority class.
vii. μ_1 = supply rate of high-priority class.
viii. μ_2 = supply rate of low-priority class.

c) *Computing Algorithm:*

The following computing algorithm has been developed to compute the optimal service rates and total optimal cost and profit of the system with two priority classes.

i. Step 1: begin
ii. Step 2: input all variables
iii. Step 3: compute derived variables
iv. Step 4: compute derivatives
v. Step 5: compute functions
vi. Step 6: $t_1 \leftarrow$ initial supply rate of HPC
vii. Step 7: $t_2 \leftarrow$ initial supply rate of LPC
viii. Step 8: iterating initial supply rates
ix. Step 9: while (error = 0.0000000001)

x. Step 10: compute optimal supply rates
xi. Step 11: compute total optimal cost
xii. Step 12: data output
xiii. Step 13: end.

4. Conclusion

As conclusions we found the following:

i. Cost analysis has a very important aspect of SCN;
ii. Realistic situations are sought;
iii. Profit along with cost analysis;
iv. For profit optimization is an important economic concept to deal with any model of ecno-science and systems so that economic viability of the model can be maintained in the real life situations;
v. Minimize total cost and maximize profit;
vi. Concept of revenue along with cost;
vii. Useful in various fields of practical applications;
viii. Telecommunications and networking;
ix. Production and inventory management;
x. Marketing, market analysis and pricing etc.

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A CHAOTIC POPULATION GROWTH MODEL AND DISABILITY

Vesna D. JABLANOVIC*

Abstract. *Chaos theory, as a set of ideas, attempts to reveal structure in aperiodic, unpredictable dynamic systems such as the fluctuation of populations. Although chaotic systems can be described by mathematical equations, chaos theory shows the difficulty of predicting their long-range behavior. In this sense, it is important to construct deterministic, nonlinear population dynamic growth model. Chaos embodies three important principles: (i) extreme sensitivity to initial conditions; (ii) cause and effect are not proportional; and (iii) nonlinearity. The basic aim of this paper is to provide a relatively simple chaotic population growth model that is capable of generating stable equilibria, cycles, or chaos depending on parameter values including the problem of disability.*

A key hypothesis of this work is based on the idea that the coefficient $\pi = \frac{p}{p - m\ h\ f}$ *plays a crucial role in explaining local stability of the population, where f – the share of population which belongs to labour force; m – the coefficient of marginal productivity of disabled memebers of society; p – the real gross domestic product per capita; h – the share of labour force which belong to disable people. The estimated chaotic population model shows the stable and declining population growth in the EU-27 countries in the observed period.*

Keywords: *chaos, population growth, disability, EU-27.*

1. Introduction

Chaos theory is used to prove that erratic and chaotic fluctuations can indeed arise in completely deterministic models. Chaos theory reveals structure in aperiodic, dynamic systems. The number of nonlinear business cycle models use chaos theory to explain complex motion of the economy. Chaotic systems exhibit a sensitive dependence on initial conditions: seemingly insignificant changes in the initial conditions produce large differences in outcomes. This is very different from stable dynamic

* University of Belgrade, Nemanjina 6, 11000 Belgrade-Zemun, Serbia

systems in which a small change in one variable produces a small and easily quantifiable systematic change.

Chaos theory started with Lorenz's (1963) discovery of complex dynamics arising from three nonlinear differential equations leading to turbulence in the weather system. Li and Yorke (1975) discovered that the simple logistic curve can exibit very complex behaviour. Further, May (1976) described chaos in population biology. Chaos theory has been applied in economics by Benhabib and Day (1981, 1982), Day (1982, 1983, 1997), Grandmont (1985), Goodwin (1990), Medio (1993, 1996), Medio, A. and Lines, M. (2004), Lorenz (1993), Shone, R. (1999) among many others [1÷20].

The basic aim of this paper is to provide a relatively simple chaotic population growth model that is capable of generating stable equilibria, cycles, or chaos depending on parameter values.

2. The chaotic population growth model and disability

Irregular population movement can be analyzed in formal framework of the chaotic growth model:

$$m = \frac{\Delta Y}{\Delta D} \tag{1}$$

$$p = \frac{Y_t}{S_t} \tag{2}$$

$$L_t = f S_t \tag{3}$$

$$D_t = h L_t \tag{4}$$

$$Y_t = L_t^{\frac{1}{2}}, \tag{5}$$

where: Y – represents the real gross domestic product; L – labour force; S – population; D – disabled memebers of society; f – the share of population which belongs to labour force; m – the coefficient of marginal productivity of disabled memebers of society; p – the real gross domestic product per capita. Equation (1) determines the marginal productivity of disabled members of society m; equation (2) determines the average productivity, p; equation (3) contains labour force function; equation (4) contains disabled memebers of society function; and equation (5) contains production function.

By substitution one derives:

$$S_{t+1} = \frac{p}{p - mhf} S_t - \frac{m\ h\ p^2}{p - mhf} S_t^2. \tag{6}$$

Further, it is assumed that the current value of population is restricted by its maximal value in its time series. This premise requires a modification of the growth law. Now, the population growth rate depends on the current size of the population, *S*, relative to its maximal size in its time series S^m. We introduce *s* as $s = S/S^m$. Thus s range between 0 and 1. Again we index *s* by *t*, i.e., write s_t to refer to the size at time steps $t = 0, 1, 2, 3, ...$ Now growth rate of the population is measured as:

$$s_{t+1} = \frac{p}{p - mhf} s_t - \frac{m\ h\ p^2}{p - m\ h\ f} s_t^2. \tag{7}$$

This model given by equation (7) is called the logistic model. For most choices of *f, m, h* and *p* there is no explicit solution for (7). Namely, knowing *f, m, h* and *p* and measuring s_0 would not suffice to predict s_t for any point in time, as was previously possible. This is at the heart of the presence of chaos in deterministic feedback processes. Lorenz (1963) discovered this effect – the lack of predictability in deterministic systems. Sensitive dependence on initial conditions is one of the central ingredients of what is called deterministic chaos.

This kind of difference equation (7) can lead to very interesting dynamic behavior, such as cycles that repeat themselves every two or more periods, and even chaos, in which there is no apparent regularity in the behavior of s_t. This difference equation (7) will posses a chaotic region. Two properties of the chaotic solution are important: firstly, given a starting point s_0 the solution is highly sensitive to variations of the parameters *f, m, h* and *p*; secondly, given the parameters *f, m, h* and *p*, the solution is highly sensitive to variations of the initial point s_0. In both cases the two solutions are for the first few periods rather close to each other, but later on they behave in a chaotic manner.

3. Logistic equation

The logistic map is often cited as an example of how complex, chaotic behaviour can arise from very simple non-linear dynamical equations. The map was popularized in a seminar 1976 paper by the biologist Robert

May. The logistic model was originally introduced as a demographic model by Pierre François Verhulst.

It is possible to show that iteration process for the logistic equation:

$$z_{t+1} = \pi z_t (1 - z_t), \;\; \pi \in [0,4], \, z_t \in [0,1], \tag{8}$$

is equivalent to the iteration of growth model (7) when we use the identification:

$$z_t = m\ h\ p\ s_t \text{ and } \pi = \frac{p}{p - m\ h\ f}. \tag{9}$$

Using (9) and (7) we obtain:

$$z_{t+1} = m\ h\ p\ s_{t+1} = m\ h\ p\left[\frac{p}{p - m\ h\ f} s_t - \frac{m\ h\ p^2}{p - m\ h\ f} s_t^2\right] =$$

$$= \frac{m\ h\ p^2}{p - m\ h\ f} s_t - \frac{m^2\ h^2\ p^3}{p - m\ h\ f} s_t^2.$$

Using (8) and (9) we obtain:

$$z_{t+1} = \pi z_t (1 - z_t) = \left(\frac{p}{p - m\ h\ f}\right) m\ h\ p\ s_t (1 - m\ h\ p\ s_t) =$$

$$= \frac{m\ h\ p^2}{p - m\ h\ f} s_t - \frac{m^2\ h^2\ p^3}{p - m\ h\ f} s_t^2.$$

Thus we have that iterating $s_t + 1 = \frac{p}{p - m\ h\ f} s_t - \frac{m\ h\ p^2}{p - m\ h\ f} s_t^2$ is really the same as iterating $z_{t+1} = \pi z_t (1 - z_t)$ using $z_t = m\ h\ p\ s_t$ and $\pi = \frac{p}{p - m\ h\ f}$. It is important because the dynamic properties of the logistic equation (7) have been widely analyzed (Li and Yorke (1975), May (1976)).

It is obtained that:

- (i) For parameter values $0 < \pi < 1$ all solutions will converge to $z = 0$;
- (ii) For $1 < \pi < 3{,}57$ there exist fixed points the number of which depends on π;

- (iii) For $1 < \pi < 2$ all solutions monotnically increase to $z = (\pi - 1)/\pi$;
- (iv) For $2 < \pi < 3$ fluctuations will converge to $z = (\pi - 1)/\pi$;
- (v) For $3 < \pi < 4$ all solutions will continously fluctuate;
- (vi) For $3{,}57 < \pi < 4$ the solution become "chaotic" wihch means that there exist totally aperiodic solution or periodic solutions with a very large, complicated period. This means that the path of z_t fluctuates in an apparently random fashion over time, not settling down into any regular pattern whatever.

4. Empirical evidence

The main aim of this paper is to analyze the population growth stability in the EU-27 countries in the period 1998-2009. by using the presented non-linear, logistic growth model (10):

$$s_{t+1} = \alpha\, s_t - \beta\, s_t^2 \tag{10}$$

where:

$$s - \text{represents population, } \alpha = \frac{p}{p - m\,h\,f}, \ \beta = \frac{m\,h\,p^2}{p - m\,h\,f}.$$

Firstly, we transform data on population [Source: Eurostat Yearbook 2006-07] from 0 to 1, according to our supposition that actual value of population, *S*, is restricted by its highest value in the time-series, S^m. Further, we obtain time-series of $s = S/S^m$. Now, we estimate the model (10). The results are presented: (Source: Eurostat Yearbook 2006-07, European Commission):

- EU-27 1998-2009:

R = .99808 Variance explained: 99.616%

	α	β
Estimate	.91761	–.08796
Std.Err.	.02248	.02302
t(9)	40.82530	–3.82167
p – level	.00000	.00408

5. Conclusions

This paper suggests conclusion for the use of the chaotic population growth model in predicting the fluctuations of the population. The model (7) has to rely on specified parameters *f*, *m*, *p*, *h* and initial value of the population, s_0. But even slight deviations from the values of parameters *f*, *m*, *p*, *h*, and initial value of the population, s_0, show the difficulty of predicting a long-term population behaviour.

A key hypothesis of this work is based on the idea that the coefficient $\pi = \frac{p}{p - m\,h\,f}$ plays a crucial role in explaining local population stability, where *f* represents the share of population which belongs to labour force; *m* – the coefficient of marginal productivity of disabled members of society; *p* – the real gross domestic product per capita; *f* – the share of population which belongs to labour force. An estimated values of the coefficient $\pi = \frac{p}{p - m\,h\,f} = 0.91761$ in the EU-27 countries is smaller than 1 in the observed period. This result confirms stable but declining population growth in the EU-27 countries in the observed period.

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SOME TYPICAL ECONOPHYSICS' AND SOCIOPHYSICS' MODELS

Gheorghe SĂVOIU*

Abstract. *Some typical Econophysics' and Sociophysics' models result from this new sciences' way of thinking or from the physicist's methods used in other domains as Economics and Sociology. This paper describes the improvements of the quality in the classical research of Economics and Sociology through some of these new and still typical models and tries also to investigate why econophysicists' and sociophysicists' models are able to perform financial or sociological analysis, and which are their most interesting strengths and weaknesses. Econophysicists' and Sociophysicists' models seek to integrate the Physics' methods and laws with classical Economics' and Sociology's theory and thinking, seeing this new domain of applied Physics as an unlimited one. Econophysics and Sociophysics replace conventional ways, with the new and broader views of Physics' thinking. The author believes that an important scope and intention of this paper is to draw a repertory of some typical models for the use of Economics and Sociology. In addition to this main purpose, the paper could be a statistical evaluation of some not so typical phenomena as crises or recessions, which can be reordered along the new coordinates of contemporary Physics' thinking and specific models.*

Keywords: *Statistical Physics, Econophysics' model, Sociophysics' model, power law, diffusion, weak and strong signals.*

1. Introduction

Econophysics and *Sociophysics* describe applications of Physics to different fields, similar to Astrophysics, Geophysics, and Biophysics. The specific fields or domains are in these distinctive cases Economics and Sociophysics.

Thus, *Econophysics* is an "interdisciplinary research field applying methods of statistical Physics to problems in Economics and Finance" [1]. The contemporary way to define Econophysics is to do so in terms of the

* University of Piteşti, 1 Târgul din Vale, St., Piteşti, Romania, e-mail: gsavoiu@yahoo.com, gheorghe.savoiu@upit.ro

ideas that it involves in effect physicists doing Economics with theories from Physics, this raises the question of how the two disciplines relate to each other and it explains interest rates and fluctuations of stock market prices, these theories draw analogies to earthquakes, turbulence, sand piles, fractals, radioactivity, energy states in nuclei, and the composition of elementary particles.

Sociophysics is a new insight into the applicability of much of elementary statistical physics to the social sciences. *Sociophysics* means a new insight followed by transferring and further developing ideas and concepts common to Physics, Biology, and Ecological Systems. First named Psychophysics, Sociophysics can be described as the sum of activities of searching for fundamental laws and principles that characterize human behaviour and result in collective social phenomena. Sociophysics tries to model the dynamics of social and economic indicators of a society and investigate how life extension will influence fertility rates, population growth and the distribution of wealth [2], religion, friendship and sex, social network, traffic etc. *Sociophysics* has become an attractive field of research over the last two decades, despite the controversies between sociophysicists and sociologists. Its relevant potential used for understanding the social phenomena always will win.

Econophysics and Sociophysics improve the quality of the classical research of Economics and Sociology through their original models. New models, already called typical after only five years, result from a new way of thinking or from the trans-disciplinary methods used in new domains.

2. The scientific research model

The expansion of contemporary science has multiplied their number to over 1,000 independent sciences, especially within borderline areas (e.g. econophysics, situated at the border between physics and economics, sociophysics – at the border between physics and sociology etc.). Science emerges when at least three elements are joined together: a distinctive theory, a segment of reality as a specific object, and a model interposed between theoretical investigation and its object of study. Sciences have their own characteristic models and laws, acquired mainly thanks to their inclination for measuring their object of study.

From the tetragrams of the ancient Chinese culture to abstract or geometrical figures in ancient Greece, from the first music sol-fa systems to the everyday languages used by calculus programs, all these types of

presentation laying special emphasis on the logical element of a visual nature have been, and are still, simplified alternatives to modelling.

In a relevant way, the model and modelling have been situated, through their initial practical uses, close to geometry, than any other scientific domain. The appearance of the term as such is linked to the year 1868, when the mathematician Eugenio Beltrami managed to construe an early Euclidian model for non-Euclidian geometry.

For the first time, he was turning the model and modelling into a concept, studying, by their agency, "a domain, a phenomenon, an object inaccessible to direct research". The geometry-inspired model became "a coagulant factor" for scientific thinking, a continuous process of pondering, represented, symbolized and conveyed, no less than the tetragrams were to Gottfried von Leibniz the inductive solution to the mechanic system of his own calculating mechanical device. At a higher level of elaboration, models are scientific representations, or representations of scientific theories. Paraphrasing Parmenides, the model that can be thought, and the one for which the thought exists are one and the same. Theoretical science, a permanent source of experimental suggestions, becomes at once experimenting and foreseeing, and along these lines the basic conditions of multi-dimensional modelling can be synthesized as follows:

– the first condition for a model is its direct relationship with thinking ("a bird is a machine functioning in accordance with the laws of mathematics, an instrument that man can reproduce with all its motions" – to quote Leonardo da Vinci, in *Macchine per volare*);

– a second condition is the identification of the essential aspects, and formulating questions in a correct manner;

– the profoundness, the intensity, and the depth represent the third condition of representation through models (the oscillation between analogy and he convention-symbol);

– the efficiency of the transposition, or the translation of the theory into the reality of the world under study seems to be anther condition, the superior models becoming themselves objects of research and re-modelling [3].

In keeping with the reasoning of modelling, as maximum fidelity translation or transposition, any theory corresponds to a model, and any model, when validated through the agency of reality, will correspond to reality. However, the closer the model will draw to the point of intersection of several sciences, the more correct the transposition/translation. Even the

exclusive answer to the question "what is a model" constitutes a difficult undertaking, and needs many-sided approaches. Below are some illustrative variants:

– in the option of physics, a model is a calculating instrument, with the help of which one can determine the answer to any question concerning the physical behaviour of the system in question, or else a precise pattern of a certain segment of the physical reality (two examples, which are today as well-known as to become banal, are the modelling of the inertial reference system, and the atomic model);

– in the vision specific to chemistry, the model becomes a structural concept that attempts to explain the properties found experimentally, or a support in deductively passing from the general to the specific, a knowing instrument that forecasts facts and "indicates the numbers" (as in the memorable example of Mendeleyev' s table of elements, or the periodicity of chemical elements);

– in the approach of biology (genetics), a model is considered a natural modality – reproduced experimentally – of genetically differentiating the populations (the model of DNA being, in this respect, a commonly cited example, and a relevant point in case);

– in the perspective of mathematics, the model is superposed to a certain type of measuring methods, specific to mathematical research, with a view to explain, in an objective manner, the "manner n which the micro-components and their mutual interactions, either interpreted individually, or grouped in subsystems, generate and explain the whole of the system" (Octav Onicescu and the model of informational energy), or a "definition and non-contradictory description of a number of processes and phenomena", of the theses, postulates and axioms, as well as their logical and mathematical correspondence;

– from a logical point of view, within the structure of the model, the causes equalize the effect (Anton Dumitriu);

– from a behaviourist standpoint, the model presupposes a number of participants gathered in a formal way, who "maximize their utility by starting from a stable set of preferences and accumulate an optimal amount of information in a variety of markets" (Becker's model);

– along the lines of the semantic, linguistic and explanatory dominant, the model is a theoretical or material system by means of which one can study, indirectly, the properties and transformations of a different, more complex system, where the first system exhibits an analogy (according to the explanatory dictionary);

– in its statistical acceptation, the phase-directed sense of the concept of model is that of a link in an integrated process of knowing, and is made up of a hypothesis, a schematic representation of a process (phenomenon), the statistical testing, and the resuming of the process in a general theory;

– in keeping with modern sciences, the multidisciplinary model becomes the optimum instrument for solving a number of complex general problems, and modelling turns into a series of means meant to disclose the real nature of the problems, where the isolated vision does not allow one to formulate characteristic laws.

– the statistical & mathematical or statistical & physical type of modelling is a mathematical transcription of a number of simplified hypotheses about the state or evolution of a social-economic phenomenon, or physical system under the factorial influence of variables that are physical or can be assimilated to the physical ones (in the modern scientific vocabulary, a statistical model also designates the explanatory hypothesis – model: χ^2, F, t etc.).

The Econophysics' or Sociophysics' models turn to account the language and methods of mathematics, testing and statistical decision, the pattern of physics in assessing (quantum, thermodynamic, acoustic etc.) reality, as well as the real variables of the segment subject to research (money flow in the economy, human behaviour in sociology etc.).

How can one manage to practically construct a model? The starting point is direct experience, or unmediated contact with reality. In order that a theory could be turned an experiment, or into an "organized contact with reality", a theory is formulated, which is subsequently represented by a material, intuitive or symbolic model, as a filtered reflection of reality. Louis Pasteur would elegantly underline the primacy of the theory, through the agency of the well-known formula: "luck favours only the well-prepared minds". Tiberiu Schatteles used to synthesize the likeness between theory and modelling through the phrase "the dogmatics of isolation". For instance, economic models are always partial models, and it is hence always possible to add another equation, quite irrespective of how large the system is. [4] In order to illustrate a phenomenon, the theory isolates it from the contingent, very much as the experiment is underlain by a type of material (i.e. laboratory) isolation. Studying a phenomenon in isolation also presupposes defining the framework of the isolation through postulates or axioms as "something that goes without saying". Due to their isolation tendencies, Econophysics and Sociophysics are somehow sciences of models joined to the art of choosing models which are relevant to the contemporary world. It is compelled to be this because, unlike the

typical natural science, the material to which it is applied is, in too many respects, not homogeneous through time. The object of a model is to segregate semi-permanent or relatively constant factors from those which are transitory or fluctuating so as to develop a logical way of thinking about the latter, and of understanding the time sequences to which they give rise in particular cases… In Physics and in other natural sciences the object of experiment is to fill in the actual values of the various quantities and factors appearing in an equation or formula; and the work when done is once and for all. In classical economics, theoreticians think that this is not the case, and to convert a model into a quantitative formula is to destroy its usefulness as an instrument of thought… "To do so would make it useless as a model. As soon as the model is done, it loses its generality and its value as a mode of thought" [5, 6].

Modelling, as a complex iterative process, oscillates between simplified variants like the "triad" (formulating a hypothesis, collecting the experimental material, and verifying the hypothesis), and excessively detailed variants (formulation of the initial model followed by the forming of repartition classes, gathering the experimental material or the data, choosing a particular repartition, checking the degree of concordance of the repartition chosen with the real situation and formulating the hypotheses that explain the random mechanisms that have generated the data). The typological diversity of the models results from the great number of the scientific theories that they reproduce. Seen from the angle of the aim they were created for, the models fall in two major types: the category of the rational or theoretical models, and the category of the operational models, or prediction (decision-making) models.

Through comparison with the time variable, modelling is static or dynamic. A major classification of modelling according to the typology of the explanatory variables reveals the deterministic type of modelling in the past (evolution of phenomena, determined solely by the mechanical, or simply causal variables) and modern probabilistic modelling (which contains perturbing variables, in keeping with the probable effect of some uncontrolled factors and unspecified variables). Contemporary evolutions of Econophysics and Sociophysics led us to the idea that modelling can not be only multidisciplinary. For a succinct description of modelling in Econophysics and Sociophysics, a few clarifications are in order, relating to their architecture and paradoxes, but also to their various stages.

The architecture of multidisciplinary modelling capitalizes on:

a) minimal simplification through hypotheses (it was formulated for the first time by William Ockham as the first economic architecture, or of

parsimony) or the existence of a minimal number of propositions not connected mutually, and undemonstrated propositions (out of two interpretations of a phenomenon, the interpretation having fewer supposetions or simplifying hypotheses is preferred);

b) he simple alternative (the highly intricate models failed to lead to categorically better results, as against the simple extrapolation formulas – Koopmans T.C.);

c) the value certified through the dialectical reasoning (a model facilitates the discussion, clarifies he results and limits the reasoning errors);

d) the cultural component (if the humans' economic and social actions were independent of their cultural inclinations, the enormous variability of the economic and social configuration in point of time and place could by no means be accounted for);

e) the shifting from only one discipline to many sciences or to a multidisciplinary model, through successive models (improvement through imitation, through analogy, and through passing from one type to another in Econophysics and Sociophysics).

Modelling in Econophysics and Sociophysics remains a process with a paradoxical content. The paradox of the infinity of the multivariable system is revealed by the infinite number of factors, which cannot be classified in a direct manner, in proportion to the particular model construed out of a finite number of essential factors. The paradox of the "relative reduction of one system to the next" proceeds from relative reducibility, centred on the translatability of the languages concerning various fields of reality, and manifests itself as an antithesis between the functional and the substantial. The paradox of the "unique community" can be translated through the antinomy holding between the correlation of the action of several models, and the building up of a unique model for a given problem. The paradox of the "double idealisation" concerns the phases of simulation, and respectively, of the assignation and interpretation of information within the model. Multiplied, information is not lost from the model, very much as, fragmented, it is nothing but information. The "double idealisation" consists in treating information as "signification" of information in the model of attribution, whereas in the interpretation model it is treated equally as signification and as sense.

The concrete stages of modern modelling in Econophysics and Sociophysics are the following:

1. the structural defining of the system (isolating the phenomenon, formulating the questions, identifying the major interest variables),

2. the preliminary formulation (sets of hypotheses and conclusions concerning the relationships between the variables), collecting the empirical (relevant) data,

3. the estimation of the parameters and of the functional forms,

4. the preliminary (gross) testing,

5. the additional testing (based on the new data),

6. the decision – accepting or rejecting (in conditions of predictions conforming or failing to conform with the available empirical evidence).

Synthetically, the relationship between completeness and precision/accuracy generates specific models (Table 1):

Table 1

Degree of the data's completeness and precision generating the typology of the model

Degree of completeness of the data	**Degree of precision of the data**	**Typology of the model**
Maximum	Maximum	deterministic
Relatively low	relatively high	probabilistic
Relatively high	relatively low	fuzzy
Relatively low	relatively low	intuitive
Minimum	Minimum	nondeterministic

The algorithm of the model has three characteristic features: determinism in point of performance, succession in point of operation, universality in so far as the spatial, temporal and structural entries and limitations are concerned. Modelling exhibits three main ways of analysis:

– using the equilibrium equations between the factors, from Leontief's input-output balance, to the fuzzy ones, and to those of quantum physics, thermodynamics etc. (Leontief's model was subsequently generalized in three distinct variants, i.e. the deterministic, the random, and the information ones, the fuzzy model has impredictable variation parameters, the quantum physics' model means transgresion or transition from energy to light, or from wave to particle etc.);

– identification of the extreme values as the model of the "catastrophes", or of R. Thom's "critical points" – which is the frequently cited example in point;

– construction or simulation of conflict situations through the "strategic games with incomplete information (i.e. competitive situations) or complete information (i.e. open situations).

The uncertainty of decision-making is paramount, all the way from Wald's (prudent or pessimistic) model, characterized by choosing the maximum profit variant, or the minimal loss cost wise, in the most unfavourable situation, to Laplace, which selects the higher average-profit variant, or the lower average-loss, in the hypothesis that the states have the same occurrence probability, to Savage, where an option is made for the lowest possible regret (i.e. the usefulness lost as a result of selecting a different variant than the optimal one, in conditions of complete information), and to Hurwicz, whose coefficient of optimism re-enters, through its real-value interval, the vast realm of the probabilities, namely [from 0 to 1].

To illustrate the above, multidisciplinary modelling maximizes the capacity of reducing the degree of *imprecision/inaccuracy* and of assessing that *imprecision/inaccuracy* through statistical testing and testing in terms of probability theory, whereas even mathematical modelling approximates, while failing to express reality exactly as it is, because reality is not "exact/precise", but subject to the stochastic laws or to the action of the law of great numbers.

To express in a Econophysics and Sociophysics manner how inaccurate a model is, is more important than modeling in a classical, hence sophisticated, isolated manner, lacking the power of specificity. The perspectives of the field of model-construction astonish through the rigour of a new concept, namely that of the system of Econophysics and Socio-physics as multidisciplinary models, which presupposes the following principles:

- the human decision has the fundamental role in its functioning;
- the construction is a logical succession, and also a process of arrangement in time, in keeping with the principle of economy, or the law of parsimony;
- the separation and combination of the individual models occurs in procedure-based chains;
- the system stays open, thus facilitating the adding / the deletion of restrictions and variables;
- the physical-mathematical structure is independent of the manner of utilization;
- the architecture is modular, hierarhical and dynamic;
- the information-based and logical connections are, in turn, part of cooperative, hierarchical, mixed models;
- although including different types of models, the database if unique.

In the natural harmony of the Econophysics and Sociophysics' approach to modelling [7], the contribution scored by discovering of an original model is to be considered much higher than knowing a new phenomenon or process.

The limits of classical sciences' modelling are abvious:

- no classical model can consistently and substantially incorporate the residual variables and areas (which can occasionally be quite considerable in point of proportions and significations);
- both human behaviour and other random variables like the climate, the radical political evolutions such as the revolutions, etc., as soon as they are modelled, bestow an increased amount of uncertainty to the respective model;
- the model has evolved in a credible manner along the coordinates of the chronological series, and less so, however, along those of the territorial series, of the associated / correlated series, in the specific situations of value optimizations, or concerning verisimilar, attainable targets developing programmes.

To conclude, a model can be said to represent an image of a specially selected part of reality, with the aid of which answers can be given to various questions, or problems belonging to an assortment of fields in the area of scientific knowledge can be solved, with a certain degree of realism and a certain limit of error. The main disadvantage of the classical model, if one resorts to the example provided by the very econometric one, is revealed by the lack of accuracy of their prediction, by the representatives of the neoclassical Austrian school of economics Ludwig von Mises and Friedrich von Hayek. The sad balance of the predictions made by the econometric models over the past few years, for all the modern calculation equipment added to the sophisticated classical or uni-disciplinary models, is nothing but an additional confirmation [8, 9].

Econophysics and Sociophysics' models are nothing else than partial models, and it is hence always possible to add another equation, quite irrespective of how large the system is. What seems to be required, then, is a determination of the reliability of the estimates of a given system *within* the system, but *without* adding further equations. Classical model are limited and modern through their multi-disciplinary solutions are more adequate to reality.

4. Some typical models from Econophysics and Sociophysics

Econophysics means also a scientific approach to quantitative economy using ideas, models, conceptual and computational methods of statistical physics. In recent years many of physical theories like theory of turbulence, scaling, random matrix theory or renormalization group were successfully applied to economy giving a boost to modern computational techniques of data analysis, risk management, artificial markets, macroeconomics [10].

In Econophysics, the activities of research focused on economic phenomena but are analyzed by concept, method and model of physics. Here three typical examples are:

a) the derivation of a price's distribution in the stock market (the change in the price "*x*" of stock market could be considered a random among dealers, then can derive a diffusion equation as a Brownian motion, for distribution *f*(*x, t*) of price in the stock market) [11]:

$$\frac{\partial f(x,t)}{\partial t} = \frac{1}{k} \times \frac{\partial^2 f(x,t)}{\partial x^2}.$$

b) distributions of the form that follows a *power law* as: $\ln p(x) = -\alpha \ln x + C$, where the constant α is called exponent of the power law, and C is constant and mostly uninteresting (once α is fixed, it is determined by the requirement of normalisation to 1), or in the case of taking the exponential of both sides, this is equivalent to: $p(x) = Cx^{-\alpha}$ (a power-law distribution occurs in an extraordinarily diverse range of phenomena such as Finance, Macroeconomics, Demography's urbanism) [12].

c) a fractal and chaos analysis originating as Benoite Mandelbrot pointed out that the change in the price of the stock market has a fractal structure for certain range of time interval [13,14], and characterized as a self-similar structure expressed as: $x(t) = Ct^D$, where D is a fractal dimension, calculated by the box counting method. The fractal structure is special case of a chaos and chaotic behaviour is very common in a non-linear system as for an economic system; whether the process is chaotic or not can be determined by sign of Lyapunov index λ defined as: $\lambda = 1/n \, \Sigma \log |F'(t)|$, and when λ is positive (negative) then the process is chaotic (non-chaotic) [10].

Modern Econophysics has developed a new learning system for econophysicists, a system consisting of several methodological parts:

1) Basic Mathematics' methods,

2) Basic Econometrics' methods,

3) Echonophysics' methods, including chaos' methods and fractals' methods,

4) Virtual market's methods.

reviewing classical methods and concepts concerning to each part: Mathematical representation and analysis of the economic data for basic Econometrics; the chaos and fractal including the Lyapunov index and the fractal dimension for Econophysics; the Sato-Takayasu model and simulation for virtual market [10].

A very difficult problem in the specific modelling is the testing of the data, model or of the predictions based on modeling. The question is always the same: How well can past information predict future evolutions? The main assumption is that there should be no pattern in the time series of information, or with other words, the information should be approximated by a random walk (and the autocorrelation of the information time series should be negligible). Sometimes the theories of modeling are called or „baptized" with very strange names as they can be found in the literature (i.e. in the efficient market hypothesis there are three major models named the fair-game model, the martingale or sub martingale model and the random walk model [15].

Sociophysics aims at a Statistical Physics modelling of large scale social phenomena, like culture and opinion formation and dynamics, cultural and behavioural dissemination, the origin and evolution of language, competition and conflicts, crowd behaviour, social contagion, gossip and rumours evolutions, Internet and World Wide Web, cooperation and scientific research, appearances of terrorism etc. A good overview of several fields of application and an accessible, entry-level description of many simulation models can be interpreted as forming part of the Sociophysics. For instance, in a paroxysm crisis of fear, opinions can be activated very quickly among millions of mobilized citizens, ready to act in the same direction, against the same enemy, but a lot of phenomena can be studied within the new emerging field of Sociophysics, in particular the dynamics of minority opinion spreading, the rumour propagation, etc [16,17,18]. The most remarkable pioneers of Sociophysics probably are Serge Galam (*Sociophysics: a personal testimony*), Dietrich Stauffer (*Sociophysics Simulations I: Language Competition*), Paris Arnopoulos (*Sociophysics: Chaos and Cosmos in Nature and Culture*). The list is necessarily limited and unavoidably lacking of many important contributions in this research area [19].

In the last two or three decades new interdisciplinary approaches to social science have been developed by natural scientists. The distribution of unemployment required a new understanding of society, the dynamics of social systems has been gradually introduced by W. Weidlich (1972) and H. E. Stanley (1992) and a thermodynamic approach to social problems has been favoured by D. K. Foley (1994), J. Mimkes (1995), A. Drăgulescu and V. M. Yakovenko (2001).

For a better understanding, there are detailed some models of spreading opinions within a human population. Serge Galam was the first who have modelled the spread of opinions within a population and gets an equation of the inertia of democratic systems against changes. In the last twenty years, sociophysicists have introduced a series of Sociophysics models. These could be divided in different general classes, which deal respectively with:

a) opinion dynamics,
b) decision making,
c) competitions / conflicts, fragmentation versus coalitions,
d) income or wealth spreading and concentration,
e) residential segregation, migration dynamics,
f) cultures and languages evolution,
g) friendship and sex,
h) internet and world wide web evolution,
i) religion spreading,
j) social networks dynamics,
k) traffic dynamics,
l) democratic voting in bottom up hierarchical systems,
m) terrorism spreading etc.

Using these original models several major real political social and religious events were successfully predicted (from the victory of the French extreme right party in the 2000 to the voting at fifty-fifty in Germany or Italy). The models are real important tools for a reasonable perspective and make Sociophysics a predictive solid field. Sometimes model are philosophical instruments more than scientific. In the year 2000, Katarzyna Sznajd-Weron have proposed another model of opinion formation, which was based on trade union maxima “United we Stand, Divided we Fall” (USDF) known as the model (SM). The main characteristic of SM model is that information flows only outward. A great hope for the model of Sociophysics is to show similar correspondence between simple interactions among entities (agents being the preferred sociophysical term) and complex behaviour in the final aggregate. A

generalized model of opinion formation in a sociophysical way details in a mathematical way the spread of thinking through social groups. In the hypothesis of a system consisting of N individuals (members of a social group), in which each of them can share one of two opposite opinions on a certain subject, denoted as: $\sigma_i = \pm 1$, $i = 1,2,\ldots,N$.

The opinions of the individuals may change simultaneously (synchronous dynamics as in Glauber theory) in discrete time steps according to the rule:

$$\delta i(t+1) = \begin{cases} \delta i(t) & \text{with the probability } \dfrac{\exp(-l_i/T)}{\exp(-l_i/T)+\exp(l_i/T)} \\ -\delta i(t) & \text{with the probability } \dfrac{\exp(l_i/T)}{\exp(-l_i/T)+\exp(l_i/T)} \end{cases}.$$

In this model parameter „T" could be called the "social temperature" and I means the impact that determines the individual person to change his opinion when $I_i > 0$ [20,21]. Since the 1780s, when Euler invented network theory, till nowadays many models and applications of the graph theory [22] exist under the form of network analysis. A model, proposed by Ausloos, M., Gligor, M., [23] considers that the M agents (countries) which the ME time series refer to, may be the vertices of a weighted network. The weight of the connection between i and j reflects the strength of correlations between the two agents and can be simply expressed as: $w_{ij}(T) = |C_{ij}(T)|$, fulfilling the obvious relations: $0 \le w_{ij} \le 1$; $w_{ij} = w_{ji}$ and $w_{ij} = 1$ for $i = j$. One must stress at this point that the link connecting the vertices i and j does not reflect here either an underlying interaction. Instead, the weight w_{ij} is a measure of the similarity degree between the ME fluctuations in the two countries. The term "fluctuations" refers here to the account of the annual rates of growth of the considered ME indicator. Networks are characterized by various parameters. For instance, the vertex degree is the total number of vertex connections. It may be generalised in a weighted network as: $K_i = \sum_{j=1}^{M} X_{ij}$ (j being different from i). Thus, the average degree in the network is: $\langle K \rangle = \frac{1}{M}\sum_{i=1}^{M}\sum_{j=1}^{M} W_{ij}$ (j being different from i). Finally, neither the model itself could solve everything, nor the method could analyse all the details. But there is a major conclusion in Sociophysics, that in modelling the human group's behaviour, a crucial

point always remains to study the group decision making and the related issue of the collective opinion formation and dynamics.

4. A final remark and conclusions

The real criticism of Econophysics is the absence of age variable, because models of Econophysics consider immortal agents who live forever, like atoms, in spite of evolution of income and wealth as functions of age, that are studied in economics using the so-called overlapping-generations models. Sociophysics needs more clarity, especially when it envisions probability at the foundation of social theory. There is no contradiction between this new field of Sociophysics and the Statistics. But, certainly, sociophysicists should be more careful when they are justifying their complex models. Sometimes this minds action seems to be averaged out and finally removed by virtue of the *law of large numbers.*

To conclude, Econophysics and Sociophysics models are multi-disciplinarity models and they try to unify, while classical models remains uni-disciplinarity models and they have succeed only to isolate. Thence, the culture of multidisciplinary modelling remains a practical issue, not certainly in as far as that culture is regarded only as a product of life, but life (reality) having become, in that sense, a consequence or an imprint of culture ... *The model needs the three great intellectual faculties, perception, imagination, and reason, and most of all he needs imagination, to put him on the track of those events which are remote or lie below the surface, and of those effects of visible causes which are remote or lie below the surface.* (Alfred Marshall)

The typical models of Econophysics and Sociophysics were and still remain the results of the weak or of the strong signals coming from outside, from the reality, into science's thinking.

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NEW ECONOMY Section

THE FINANCIAL CRISIS AND THE TRANSMISSION MECHANISM IN ROMANIA*

Elena PELINESCU**, Petre CARAIANI**

Abstract. *In this paper we analyze the transmission mechanism of the financial crisis in Romania. We estimate a four variable VAR on quarterly data using data on GDP, interest rate, the exchange rate and net exports following the SVAR method as proposed by Amissano and Giannini (1997). A shock in the interest rate negatively affects the aggregate demand and generates a slight depreciation of the nominal exchange rate.*

Keywords: *financial crisis, monetary policy, real economy, rate channel, structural shocks.*

1. Introduction

The issue of the current financial crisis was debated within the economic scene in Romania. The most important points of discussion were the potential impact on Romanian economy and the possible economic measures that could be taken.

The Romanian banking system, due to a prudent policy by the National Bank, was not directly affected by the financial crisis as it did not need government support. However, there are a few channels through which Romanian economy will be influenced: the credit channel, the real economy channel (through the drop in demand), the trade channel and the exchange rate channel, so that the efforts should be directed towards the impact through those channels.

As Governor of the Romanian National Bank – Mugur Isărescu (2008,a) pointed at the debate organized by Romanian Academy and NBR on 2nd October 2008, the banking sector in Romania was mainly influenced through the growth in the costs of external financing. But this influence is

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limited due to the characteristics of the financial sector in Romania, and also due to the financial and fiscal policy promoted by the National Bank. Here are few of the most important measures:

- The lack of exposure of credit institutions in Romania on the complex financial instruments that are at the origin of this crisis; the main reason for this is that there was a rapid expansion of traditional banking products on Romanian market;
- Most of the banks in Romania, including the branches of foreign banks, work under the authorization, rules, and overview by the National Bank and the capitalization and prudential standards Basel II of European Union;
- The National Bank imposed rules that are more restrictive even than those from Basel II, like those regarding the initial capital requirements for authorizing a credit institution in Romania;
- The high level of minimum mandatory reserves (20% for passives in RON and 40% for those in foreign currency) which ensure both a moderate growth in credit and a proper level of liquidity for credit institution.
- The National Bank promoted several measures to temper the growth in credits so as to lead to a sustainable credit process.
- There is also a certain level of liquidity for the credit institutions, although somehow lower than in the previous years, in Romania that ensure a good functioning of the financial markets.

In a speech on 10th December 2008, Governor Isărescu (2008,b) brought several arguments in the favor of Romanian banking system: a prudent policy from NBR characterized by high levels in the minimum reserves rates, administrative measures that targeted the credit expansion, a low level of bad credits. However, some negative effects are possible: a higher volatility of the exchange rate, a growth in the external financing costs, a decrease in the foreign capital inflows.

In order to underline the changes in the macroeconomic framework as well as the impact on the monetary policy transmission mechanism that appeared during 3rd quarter 2008 compared to the other quarters in 2007 and 2008 we discuss the main dynamics in the economy.

First of all, the economic growth rate in Romania continued in the 3rd quarter in 2008, reaching a level estimated at 8,9% with a slow tendency towards slowdown. The unemployment rate fell to 3,9%, following

the negative correlation with the economic growth. The signals of the crises impact take in place in the last quarter of the 2008 when the GDP growth increased only by 2.8% as compare the same quarter of 2007, the unemployment increased to a level of 4.4 as we see from the figure 1.

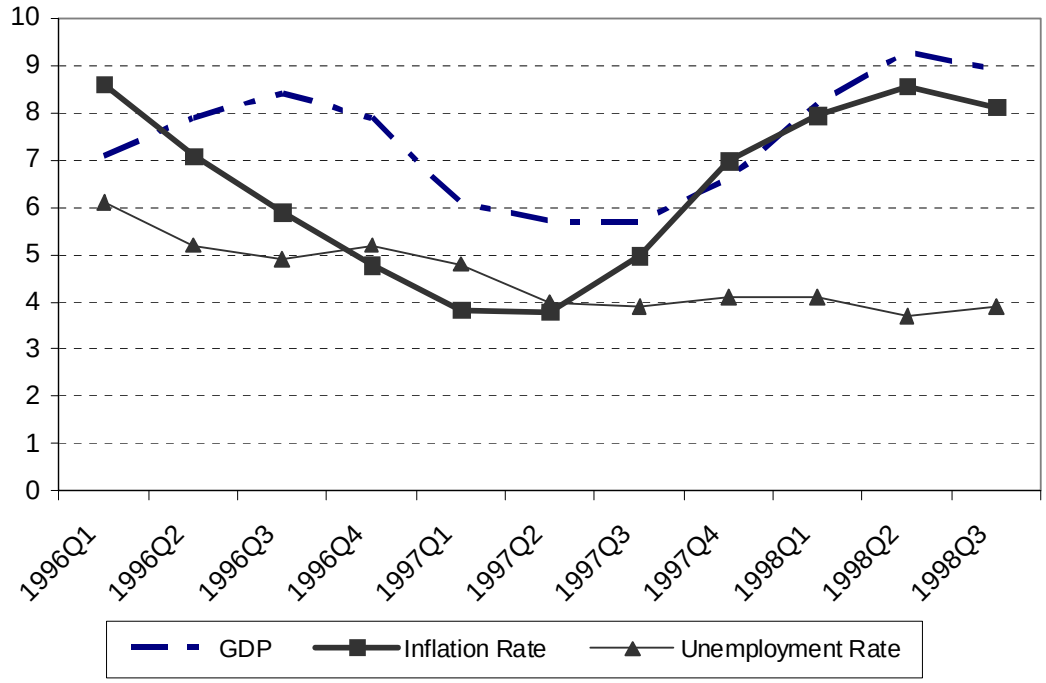

Figure 1. The quarterly dynamic of GDP growth, inflation rate and unemployment rate.

Source: Data from monthly bulletins INSSE, NBR, National Commission of Forecasting.

We also notice that the inflation rate, after a minimum of 3,79% in 2nd quarter 2007 entered on a slightly rising trend and reached 8,56% in the 2nd quarter in 2008 very close to the first quarter in 2006 and decreased to 6.8% in the last quarter of 2008. The acceleration in inflation was mainly generated by the increase in the international price for fuel and the depreciation of national currency with respect to Euro.

The analysis of the credit in Romania during December 2005 to September 2008 shows that the credit volume grew from one year to the other. The growth rate accelerated starting from the second half of 2007, especially due to the nongovernmental component. During this period, the growth of credits in foreign currency surpassed that of

credit in RON suggesting a higher exposure of population and of the economic agents to the fluctuations of national currency to the foreign currency.

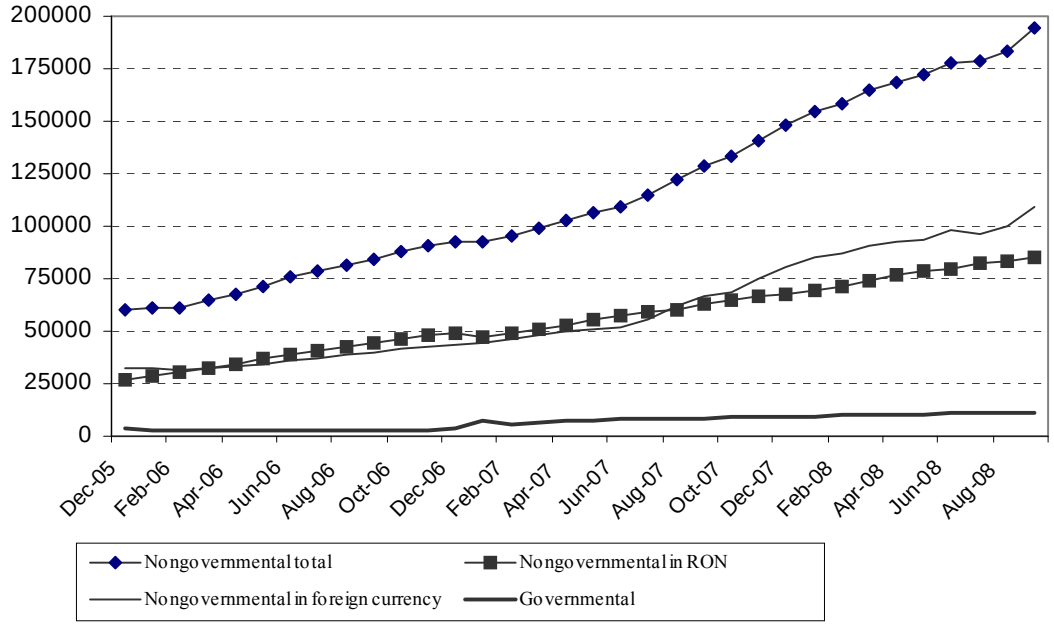

Figure 2. The dynamic of internal credit on main components in Romania.

Source: Data in monthly bulletin of NBR for September 2008.

The nongovernmental credit witnessed a more temperate growth during this period. The acceleration of the growth in nongovernmental credit explains the decision of National Bank to take administrative measures in order to temper the credit need of the economic agents.

The national currency continued to appreciate toward a minimum level of 3.47 RON/Euro on 7th of August 2008, and 2.23 RON/USD on 31st July 2008, after which is depreciated as we can see from figure 3.

The volatility of the national currency with respect to the foreign currency (both USD and Euro) has increased toward the end of September 2008 (see figure 4) in the context of the global financial crisis and its spread to other countries.

We also notice higher amplitude of the RON variation with respect to USD, having in mind that USA was the country that provoked the crisis from which it rapidly extended to the global economy. The impact on EU

was lower due to the rapid measures taken by the European Union countries and by the ECB in order to ensure a stable financial system in the EU.

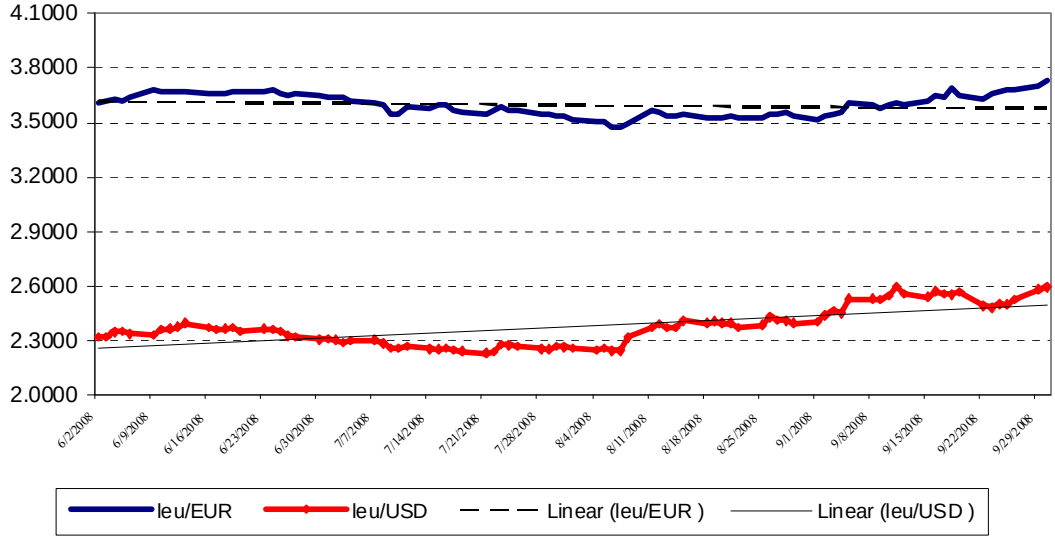

Figure 3. The daily dynamic of national currency relative to USD and Euro.

Source: Data from monthly bulletin NBR, June-September 2008.

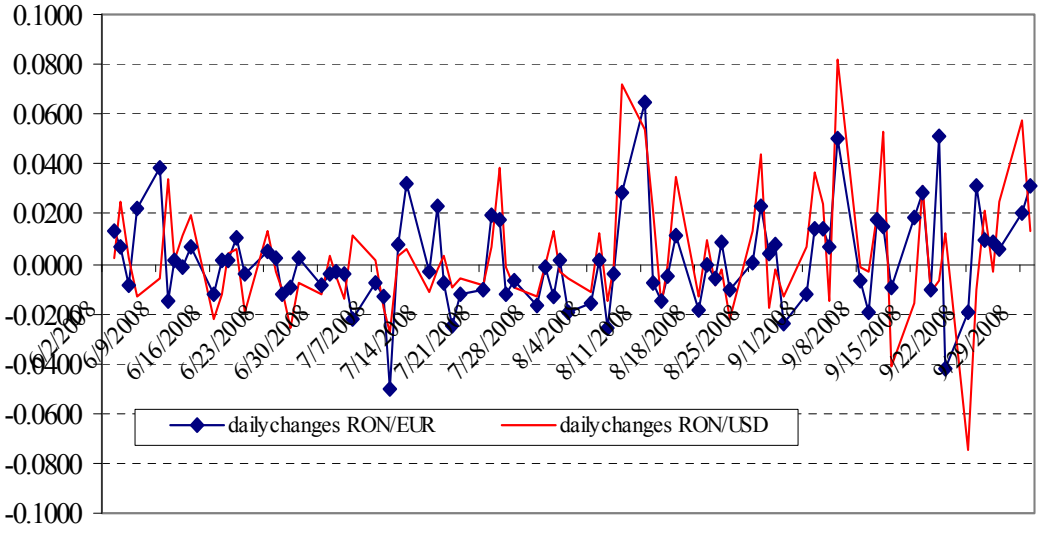

Figure 4. The Daily changes in the exchange rate of national currency relative to EUR and USD.

Source: Data from monthly bulletin of NBR: June to September 2008.

2. The Transmission Mechanism of crisis in Romania

The transmission mechanism of the economic and financial crisis had as the main channels in Romania the exchange rate channel and the credit channel, with a significant impact from the interest rate.

In order to underline the way the shocks were propagated through the two channels, a VAR model was used. The VAR contained the following variables:

$$Y_t = [r\_3re\_sa, \Delta gdp\_\text{lei}\_sa, ixm, \Delta er\_sa].$$

where:

- Δgdp_lei_sa expresses the change in real terms of the GDP, expressed in millions RON, with 200 as the reference year;
- r_3re_sa shows the index of the interest rate at three months, expressed at a quarterly level;
- Δer_sa is the quarterly change in the exchange rate for RON/Euro;
- *ixm* is the index relative to the previous month of the net export of goods and services.

By using the way of writing a SVAR as proposed by Amissano and Giannini (1997), we can write:

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & c_{32} & 0 \\ c_{31} & 0 & 1 & 0 \\ c_{41} & c_{42} & c_{43} & 1 \end{bmatrix} \times \begin{bmatrix} R\_3re \\ \Delta GDP\_re \\ IXM \\ \Delta ER \end{bmatrix} =$$

$$\begin{bmatrix} c_{11} & 0 & 0 & 0 \\ 0 & c_{22} & 0 & 0 \\ 0 & 0 & c_{33} & 0 \\ 0 & 0 & 0 & c_{44} \end{bmatrix} \times \begin{bmatrix} R\_3re \\ \Delta GDP\_re \\ IXM \\ \Delta ER \end{bmatrix} + \begin{bmatrix} u_{MP} \\ u_{gdp} \\ u_{IXM} \\ u_{ER} \end{bmatrix}$$

where: u_{R_3RE}, $u_{GDP,}$ u_{IXM}, şi u_{ER} are structural shocks due to monetary policy interventions (u_{R_3RE}), real economy (u_{GDP}), external balance (u_{IXM}),

and the forex market (u_{ER}). The lines from the matriceal form are treated as single equations. As the rank of the matrice is 4, the equivalent system has four equations.

The first equation is interpreted as a monetary policy rule, which the National Bank using the interest rate to influence the money demand with the highest liquiddity degree ($M1$); this leads to the restriction of c_{12} …c_{13} c_{14} coefficients to zero.

The second equation, that of the aggregate demand, shows the impact of the interest rate, as an instrument of monetary policy, on the real activity. It uses as restrictions the ones the imply that the National Bank does not immediately react to the real economy evolutions. Thus, the coefficients c_{21} and c_{24} are restricted to zero.

The third equation, which characterizes the external side, shows the influence of changes in the relations of the economy with the world economy. The coefficients c_{32} and c_{34} are restricted to zero.

The fourth equation is an equilibrium equation for the financial markets.

We discuss the impulse response functions to a 1% interest rate, unanticipated, positive shock, to the monetary policy instrument (shock 1), aggregate demand (shock 2), net export (IXM, shock 3), and the exchange rate (shock 4).

In figure 5, we observe that the unexpected interest rate shock (shock 1) leads to a 0.4% drop in aggregate demand with a delay due to the lag in the variables used. The impact on the exchange rate is rapid and strong. An unexpected shock in the net export leads to a drop in the interest rate by 0.4%. A shock in the exchange rate (shock 4) leads to a growth by 0.4% in the real interest rate at three months on the monetary market and a drop in the net exports which variations that span over five quarters.

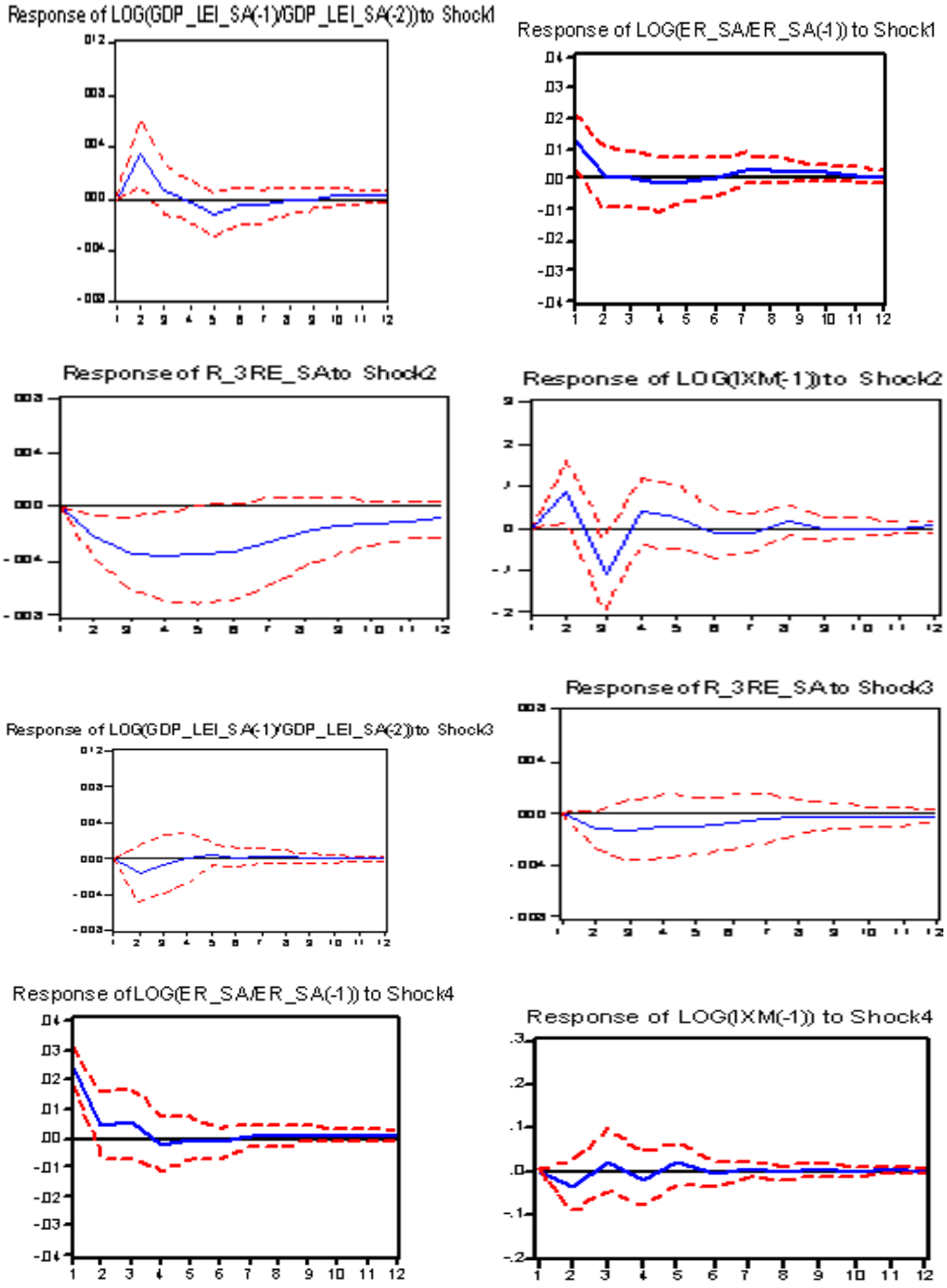

Figure 5. The Response of macroeconomic variables to structural shocks.

Source: Authors' computations.

3. Conclusion

The model discussed here reveals the fact that a monetary policy shock leads to a drop in the aggregate demand, which dies out after two periods. It also leads to a slight depreciation of the nominal exchange rate. A shock in the nominal exchange rate leads to a drop in the money demand in the first two periods and an increase in the real interest rate.

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METHODS AND MODELS FOR EVALUATION THE EFFICIENCY OF INVESTMENTS IN DISTRIBUTION FOR FOOD PROPRODUCTS COMPANIES

Felicia Adriana LUPU[*], Adrian Gelu LUPU[**]

Abstract. *In the process of investment decision making it is not only the question if some investment has to be made, but it has frequently appear the problem of selection the best investments between two or more alternatives. The managers must make investments decisions among alternatives that have varying cash flow patterns over times. Business investments, involve cash flow benefits over the life of the project lasting several years. An evaluation of the project would require calculating the present value of the stream of future benefits. The goal of this article is to develop a theoretical basis for creating a decision support system for distribution for food products companies. To achieve the goal, the following problems have to be solved: to analyze new models currently used in developing investment strategies, to show methodological procedure of investment economic analysis, to find the most important dynamic indicators used in estimating the economic efficiency of the investments in distribution for food products companies.*

Keywords: *alternative investments, investment decision, economic indicators, present value, future value, distribution.*

1. Introduction

An important characteristic of investments that is usually linked with the investment process is uncertainty of expected benefits. As longer is investment period, as higher is uncertainty of future effects. Although in investment theory those items invested into assets (buildings, vans, equipment etc.) are usually realized as investments, in broad sense of this topic investments include the permanent working capital as well as the following items: new technical and technological solutions, staff education and training, provision of licenses and other similar property rights,

[*] The Academy of Economics Studies, Piața Romană 6, Bucharest, Romania, e-mail: feli@yahoo.com

[**] The Academy of Economics Studies, Piața Romană 6, Bucharest, Romania, e-mail: adrian_lupu06@yahoo.com

development of trade network. Nowadays, the concept "Make money on events" is assimilating with investment[1]. Event driven strategies invest during special events in the life cycle of a corporation. Such special events can be: bankruptcies of other distribution companies, reorganizations, mergers and acquisitions. During these events, stock prices are mainly driven by the event not by the market. Therefore, most event-driven managers are specialized in certain industries[2]. Also, during unfavorable general market conditions, many investors consider investment vehicles that offer stable stream of returns[3].

The term *distribution*, in Patriche's vision[4], designates the complex of means and operations ensuring the placement at the users' or final consumers' disposal of goods and services provided by manufacturing enterprises. Or, in other words, distribution represents the process by which the goods and services are placed at intermediate or final consumers' disposal, providing them with the facilities of location, time, size etc.

The term *distribution* designates the complex of means and operations ensuring the placement at the users' or final consumers' disposal of goods and services provided by manufacturing enterprises. Or, in other words, distribution represents the process by which the goods and services are placed at intermediate or final consumers' disposal, providing them with the facilities of location, time, size etc., according to the requirements they express on the market[5].

In a society based on knowledge, distribution exceeds the limits of a mere transmission of merchandise, adding or associating to it a constantly-increasing range of services, as well as an active influence of production, based on the detailed knowledge of the consumers[6].

Distribution is meant to regularize the circulation of goods and services between production and consumption and satisfy consumers' needs, providing them with a series of services, giving them the possibility to choose from a wide range the goods and services that better correspond to their needs and exigencies etc.

Contemporary economy, by the complexity of the phenomena it generates, makes distribution methods evolve constantly. In such a context,

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[1] See for instance Jaeger L. (2002)
[2] See for instance Black K. (2004)
[3] See for instance Brant E. (2005)
[4] See for instance Patriche D. (1993, p. 35)
[5] See for instance Dayan A. (1987)
[6] See for instance Gnetta J. (1999)

new forms of wholesale and retail sale as well as new retail distribution systems appear[7].

2. Methods and Models for evaluation the efficiency of investments

Static models[8] – Only one period is being analyzed while applying a static model. It is a particular period of exploitation that should be considered as an essential period of exploitation, or, in hypothetical terms, it is a medium period. In such a case, all the data from the planned period are received, which characterize the relative medium period. The question arises if it is justified to rely on one objective function or it is possible to ignore relations between other areas of enterprise activities in the process of decision making. Moreover, the problem of static model should be assessed critically[9].

Dynamic models[10]. Investment projects are described by installments and payoffs, which should be paid while realizing the projects in the particular period of time. The assumption is usually related with this, that major influence of alternatives is limited by definite specified installments and payoffs. Their values can be determined in terms of time intervals. Installments and payoffs accounting as well as the analysis of dynamic indices in the particular periods is an essential feature differentiating the dynamic models from the statistical ones. It should be noted, that the dynamic evaluation of utility model in comparison with the static model is closer to reality, because, in this case, several periods are analyzed. Therefore, even though the application of the dynamic model requires more time, it is more efficient compared with the static model.

When we have to evaluate the efficiency of investment projects with a number of objective functions we use:

1. Methods based on quantitative measurements – consists in methods within multicriteria utility theory[11].

2. Methods based on initial qualitative assessments, the results of which later take a quantitative form. This group consists of analytic hierarchy method[12].

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[7] See for instance Kotler Ph. (1997, p. 684)
[8] See for instance Perridon L., Steiner M. (1999)
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[10] See for instance Heinhold M. (1997)
[11] See for instance Triantaphyllou E. (2000)
[12] See for instance Saaty T. L. (1994)

3. Methods based on quantitative measurements but using a few indices to compare the alternatives (comparison preference method). This group consists of comparison preference methods[13].

4. Methods based on qualitative data not using a shift to quantitative variables. This group comprises verbal decision analysis (VDA) methods[14].

It is possible to use methods from different groups of the classification above to analyze the effectiveness of investment policies. However, one should take into account peculiarities of individual investment problems.

A major goal of research is to develop a theoretical basis for creating a decision support system aimed to increase efficiency by applying multiattribute decision making approaches and mathematical modeling.

Mathematical models may be referred to classical optimization or multiple criterion decision problems, depending on major data, constraints or objective function. They can be solved for cases either of definite or indefinite information. According to game theory and under the condition of indefiniteness of the alternative selection the problem may be referred to one of the following types:

a) problems of stochastic indefiniteness arbitrary conditions described in terms of statistical distribution.

b) problems of total indefiniteness – the probability of effects of random action and the environmental factors is unknown. A decision is made by comparing advantages and disadvantages of the potential variant under various environmental conditions.

In completely defined problems unreliability or deviations are not taken into account. The preliminary stated limiting conditions are satisfied by forced decisions, while the unfavorable initial data are corrected based on practical experience. In this way, admissible but often unfavorable decisions are made. The above problems are intended only for a theoretically ideal case.

Many problems lack the essential data, while the provided data are incomplete or unreliable. When the uncertainty is caused by random factors defined by various statistical methods based on distribution laws, then we have the problems of stochastic indefiniteness[15]. When the laws governing the effects of environmental conditions and their probability are

[13] See for instance Roy B. (1996, p. 293).

[14] See for instance Larichev O. L., Olson D. L. (2001)

[15] See for instance Zavadskas E. K., Peldschus F., Ustinovichius L. (2003, p. 259-272)

unknown, we get the conditions of total indefiniteness. Then decisions are made by considering the advantages and disadvantages of the potential alternatives in the context of varying environmental conditions[16]. The problems of this type can usually be solved only by game theory approach.

If weights of attributes are unknown in a problem, it should be considered a problem to be solved under the conditions of uncertainty (indefiniteness). In this case, game theory approaches may be applied.

3. Dynamic indicators used in estimating the economic efficiency of the investments in distribution for food products companies

Construction of the alternative investments' models in a distribution companies is based on determination of input-output indicators and relations. In analysis of alternative investments in an enterprise we could get answers on the following questions:

- What investment alternative in enterprise is the most profitable one?
- Determination of choice between alternative investment possibilities.

In the process of finding out the answers on above-mentioned or similar questions, it is necessary to define the investment goal. If the leading principal is profitability, in the case when we have at disposal mutually exclusive investment projects, the investor would tend to invest available financial resources into economically most profitable solution. In the process of selection between possible investment project alternatives, the decision will be made in favour of the alternative with highest profitability degree, with greatest amount of profit in an enterprise. It is necessary to emphasize that it is started from preposition that management team makes choice between two possible investment alternatives economically justified in an absolute sense with given calculative interest rate. That is why the solving of this problem is in making choice of those investment projects which could be more profitable for the investor.

If management team has at disposal amount of financial resources sufficient for implementation of only one of possible two alternative investments, then profitability level of chosen investment alternative should not be lower than minimal profitability level investor would like to

[16] See for instance Peldschus F. (1986, p. 119)

achieve in the process of investment into enterprise. In that case the investor limits itself into the project that promises the highest level of economic effectiveness. In that way there have been adjusted amounts of available financial resources with investment possibilities in an enterprise.

The concept "time value of money"[17] is used in the evaluation of investments projects expected to provide benefits over a number of years. Money can be thought of a having a time value. In others words, an amount of money received today is worth more than the same Ron amount if it were received a year from now.

Because of the fact that the processes and the phenomena from the investment field are influenced by the implications of the time factor, it is necessary to valuate dynamically the parameters of the investment projects (the investment value, the project incomes and costs, the profit or the net cash flow etc.).

The dynamic valuation of the effort and effect indicators within the analysis of the economic efficiency provided by the investment projects has a significant relevance, when the value indicators defining the investment activity involve an unfolding, an evolution in time and consists in recalculation of the investment parameters, their presentation depending on the reference chosen moment, an operation that requires the use of the up-dating procedures. So, the up-dating is a specific method for the dynamic valuation of the investments economic efficiency, giving the possibility to calculate certain adequate dynamic indicators[18] that allow expressing and estimating the economic efficiency of the investments.

3.1. The capital commitment (*engaged capital/ up-dated total costs*)

The capital commitment indicator expresses the initial total costs of the investments for building the projected production capacities and the ulterior costs for commissioning, for their operation minus the redemption expressed in the present value for a certain reference moment, usually, at the moment of beginning the investment works (t_0). The time horizon for calculation of the engaged capital is (d +D), namely the duration of executing the investments works (d) and the duration of efficient operation for the investment objective (D)[19].

[17] See for instance Moyer Charles, J. McGuigan, Ramesh P. Rao (2007, p. 161)
[18] See for instance Bradu (2007, p. 49-52)
[19] See for instance Stoian M., Ene N. (2002, p. 92)

In distribution companies, it is aimed to minimize the capital commitment at a given level of the storage capacity, total incomes and total economic advantages.

3.2. The Payback Period (PP)

The payback period of the investments is a segment of the useful life concerning the operation of the capacities provided through investments. The payback period of the investment represents the period of time that begins at the moment of commissioning the storage capacities, when the cumulated sum of the provided economic advantages equals the volume of the investments allocated in the project. In a dynamic approach one calculates the updated term of the investment payback, starting from the equality:

$$\sum_{t=1}^{d} \frac{I_t}{(1+r)^t} = \sum_{t=d+1}^{d+T} \frac{P_t}{(1+r)^t}. \tag{1}$$

This one is the variant when the calculations are done from the beginning of the investment works on the assumption that the annual profits Pt are generated only after commissioning the objective. Therefore, during the execution period are partially put in exploitation certain storage capacities that will generate certain advantages.

If the calculations are done at the moment of putting the objective into operation, then we have:

$$\sum_{t=1}^{d} I_t (1+r)^{d-t+1} = \sum_{t=1}^{T} \frac{P_t}{(1+r)^t} \tag{2}$$

where T – term of payback the investments.

If we accept a simplifying assumption such as the volume of the economic advantages expressed by the annual profit (*Pt*) is a constant quantity, i.e. it will the same for all the years of project operation:

$$\sum_{t=1}^{d} \frac{I_t}{(1+r)^t} = P_t * \frac{(1+r)^T - 1}{r(1+r)^T (1+r)^d}. \tag{3}$$

And then by applying the logarithm we get:

$$T = \frac{\log P_t - \log(P_t + I_t (1+r)^d * r)}{\log(1+r)}. \tag{4}$$

If more variants of the investments projects are compared, then is preferable the project providing a minimum payback period.

The use of the payback term analysis in the economic and financial valuation of the investment decision is considered as a way to take into account the risk of the projected investments. By giving the priority to the more advantageous projects, characterized by short payback periods, it is accepted the conclusion that the future incomes and economic advantages will not be affected by incertitude and risk at the same scale as in case of variants with larger payback periods.

Another argument in the favour of this method is represented by the fact that the companies confronted with a cash shortage will give more importance to the rapid recovering of the invested funds and, respectively, to the possibility to satisfy other necessities.

Although this method gives, really, an indication concerning the level of the project liquidity, it has also certain deficiencies. It is known that the expansion project and those related to innovations and modernizing as well are implying a planning on long term. And this method does not take into account the cash flows ulterior to the payback term and, therefore, can lead to selecting investment projects less profitable. In spite of the fact that the method of investment payback period is easy for use, knowing its disadvantages, it is recommended that, during the taking the decision about the investment, certain valuation criteria have to be used.

3.3. The net present value (NPV)

This indicator, being a fundamental criterion for the economic and financial valuation of the investment projects, characterizes, as absolute value, the advantage gain of an investment project, the investor's gain for the invested capital expressed as cash-flow in present value.

Defined in comparison with the cash-flow, the *NPV* provided the scale of comparison between the total present cash-flow generated during the life of the project (CF^{up}) and the total investment effort provided by that project, expressed in present value (I_t^{up}) [20, 21].

Defined by means of the net value, *NPV* expresses the algebraic sum of the present net value upon the horizon of time (*d*+*D*). By annual net value *NV* it is understood the difference between the annual volume of

[20] See for instance Stancu I. (1997, p. 291)
[21] See for instance Cistelean L. (2002, p. 319)

incomes (receipts) generated during the all operating period of time *Vt* and the volume of the total annual costs (investments and operation in the year *t* (*Kt=It+Ct).*

According to the criterion *NPV*, must be accepted the projects and the project variants for which $NPV > 0$. This fact means that the corresponding project has the capacity to reimburse during the economic life (D) the invested capital or, in other words, has the capacity to generate an income flow in excess, providing a certain volume of net value.

A project with $NPV < 0$ has to be rejected because its rentability will be smaller than the updating rate.

This indicator has, also, certain deficiencies:

- *NPV* allows us to see if the investment project is or is not profitable, but does not strike off the register the relative importance, that comparative one of the project advantage;
- *NPV* does not take into account the size of the payback term;
- *NPV* depends very much on the size of the updating rate (*r*) and in this case it is very important that this size must be fixed depending on its main components (the capital cost, the risk prime, the inflation prime).

Nevertheless, *NPV* remains one of the best criteria for selecting the investment projects. But, in order to exclude the risk of certain incorrect decisions it is recommended the analysis of this indicator together with other ones, namely the profitability index, the internal rate of return, the updated term of the investment collection.

3.4. The profitability index (PI)

Usually, the profitability index is used together with the *NPV* indicator. During the calculation and the analysis of the investment project one uses this index when the investment projects or the projects variants are differentiated between them through the necessary investment effort, because this index takes into account the size of the investments, i.e. the necessary investment costs, element that is not provided when we use the *NPV* indicator. The profitability index is calculated according to the relationship[22].

An independent investment project must be accepted only if $PI > 1$ and has to be rejected if $PI < 1$. The project having $PI = 1$ (same as when

[22] See for instance Cistelean L. (2002, p. 333)

NPV = 0) will provide the recovering of the investment expenditure only, without generating some profit. The more *PI* is the more profitable are the projects.

3.5. The internal rate of return (IRR)

This is defined as the updating rate that provided equality between the updated value of the net cash-flow incomes and the updated value of the investment costs. It results that *IRR* represents that discounting rate for which the *NPV* value is equal with zero.

The internal rate of return is one of the most significant indicators for the efficiency of the investments project, because it expresses the investment capacity to generate profit during the all operating period of the objective by fixing its economic power.

The *IRR* value can be calculated through the *interpolating method*[23].

When we compare alternatives of investment projects or project variants, characterized through *NPV* close values the priority is given to the project (variant) having a maxim *IRR*.

The resulted *IRR* value is compared frequently with the interests rate of credits r_i. Depending on the capita taken as a loan, *IRR* represents the maximum rate of the interest for which is possible the capital loan for financing the investment in conditions of profitability. For an interest rate $r_i < IRR$, the project will have a $NPV > 0$ and, consequently, the project will be accepted. For an interest rate $>IRR$, the project will be unacceptable, because it will generate losses for a $NPV < 0$. In the case of $= IRR$ the capital taken as a loan does not bring any gain. As a conclusion, there are accepted only the projects characterized by a *IRR* larger than the cost of the capital.

4. Conclusions

A complex analysis of methods and techniques currently used by the researchers of various countries to determine the efficiency of investments was made.

For selection of investments that compete to be implemented in an enterprise it is necessary to estimate do those investments represent alternatives.

[23] See for instance Stoian (2002, p. 98).

In the analysis of the economic efficiency concerning the investment projects, a significant importance has the number of the analyzed projects, either a sole project or a set of investment portfolio when there are independent projects and projects that exclude themselves reciprocally is in discussion. The analysis of a sole project is a particular case of a portfolio of investment projects when the criteria *NPV, IRR* and *PI* leads to the same conclusion concerning the acceptation or the rejection of the investment project. This happens because between these indicators there are relationships of interdependence:

if $NPV > 0$, it is obvious that *IRR* >and $PI > 1$

if $NPV < 0$, then also *IRR* <and $PI < 1$

if $NPV = 0$, then also $IRR = 0$ and $PI = 1$.

It could be resumed that in the case of selection between two (absolutely) economically justified investment alternatives, it is valid the following criterion of maximal net present value: Under supposition that one investor could save money in bank or get any amount of credit under determined interest rate, between two economically justified investment alternatives, it is more favorable one for the investor which at the moment before the first investment (in the moment 0) has higher net present value. Beside amount of net present value, the selection between alternative investments could be done even by some other absolute parameters of economic investment effectiveness, i.e. by application of annuity method or the method of changing asset value at the end of investment period.

We could conclude that for investor the more favorable investment is the one which enables higher rate of effective invested capital compounding. Similarly as in the case of net present value method utilization, procedure of economic effectiveness comparison between two alternative investments on the basis of their internal rate of return depends on the fact if analyzed investments represent full alternatives, or they differ in investment amounts, or expected utilization period. In the cases when those two parameters (investment amount and utilization period) are the same in two investments, criterion for selection of economically more effective investment alternative is the following: Investment I is economically more effective than Investment II if it has higher internal rate of return.

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SPIRITUAL VALUES – THE PATH TO MORAL CAPITALISM

Ana Maria GRIGORE*

Abstract. *Business must acquire a moral dimension, and leaders and managers should also take responsibility for the world in which they operate and create wealth.*
The true measure of a firm performance is multi-dimensional and should say something, besides the profit or increase market share, about the moral values and business ethics.
This paper aims to show that a company can have spiritual values and be profitable at the same time.

Keywords: *spiritual values, moral capitalism, business ethics, crisis.*

1. Introduction

In these times we live the terrible effects of the lack of responsibility. As Friedman [6] notices, referring to the financial crash: "this is how we got here: a total lack of responsibility at all links of the financial chain on which we all depend, and we either eliminate those who did it, or we risk a complete crash of the system. This is the price of our sins".

Wilson [19] said: "capitalism won the economic battle in the world, but it is on the defense when it comes to morality. The last challenge of capitalism is moral". Kolp and Rea [11] think that the mentality that drives executive managers to maximize shareholders, profit (and their own) led to a loss of 'soul' corporation – a good example is Enron. Kevin Rollins, CEO at Dell, refers to the 'soul of Dell' and states that a company has soul only if it has ethical behavior.

Gore and Blood [7] estimated that market economy is now at crossroads. To go forward, it is necessary to make a major transformation. They think the fundamental causes for the current crash are: short term thinking, weak management and set of rules, incorrect compensation, lack of transparency, mediocre leadership and disfunctional business culture.

* Hyperion University of Bucharest, 169 Calea Călăraşilor, St., Bucharest, Romania, email: anagrig27@gmail.com

This crisis is the latest in a long row, for example Enron, Worldcom, Adelphia or Savings and Loan scandal. Thousands of billions of dollars of investors and pension funds have disappeared, as well as many jobs, due to unscrupulous executives, managers, accountants, bankers, politicians, lawyers and auditors [14].

CEO's are generally seen as part of the problem, and not the solution. It became obvious that their concern was to increase personal wealth. We can expect the beginning of a new huge scandal: tedious arrangements for liquidation of companies at a small price with the help of evaluators willing to violate rules [17].

We are not surprised that the Americans have lost confidence in the business world and in those who lead it. In a recent poll, only 2% of respondents considered the executive managers in the "Fortune 500" worthy of trust. Robert Miller, CEO at Delphi, said: 'Society has come to believe that the collocation "corrupt CEO" is pleonastic' [4].

It is not surprising that CEO's are badly seen in the U.S. It is ironic that many of those who have led the company to insolvency have done very well on the personal level. Richard Fulda, for example, who led Lehman Brothers between 1993 and 2007, won about half a billion dollars, while Lehman Brothers no longer exists. Stanley O 'Neil, CEO at Merrill Lynch, retired with 161 billions [12]. The major losers of this crisis were not CEO's, but rather employees, shareholders, and tax payers are the ones who suffered.

2. Spirituality at work

Mitroff [15], with an experience of 25 years in crisis management said: 'no single crisis that we have studied so far was an isolated crisis. Each crisis is simultaneously an ethical crisis, a public relations one, a legal crisis, a communication and a coordination one, etc. He speaks of the two challenges facing all organizations today, both public and private, both profit- oriented and non-profit organizations, both government and business. They are: management and spirituality crisis. While the two may seem to have no connection with one another, they are actually only two opposite sides of the same complex coin, he says.

Spirituality cannot be confused with religion, although the two are related. White [18] makes a distinction as follows: 'spirituality consists of opening the perspective of a person to a superior power or of a Superior Self, it is not necessarily linked to any religious institution or a certain

Dogma.' Spiritual people want their lives and work to have purpose and meaning.

The main challenge of spirituality is to overcome the false perception that spirituality is a taboo and that does not apply to most organizations. Rhodes [16] emphasizes that 'workplace spirituality' has become a respectable topic, discussed in management textbooks.

Nowadays, people no longer want to leave their fundamental values at the enterprise gateway. Fogel [5], a Nobel Prize laureate in 1993, is one of the economists who have stressed the importance of spirituality in the new economy. He identified fifteen vital spiritual resources that include concepts such as: a perception of the purpose, a perception of the opportunity, a sense of the idea of community, strong family morals, a strong work ethic and high self esteem.

Above all, people are constantly searching for meaning and purpose in life. And they will find them where they spend most of their time, i.e at work. They want to work for a good organization, one that treats them and everyone else with respect. Research also shows that organizations which have learned to meet the spiritual needs of all stakeholder and employees are more profitable and productive. But equally important, they are happier places to work in [15].

3. Spiritual Capital – a new paradigm

One reason for which visionary leadership is so undeveloped today is the importance that the today's society confers to a certain type of capital: the material capital. Too often, the value of a company is judged according to the money earned at the end of a day, or to how much power it might provide us in comparison with others. This obsession with material gain has led to short-term thinking and the pursuit of one's own interests. It is true that any type of company we would like to work for needs some form of financial wealth if it wants to be successful in the short term. But for leadership to inspire long term, sustainable goals, it needs to focus on two other forms of capital: the social and the spiritual ones. These three types of capital resemble the layers of a wedding cake. The material capital is the top layer, the social capital is in the middle, and the spiritual capital is the lowest one, supporting all three of them [20]. This approach suggests a capitalism that is not solely concerned with selfish interests. It employs other terms as well for this new type of capitalism: 'moral capitalism', 'spiritual capitalism', 'sustainable capitalism' etc.

There is sufficient evidence that the managers interests in the spiritual values has started to grow. Kerns [10] signals a large number of sites and books about the business that deals with spirituality and a large number of 'business guru' that hold seminars related to this topic. White [18] considers that the academic world will no longer have the choice and will become "visionary in relation to new generations of students and their need for spiritual development that will have to be stimulated in school".

Fundamentally, spiritual capital reflects the reason for which an individual or an organization exists, the things one believes in, aspires to and assumes responsibility for. Our spiritual capital includes our moral capital. The spiritual capital is a new paradigm that requires us to radically change the mentality regarding the philosophical foundations, the practice of business management or any other type of company. I do not refer here to the concern of religion or spiritual practice. Rather, I refer to the power that a leader can unleash within individuals or organizations through the evocation of the deepest meanings, values and goals of people [20].

4. Spiritual Leadership

In today's world the thing that we miss most are the leaders who can transmit vision. A vision is something that you yearn for, we aspire to, something that is the binder of our company, the driving force, its inner vitality. When we are touched by a vision, the deepest values in us come into action, acquiring a sense of long-term goal of our company.

In his book, about the 8th step of wisdom, Covey [3] says 'When we study the life of all great personalities – people who had an overwhelming influence on those around ... we always find a model, a constant. Due to their constant efforts and inner struggle they always pursued in life, they managed to develop to a great extent the four capacities and native intelligence. In Covey's opinion, these are:

• mental intelligence (IQ). When talking about intelligence, we usually make an association with mental intelligence, and with our ability to analyze, to reason, to think abstractly, to use language, to visualize and understand. IQ, or share of intelligence, was discovered at the beginning of the XXth century and is tested using the Stanford-Binet intelligence scale. We all use to some extent IQ, because we would not be functional otherwise.

• physical or body intelligence (PQ) of the human body is a different type of intelligence, of which we are all aware implicitly, though, most of

us very often discover it openly. It is found in the respiratory system, circulatory, nervous as well as the vital systems. It scans ceaselessly the environment, destroying the diseased cells and fighting constantly for survival.

• emotional intelligence (EQ) refers to our share of emotional intelligence. In the mid 90s, in the book *Emotional Intelligence – Why it can matter more than* IQ, Daniel Goleman has expressed the kind of intelligence that our hearts and emotions have. EQ expresses through trust, empathy, self-consciousness and self-control, and the ability to meet the appropriate emotions of others. It is that state of synchronization and social opportunity, and is articulated in the courage to admit mistakes, to express differences and respect them.

• spiritual intelligence (SQ). Same as EQ, SQ has started in recent years to hold an increasingly important place in scientific research and in philosophical/psychological debates. Spiritual intelligence is the most important of all intelligence, because it becomes the source of orientation, guiding the other three types of intelligence. Spiritual intelligence is the ability to access meanings, values and of higher, long-term goals and unconscious aspects of the self, and to use these meanings, values and goals to live a richer and more creative life. Spiritual intelligence is the supreme intelligence of the visionary leader. It was the intelligence which guided men and women like Churchill, Gandhi, Mandela, Luther King Jr. and Mother Teresa. The secret of their leadership was their ability to inspire people by giving them a sense of the thing worth fighting for.

The highest forms of manifestation of these four types of intelligence are: vision for mental intelligence, discipline for physical intelligence, passion for emotional intelligence, and conscience for spiritual intelligence.

Since these four dimensions of life clearly overlap, we cannot act exclusively on any of them without directly or indirectly influencing the other dimensions. And this means to recognize that when people come to work, they do not leave their 'spiritual side' at home. Although 'the whole person enters the door every day, very often, people are forced to fragment themselves into a thousand disconnected pieces' [15].

Intelligent Management from the spiritual point of view can be developed by applying 12 principles [20]:

- *Self Knowledge*: Knowing what I believe in and appreciate, what motivates me deeply.
- *Spontaneity*: Seizing the moment and being responsive at any moment in time.

- *Being led by vision and value*. Acting according to principles and deep beliefs and living in the same way.
- *Holism*: Envisaging higher models, relationships and connections; having a sense of belonging.
- *Compassion*: Having the quality to feel as other people do, and a deep sense of empathy.
- *Celebrating Diversity*: Appreciating other people for their differences, and not in spite of them.
- *Domain independence*: Standing up in a crowd and having one's own beliefs.
- *Humility*: The feeling of being a player in a larger drama, the sense of one's place in the world.
- *The tendency to ask fundamental questions beginning with Why:* The need to understand things and their causes.
- *Ability to change perspective*: Ceasing in to a situation or problem and seeing the bigger picture; viewing problems in a wider context.
- *Use of adversity in a positive way*: Learning from mistakes, going back and suffering; the consequent growth.
- *Sense of vocation*: The feeling of being called to serve, of giving something back.

5. Spiritual values and the competitive advantage

The benefits of being fair and responsible will not appear immediately, it is sometimes necessary for several years to pass. Some benefits are obvious: a solid reputation, strengthen the market image, more loyal employees.

Hollender and Fenichell [9] think that a company's reputation and its brands are more valuable than the company's buildings and machines. In fact, they are the most valuable assets of the firm. The second most valuable asset is human capital. Consequently, the company that stains its reputation will suffer a decline in the market value. The above-mentioned specialists state that there is a strong positive correlation between being animated by a firm moral values and its performance in the market…

Leaders of large businesses – participants at the World Economic Forum – have been asked which is the most important measure of success. Only 20% answered profitability. Most mentioned corporate reputation, integrity and quality of products [8]. Of course, profit is essential for

the company survival. However, firms which are not concerned with stakeholder satisfaction will soon discover how hard it is to survive.

Batstone [2] signals that company employees with ethical values and behavior are six times less likely to leave the firm than others. Can ethical values – influenced at work – make an organization more profitable and grow employee satisfaction? The answer is definitely yes. Mitroff [15] provide strong (empirical) evidence which confirms the superior performance of the company ethics. Primarily, this is because these companies have more loyal, more productive and more creative employees.

There are claims that there are countless ways that reflect the company's principles in relation to its financial performance: growth in turnover, reduced risk, improved image, better relationships between employees and higher productivity. These arguments have reduced to silence those who said that 'making more than the basic obligations and legal requirements is pure madness'. There is evidence that people easily accept the price of known firms with social responsibility, and will buy from companies with ethical values, only if they offer a great discount.

Milliman et al. [13] in a case study demonstrate how Southwest Airlines uses 'a spiritual model based on values' to be a successful firm. A spiritual company, in the authors' opinion, is the one which wishes to have a positive contribution in the world. Bayley [1] found out that many employees of Southwest Airlines are now millionaires, yet they continue to work (they have a system of participation in profits, not a pension), because they are proud of their company, of what they have accomplished. Southwest Airlines has prospered while companies like Eastern and Pan Am have disappeared. They have the lowest costs in the industry, but pay the highest salaries. It is possible to do so because they have the most productive employees.

Jim Sinegal, co-founder and CEO of Costco, believes his company has a simple code of ethics, which contributed to its success. This includes the following: 'respect for the law, taking care of employees, shareholders and customers, as well as suppliers'. According to Sinegal, 'leading a good business and having a sense of ethics is a standard if you want to have success'.

Undoubtedly, it is clear that, in time, a company with principles and values will benefit from them in many ways.

6. Changing human behavior

John Sterman in *Business Dynamics: thinking and systems modeling for a complex world* provides a model for a system to work effectively. However, he shows, the system will work properly only if the people behave as they should. Most systems have the same defects as human behavior [20].

If one wants to change systems, one must first change human behavior. But human behavior does not change easily. To get a real transformation one must change the incentives that induce the behavior. This is the responsibility of a visionary leader. Nowadays business, politics, education and society in general are driven by four negative motivations: fear, greed, anger and too much importance given to self. When we control these negative emotions, we have confidence in ourselves and in other people, and strive to act from within ourselves.

We can change the motivations to more positive ones if we are inspired to do so. A leader who implements the 12 principles of the SQ can provide the inspiration and energy that it releases. I use the analogy of a pinball to explain the attractors, a concept in chaos theory, says Zohar [20]. The attractors are points that either collect energy or disperse it. In pinball the attractors are the small holes where the metal balls fall. Our motivations resemble these small holes, and metal balls are our behaviors. If one wants to move the ball in a pinball machine, one pulls on a spring and throws a new ball in the system, making thus everything fly and rearrange.

Pumping spiritual intelligence in our motivational system works in the same way. Hit the ball in their current motivational holes and enable them to reposition. In this way, when we apply the 12 principles of spiritual transformation in our relationships and lives, the exaggerated importance given to the self becomes exploration, anger becomes cooperation, greed becomes self control, fear becomes mastery of the thing we feared, and so on. Our motivations were stimulated, and this changes the behavior. While we change the behavior, we change the results, and the whole purpose and sense of our collaboration.

7. Conclusions

Each crisis is a spiritual one. ... There is no doubt that we are facing an unprecedented crisis. However, I strongly believe that if we can use

these times to develop organizations that meet the 'highest needs' of everyone who is linked to them, then we will not only survive, but will become even better. If we will not do so, we will continue to limp from one crisis to another [14].

The true measure of a company's performance is a multidimensional one, and it should say something, besides the profit increase or market share, about moral values and business ethics. Business must acquire a moral dimension, becoming more service-oriented and achieving value.

Leaders and managers must see above their own interests, and should see their role as the one to determine the company to have goals and spiritual values, not just profit. They should also take responsibility for the world in which they operate and where they create wealth.

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ROMANIA …ON ITS WAY TO EURO

Calcedonia ENACHE*

Abstract. *This paper aims to analyze whether Romania has achieved a high degree of sustainable economic convergence, if the national legislation is compatible with the Treaty establishing the European Community as well as the statutory requirements for national central banks are fulfilled by this country in order to become an integral part of the Eurosystem. The analysis reveals the need to further implement some structural reforms ensuring a higher ability of the Romanian economy to face asymmetrical shocks in relation to those impacting euro area economies. The perspective of Romanian's accession to the Economic Monetary Union – thus becoming part of the "heart of Europe" with a more powerful and more profound integration than in EU-27 – is in favor of ERM II entry in 2012 and changeover to the euro at the horizon of 2014, in context to minimize the duration of participation in this mechanism*

Keywords: *European Monetary Union, euro, convergence, economic integration.*

1. Introduction

Romanian's adhesion in the European Union on 1 January 2007 was the result of a period of sustained efforts on the reform of society and the economy, embarked on the previous decade, but accelerated since 2000. Thus, a new period started which should be completed with the euro adoption (2014), the transition to this stage requiring for the achievement of nominal convergence criteria as settled in the Maastricht Treaty for participation in a precursory phase of ERM II (2012). Nevertheless, the long term maintaing of nominal convergence indicators and, moreover, the full fructification of the benefits due to belonging to a performance monetary system, involve the fulfillment of real convergence criteria, which have a highly predictive content of the successful euro adoption by a country, respectively the acquiring of a positive cost benefit ratio.

For both the Economic Monetary Union and the European Union – the principal advantage of euro area extension is finalizing the internal market for goods, services and capital. However, these benefits would not

* Hyperion University of Bucharest, 169 Calea Călăraşilor, St., Bucharest, Romania

apply in the case of premature euro adoption, which could harm a country in many ways. Differences in business cycles could lead to "sub-optimal" interest rates in a national context (from the perspective of both economic stabilization and resource allocation) and the emergence of local "bubbles" or "crises". Unless convergence is sustainable, a country might run into competitiveness problems, which could no longer be solved through exchange rate adjustments. If there were not enough salary and price elasticity to adjust to changes in competitiveness and/ or shocks, there would also be a risk of protracted economic losses. For the euro area as a whole, premature euro adoption could lead to losing the credibility of the EMU project.

The admission of the Romanian economy in the euro area is an objective of extreme importance that can be carried out by considering the related costs and benefits. The position of the National Bank of Romania builds on sustaining macroeconomic consolidation and on encouraging the attention of structural reforms in the first years of the post-accession period, as well by pursuing a restricted flexibility of monetary and exchange rate policies (subordinated to the objectives of accomplishing a planned disinflation and of closing the ECB's definition of price stability) through this interval. The deadlines proposed for ERM II entry and for the euro adoption take into consideration the following issues: completing the major part of structural reforms and streamlining the labor market; getting the annual rates of inflation closer, in a sustainable way, to levels consistent with the Maastricht Treaty specific criterion and the ECB definition of price stability; the ongoing synchronization of the business cycle in Romania with the euro area and making progress in terms of real convergence; the relative exchange rate stability; consolidating the domestic financial market over the long run.

Thereby ensuring a sufficiently interval of time for making important steps forward in terms of nominal and real convergence, being ambitious enough to focus political will for furthering reforms.

2. How Romania meets the convergence criteria

2.1. Nominal criteria

Romania differentiates from the most countries that have committed by the Treaty to adopt the euro by the fact that it has no problems in terms of budget deficit and total public debt, while the exchange rate criterion cannot be correctly assessed as long as the Ron takes part in the Exchange Rate Mechanism II. The present position of the Romanian economy in

relation to the achievement of the nominal convergence criteria is summarized in the table 1 on the Maastricht criteria.

Table 1
Maastricht Criteria
(Nominal convergence indicators)

Nominal convergence indicators	Maastricht Criteria	Romania 2007
Inflation rate (percent, annual average)	<1.5 pp above the average of the three best performing Member States (2.8 percent)	4.9
General government deficit (percent of GDP)	< 3 percent	2.5
Government debt (percent of GDP)	< 60 percent	13.0
Exchange rate vs. euro	+/– 15 percent	+10.8/–9.6
Long term interest rates (percent per annum)	< 2 pp above the average of the three best performing Member States (6.4 percent)	7.1

Source: ECB, May 2008 Convergence Report

The inflation rate, as it was measured by the consumer price index, had an descendant trend from 45,7 percent in 2000 to 4,8 percent in 2007 (Table 2). The performance was mainly due to the following factors: the substantial sterilization of the liquidity excess in the domestic market through market operations; raising the restrictions of the reserve requirements regime applied to the foreign currency liabilities of credit institutions; the prudential measures to maintain the moderation of the non-government credit expansion, especially its currency component; the accelerated implementation of the legislation for establishing the business of lending to non-bank financial institutions. Across the euro area the average inflation rate was 2,2 percent, ranging between 1,6 percent in Finland and 3,5 percent in Ireland – against the backdrop of increasing in indirect taxes, administered prices (especially with the effects in terms of prices of tobacco and health services) and the evolution of oil price. Between April 2007 – March 2008, according to the Harmonized Index of Consumer Prices (HICP) used by European Commission and by European Central Bank, the inflation rate in Romania equaled 5,9 percent compared to the reference value of 3,2 percent, i.e. 1,5 percentage points above to the average of three best performing EU Members States: Malta (1,5 percent), Netherlands (1,7 percent) and Denmark (2 percent).

Table 2

The evolution of the inflation rate in Romania
and in some Member States of European Union, 2000-2007
(annual percentage changes)

Year	2000	2001	2002	2003	2004	2005	2006	2007
Romania	**45,7**	**34,5**	**22,5**	**15,3**	**11,9**	**9,1**	**6,6**	**4,8**
Belgium	2,7	2,4	1,6	1,5	1,9	2,5	2,3	1,8
Denmark	2,7	2,3	2,4	2,0	0,9	1,7	1,9	1,7
Germany	1,4	1,9	1,4	1,0	1,8	1,9	1,8	2,3
Ireland	5,3	4,0	4,7	4,0	2,3	2,2	2,7	2,9
Greece	2,9	3,7	3,9	3,4	3,0	3,5	3,3	3,0
Spain	3,5	2,8	3,6	3,1	3,1	3,4	3,6	2,8
France	1,8	1,8	1,9	2,2	2,3	1,9	1,9	1,6
Italy	2,6	2,3	2,6	2,8	2,3	2,2	2,2	2,0
Malta	3,0	2,5	2,6	1,9	2,7	2,5	2,6	0,7
Netherlands	2,3	5,1	3,9	2,2	1,4	1,5	1,7	2,2
Portugal	2,8	4,4	3,7	3,3	2,5	2,1	3,0	2,4
Finland	2,9	2,7	2,0	1,3	0,1	0,8	1,3	1,6

Source: EUROSTAT

The criterion of the Maastricht Treaty referring to the deficit budget – maintaining it below the ceiling of 3 percent of GDP – was respected in Romania since 2001, amid tighter control over spending and the improved performance of revenue collection (Table 3). Regarding euro area, in 2000 there was awarded a budget surplus of 0,1 percent of GDP, in view of the fact that fiscal policy was chiefly aimed at boosting the economy, as well as France and Italy (1,3 percent and 0,3 percent respectively). In the next period, the weaker-than-expected economic performance made most of the EMU members resort to tax incentives, which brought about a widening of the budget deficit, from 1,8 percent of GDP in 2001 to 3,1 percent in 2003, the highest deficits were seen in Greece (5,7 percent of GDP), France (4,1 percent of GDP) and Germany (3,9 percent in GDP). The budget deficit down to 0,6 percent of GDP in 2007, public investment and social benefits (other than social transfers in kind) paid by the general government representing 2,4 and respectively, 15,3 percent of GDP.

Table 3

Consolidated government budget in Romania
and in some Member States of European Union, 2000-2007
(as a percentage of GDP)

Year	2000	2001	2002	2003	2004	2005	2006	2007
Romania	**– 4,4**	**– 3,5**	**– 2,0**	**– 1,5**	**– 1,2**	**– 1,2**	**– 2,2**	**– 2,6**
Belgium	0,0	0,5	0,0	– 0,1	– 0,2	– 2,6	0,3	– 0,3
Germany	1,3	– 2,8	– 3,7	– 4,0	–3,8	– 3,3	– 1,5	– 0,2
Ireland	4,7	0,9	– 0,4	0,4	1,4	1,7	3,0	0,2
Greece	– 3,7	– 4,5	– 4,7	– 5,7	– 7,5	– 5,1	– 2,8	– 3,5
Spain	– 1,0	– 0,6	– 0,5	– 0,2	– 0,3	1,0	2,0	2,2
France	– 1,5	– 1,5	– 3,1	– 4,1	– 3,6	– 2,9	– 2,4	– 2,7
Italy	– 0,8	– 3,1	– 2,9	– 3,5	– 3,5	– 4,3	– 3,4	– 1,6
Luxembourg	6,0	6,1	2,1	0,5	– 1,2	– 0,1	1,3	3,2
Netherlands	2,0	– 0,2	– 2,1	– 3,1	– 1,7	– 0,3	0,6	0,3
Austria	– 1,7	0,0	– 0,7	– 1,4	– 4,4	– 1,5	– 1,5	– 0,4
Portugal	– 2,9	– 4,3	– 2,8	– 2,9	– 3,4	– 6,1	– 3,9	– 2,6
Finland	6,9	5,0	4,1	2,6	2,4	2,9	4,1	5,3

Source: EUROSTAT

In 2007, the interest rates on long-term government securities stood on average at 7,1 percent per annum, slightly above the reference value of 6.4 percent (2 percentage points above the average nominal interest rates of the three best performing EU Member States in terms of price stability), vis a vis the euro area their differentials reached on average 273 basis points (Table 4). In view of the fact that long term government securities issues have a reduced frequency and the secondary market is not sufficiently liquidly – the emergence of a fair price being difficult due to the reduced number of transactions, satisfying these convergence criterion dependents on the inflation performance.

At the end of 2007 general government debt in Romania reached the level of 12,9 percent of GDP, with 9,7 percentage points below 2000 (Table 5). Even though, in terms of structure by currency it is clear that the euro was the leader (65,6 percent, mounting by 39,2 percentage points), the overall low level reduced the sensitivity to exchange risk. In terms of the Maastricht criteria, the value of this indicator is below the reference level of 60 percent of GDP. In the euro area, the public debt ratio recorded the smallest level since the beginning of Stage Three of the Economic and Monetary Union in 1999 (63,3 percent), the lowest values were acquired in Luxembourg (7 percent), Ireland (24,8 percent) and Finland (35,1 percent),

being on the opposite side Italy (10,1 percent), Belgium (83,9 percent) and Germany (65,1 percent).

Table 4

Maastricht criterion bond yields in Romania
and in some Member States of European Union, 2000-2007
(percentage per annum)

Year	2000	2001	2002	2003	2004	2005	2006	2007
Romania	**n.a**	**n.a**	**n.a**	**n.a**	**n.a**	**n.a**	**7,23**	**7,13**
Belgium	5,59	5,13	4,99	4,18	4,15	3,43	3,82	4,33
Denmark	5,64	5,08	5,06	4,31	4,30	3,40	3,81	4,29
Germany	5,26	4,80	4,78	4,07	4,04	3,35	3,76	4,22
Ireland	5,51	5,01	5,01	4,13	4,08	3,33	3,77	4,31
Greece	6,10	5,30	5,12	4,27	4,26	3,59	4,07	4,50
Spain	5,53	5,12	4,96	4,12	4,10	3,39	3,78	4,31
France	5,39	4,94	4,86	4,13	4,10	3,41	3,80	4,30
Italy	5,58	5,19	5,03	4,25	4,26	3,56	4,05	4,49
Malta	n.a.	6,19	5,82	5,04	4,69	4,56	4,32	4,72
Netherlands	5,40	4,96	4,89	4,12	4,10	3,37	3,78	4,29
Portugal	5,59	5,16	5,01	4,18	4,14	3,44	3,91	4,42
Finland	5,48	5,04	4,98	4,13	4,11	3,35	3,78	4,29

n.a. – Not available

Source: EUROSTAT

Table 5

General government debt in Romania
and in some Member States of European Union, 2000-2007
(as a percentage of GDP)

Year	2000	2001	2002	2003	2004	2005	2006	2007
Romania	**22,6**	**26,0**	**25,0**	**21,5**	**18,8**	**15,8**	**12,4**	**12,9**
Belgium	107,8	106,5	103,5	98,7	94,3	92,1	87,8	83,9
Germany	59,7	58,8	60,3	63,8	65,6	67,8	67,6	65,1
Ireland	37,8	35,5	32,2	31,1	29,4	27,3	24,7	24,8
Greece	103,2	103,6	100,6	97,9	98,6	98,8	95,9	94,8
Spain	59,3	55,5	52,5	48,7	46,2	43,0	39,6	36,2
France	57,3	56,9	58,8	62,9	64,9	66,4	63,6	63,9
Italy	109,2	108,8	105,7	104,4	103,8	105,9	106,9	104,1
Luxembourg	6,2	6,3	6,3	6,1	6,3	6,1	6,6	7,0
Netherlands	53,8	50,7	50,5	52,0	52,4	51,8	47,4	45,7
Austria	66,5	67,1	66,5	65,5	64,8	63,7	62,0	59,5
Portugal	50,5	52,9	55,6	56,9	58,3	63,6	64,7	63,6
Finland	43,8	42,3	41,3	44,3	44,1	41,3	39,2	35,1

Source: EUROSTAT

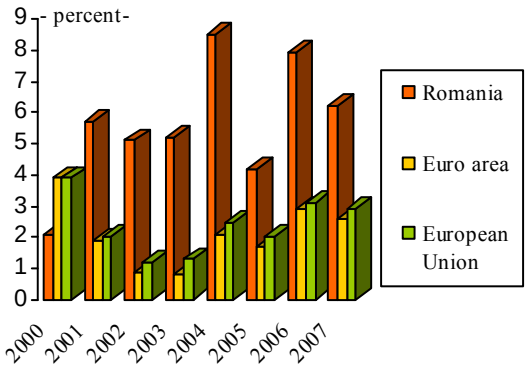
At the moment, the domestic currency is not taking part in the Exchange Rate Mechanism II (ERM II). The RON is anticipated to come into this mechanism no earlier than 2012. For this reason, neither a central parity against the euro, nor ± 15 percent band for the exchange rate fluctuations was defined.

2.2. Real convergence

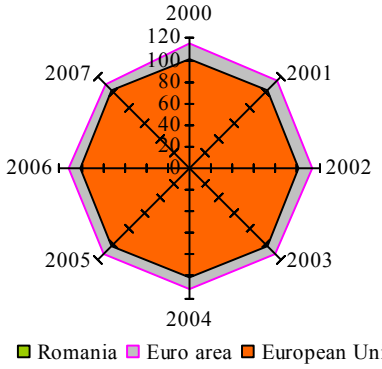
Gross domestic product grew an average rate dynamics of 5,6 percent, services strengthening its position of the main source of economic expansion (Graph 1). Nevertheless, at the end of 2007 the GDP per capita calculated in terms of Purchasing Power Parity was only 40,3 percent of the EU 27 average (Graph 2). The euro area saw a decrease in the rate of economic growth from 3,9 percent in 2000 to 0,8 percent in 2003, on the background of the over assessed perception of inflation following the introduction of the euro, of the uncertainties about future incomes as a result of growing unemployment and the declining public finance. In the next period, gross domestic product registered a dynamic average rate of 2,3 percent, domestic demand becoming the main engine of economic development. The performance was indicative of an augment in confidence in consumption and business environment, as well as an improvement of the labor market conditions.

In Romania, final consumption augmented from 86,16 percent of GDP in 2000 up to 87,89 percent of GDP in 2007, due to real rise incomes and to still readily available loans, that were characterized by downtrend in interest rate, particularly on Leu dominated loans and by the appreciation of the domestic currency against Euro, as well as to the larger expenditure of the services related to national defense, public order and security services, which are subject to restructuring and modernizing processes according to the requirements imposed by the accession to NATO (April 2004) and to the European Union (January 2007). In 2007, the euro area level of this indicator was 76,4 percent of GDP, less by 0,7 percentage points compared with 2000. This evolution was due to increasing share of final consumption expenditure of general government to 20,1 percent in GDP (+ 0,2 percentage points from 2000), in parallel to reducing final

consumption of households and non – profit institutions serving households to 56,3 percent of GDP.



Graph 1. Real GDP growth rate in Romania Euro area and European Union, 2000-2007.



Graph 2. Development of GDP per Capita in PPS in Romania, Euro area European Union, 2000-2007.

Expansion of the investment 18,9 percent in GDP in 2000 to 30,4 percent in GDP in 2007 was supported by a complex of factors: better financial results of the corporate sector, the accessibility of the domestic and external funds, availability of non redeemable external loans taken under program such as SAPARD, ISPA, growing the private money inflows in the form of foreign current transfers. In the euro area, the restricting in investment to 20,2 percent of GDP in 2002 (less with 1,2 percentage points from 2000) was generated by upper capital expenses, inducing from falling share prices, in addition to the negative impact of labor market strictness on corporate profit margins (real unit labor costs augment thanks to the reduced correlation between salary dynamics and labor productivity, and therefore discouraging investment). In 2003, after three quarters of continues decline, investment revived in the last part of the year, due to improved financing conditions, as the European Central Bank diminished its refinancing rate to an all time low of 2 percent. In the following period, investments had a way upward trend reaching 21,8 percent of GDP in 2007 and being sustained by strong corporate wages and further business gains achieved in the corporate sector.

Between 2000-2007, Romania's trade balance recorded an average deficit of 8,9 percent in GDP, while members of the Economic Monetary Union had a trade surplus of 0,49 percent in GDP, as Germany (3,36 percent in GDP) and Netherlands (0,71 percent in GDP) had performances above the euro area average. In 2007, exports in the EMU

amounted to 62,22 percent in GDP, up 25,0 percentage points to 2000 due to external price and physical volume.

Deliveries for China and new EU Member States recorded faster growth, the most requested products coming from the scope of capital products. Thus, the euro area had a share of 17 percent in total world exports, followed by United States (12 percent) and Japan (6 percent). Also the imports had an ascendant trend from 42,1 percent in GDP in 2000 to 65,8 percent in GDP in 2007, as they were stimulated by high dynamics of investment and cooperative exports, and currency appreciation.

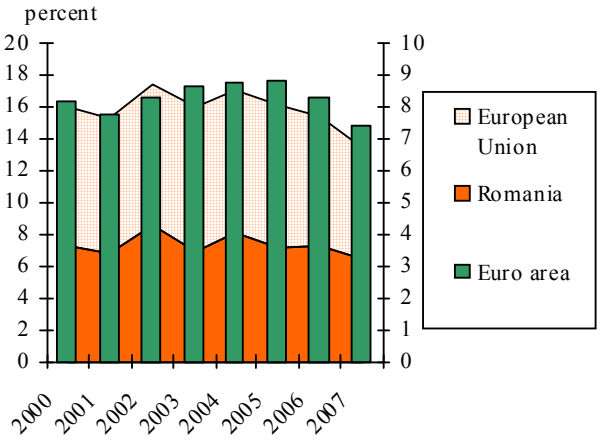
In since relation to the euro area, the Romanian foreign trade was characterized by a high concentration, the annual variation of the physical volume of exports and imports of goods was backed up in proportion of 65 percent by three and, respectively four groups commodities (in case of exports – textiles, wearing apparel and footwear; machinery, equipment and transport means; base metals and in case of imports – mineral products, equipment and transport means; textiles, wearing apparel and footwear; chemical and plastic products). In 2007, the exports to EMU represented 53,21 percent of total (increasing by 8,09 percentage points from 2000) and it was concentrated in proportion of 78,37 percent in three countries: Italy (32,04 percent), Germany (31,83 percent) and France (14,5 percent). At the same time, the imports accounted 52,11 percent of the entries of 2007 (more by 14,1 percentage points from 2000), originating mainly from Germany (32,9 percent), Italy (24,4 percent), France (11,98 percent), Austria (9,28 percent) and Netherlands (6,93 percent). The openness of the Romanian economy had an upward trend soared to 63,4 percent in 2007, amid the removal of protectionist tariffs and the faster integration of the country into the world trade.

In the period 2000-2007, a essential economic correlation was noticed in Romania, i.e. productivity mounted more rapidly than wages (Graph 3). Therefore, the domestic currency strengthened versus the major currencies in real terms (and even in nominal terms more recently) entailing a wealth effect (an augment in the EUR – denominated value of fixed and non-fixed assets of households).

Unemployment rate reached 6,4 percent at the end of 2007 (Graph 4). Unlike 2002, reducing the number of the unemployed (by 204 thousand persons) was higher to increasing the number of the employees (by 119 thousand persons) and it can be made on the account of amplifying external migration – suggested by the growth of private transfers by non – residents and compensation from work (altogether, they posted an annual growth rate of 33,78 percent), having the effect of limiting the current account

deficit – and on the persistence of the informal economy, especially in rural area auto producers. Compared with the Economic Monetary Union, in terms of unemployment rate, Romania was below the euro area average (7,0 percent), lower than Germany (8,4 percent), Greece, France and Spain (8,3 percent), Portugal (8,1 percent) and Belgium (7,5 percent).

Graph 3. Labour productivity per person employed in Romania, Euro area and European Union, 2000-2007.



Graph 4. Unemployment rate in Romania Euro area and European Union, 2000-2007.

In 2007, Romanian's economy apparently made steps forward in achieving a structure of the economy by sectors similar to the advanced EU member States. Compared with 2000, the share of industry and agriculture of GDP declined by 3,8 and 4,5 percentage points reaching 23,5 percent with 2000 and, respectively 6,6 per cent of GDP. At the same time, the share of services rose to 49,7 percent of GDP (+ 8,3 percentage points),but

there still exist a gap towards the euro area, where this sector of activity holds 65-70 percent of GDP.

3. Priorities on the way to euro

Taking into account the big number of challenges that Romanian economy has to handle in regard to nominal and real convergence, it is necessary to adapt the macroeconomic policy mix to the change in the economic environment and that means: to persist putting into practice structural reforms to facilitate the growth of productivity and external competitiveness of Romanian products and services; to pursue a further restrictive monetary policy; to conduct a tighter-than-projected fiscal policy in an effort to remedy macroeconomic disparities through measures like optimized budget planning by approving multi-annual budgets, ensuring smooth and predictable budget execution, limiting the enlarge of public expenditures and their channeling mostly into investment; to adopt a policy of corresponding wage augments to productivity gains.

A major challenge is that the Romanian foreign balance of payments showed a progressive worsening of the current account from 3,3 percent in GDP in 2002 to 13,9 percent in GDP in 2007. Along with the stringer RON versus the EUR and income increases overtaking productivity gains, some structural causes generated this decline. Net external demand represented a factor limiting economic growth, its negative contribution to GDP was under the conditions of mounting the spread between the rate of increase the volume of imports and exports of goods and services by 4,8 percentage points, based on lower competitiveness of some products holding a large share in total exports (electrical machinery and apparatus; chemicals; light industry products) and competition of Asian countries. Another critical issue for Romania is the fact that important services, for example transportation and tourism, recorded deficits and, contrasting the state-of-affairs in other Central and East-European countries, they have a dampening effect on the current account. Also, the net increase in inflows came out of private transfers, mainly due to the fact that acceleration of money flows towards residents was largely counterbalanced with the output revenue obtained by foreigners who operate in Romania. In the following period, it is possible for the amounts transferred by the Romanians working abroad (Italy – 35,2 percent, Spain – 21,2 percent, United Kingdom – 5 percent, Germany – 3,2 percent) to diminish, given the expected significant decline in the economic activity in these countries and the European fund-absorbing capacity which becomes more and more

important. As for financing the deficit via the capital and financial account it was subsidized over 80 percent by the net entering of direct investments. As the inflows were channelled towards the manufacturing sector, it is considered that a potential focus on resources ear-marking for non tradable sectors may cause boom & bust developments.

At the same time, external debt had a constant upward evolution in the whole analyzed period, reaching 48,27 of GDP the end 2007. In the following period, the growth of the indicator can generate problems in terms of financial stability due to the risk of exchange rate and its sharp depreciation may lead to an increase in the cost of external financing. That may happen in case of a change in the perception of investors (expressed in the withdrawal of capital flows), as a result of an internal shock, or through contagion after a crisis in one of countries in the region. In relation to the liquidity risk, strengthening of the foreign exchange reserves decreased substantially the risk, as the debt service was entirely covered by them.

Concerning product markets, efforts should be made to complete the liberalization of network industries and to significantly boost energy efficiency. In addition, developments in the labor supply conditions are of principal importance, as increasingly severe labor deficiencies are threatening the continuation of the successful catching-up process, as well as the past achievements with regard to disinflation. At the same, time as employment creation should be sustained by adjusting tax and benefit systems, it must be ensured that tax reductions are accompanied by expenditure restraint, which ought to be supported, among other things by an increased public spending efficiency. Measures to improve the quantity and quality of the labor supply should refer to the tailoring the education levels to labor market requirements, they should regard the development of training programs for the rural population, a greater flexibility in labor contracts and better incentives for regional mobility. Moreover, wage increases should reflect labor productivity growth, labor market conditions and developments in competitor countries. Public sector wage restraint is important for moderate overall wage developments. Such measures, jointly with a stability-oriented monetary policy, will help to attain an environment favorable to sustainable price stability, in addition to encourage competitiveness and employment growth.

A suggestion is the implementation of a fiscal policy lax, which allows in future budget deficits above the ceiling of 3 percent of GDP stipulated in the Maastricht Treaty. The motivation of such measures lies in the need for numerous budgetary expenditures related to the accession to the EU and NATO, to the reform of the pension system and to improving

the infrastructure. Hence, several Central European countries that have proceeded in a similar manner is moot. Although motivated, such an approach incubated numerous risks.

Thus, if in the other countries with large budget deficits, the inflation was previously brought under control, in Romania that has not happened yet, and one of the main anti inflationary policies consists in controlling the budget deficit; if Romania gave up of the low budget deficits, it would be without one of the few advantages that this country has and which qualifies it to the subsequent euro adoption. In addition, large quasi fiscal deficits should not be lost sight of; only after significant and length reduction of them, there may be possible a question of increasing the budget deficit.

Romanian law does not meet the terms with all the requirements for the independence and legal integration into the Eurosystem of the Central Bank. Romania is a Member State with derogation and for this reason it must fulfill with all adaptation requirements under Article 109 of the Treaty.

4. Conclusions

The main benefit of Monetary Union can be considered the easy adjustment to a shock. The benefits of a single currency found at microeconomic level and it is consider that they are not exhausted until all the countries of the world are not covered. There are four benefits exchange rates irrevocably established: reducing the costs of exchange rate volatility, diminishing the transaction costs and of the uncertainty, as well as decreasing on the "local preference". Although monetary policy is seen as powerless in influencing real variables in the long term, the EU may be close to an optimal currency area. Euro holds an extremely important role in the smooth functioning of the vast European market, and thence in achieving a true single market. Meanwhile, common currency has helped to protect the economy of the euro against the many shocks that have occurred worldwide and the major turmoil in the recent years.

The current euro area may have positive net benefits, as the adjustment mechanism works best and the economy becomes more flexible. Firms and population are becoming more aware of the euro area dimension of their actions and decisions. Households are increasingly aware of the chances offered by an expanded economic and financial area. The public and its political representatives are starting to think beyond their national horizons and more towards a euro area dimension. This shift in mindset is gradually unfolding.

There is no trace of doubt that the decision to adhere the Economic Monetary Union is the only accurate and useful for the long time development of Romania, because such decision represents a catalyst towards progress and a tool by which it is possible to eliminate disparities towards EU, both in economy as well as institutions and in the overall performance of the society. There is no doubt that this will involve a long term effort, and it entails giving upon an outdated mentality for a society characterized by competition, performance and welfare.

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APPLICATIONS IN BUSINESS INTELLIGENCE

Wolfgang ECKER-LALA*

Abstract. *In the past 10 years Business Intelligence became a more and more appropriate tool for supporting decisions. Business Intelligence Systems are based on any kind of data warehouse technology. A combination of reporting and advanced analytics creates a very efficient tool for managers. A special topic in the area of advanced analytics is datamining. Special datamining methods use e.g. Baysian methods. This will be shown in an example in which a basic rating for giving a loan will be calculated.*

Keywords: *Business Intelligence, IT systems, advanced analytics, data warehousing, reporting systems.*

1. Short Introduction in Business Intelligence

Business Intelligence (BI) is based on considerations which have been done by the Gartner Group in 1996. In fact – in the scientific/mathematical sense – there exists no real definition for BI.

In fact it has to be a tool for retrieving necessary information out of big sets of data. The implemented filtering processes has to be:

- efficient
- sufficient,

and has to provide the necessary information in an defined timeframe.

Different people have different points of view on BI. So BI can be seen as:

1. *Extension of Information Technology*

   This means that BI provides information which are extracted, aggregated etc. out of several data sources to people who has to find specific answers to specific questions based on their daily business. Using BI each query on operational data storage systems can be avoided.

* MATH-UP.COM, Landesstrasse 58, A-3441 Ranzelsdorf, Austria

2. *Filter for/against information overload*
Using BI information can be filtered. The result of such filtering are attributes which are necessary to get information in order to be able to answer specific questions. Attributes which are not necessary for finding answers will not be given to the person.

3. *Management Information System*
BI has to aggregate information out of large data sets to the minimum "point of information" which is needed to make decisions which has to be done by managers.

4. *Early Warning System*
Using appropriate information provided by BI systems can show "what is going wrong in my business?" or (which is equivalent) "was my decision which I have done some time ago correct?". If this information can be retrieved "just in time" BI can be used for managing risk.

5. *Data Warehouse*
BI stores centralized data which have been retrieved out of several operational data storage system. This is a very old definition. In fact BI is much more.

6. *Storage of Information and Knowledge*
BI uses data out of several operational systems, combines it with data out of (maybe external) databases and provides us data which can be results out of "artificial intelligence". So we can get new knowledge and we can retrieve information of events which have been done or seen or investigated in the past.

7. *Process*
BI is a set of tools or a system which allows us to do some investtigation of symptoms, make diagnosis, decide the "correct" therapy, gives us the possibility to make a prognosis (if necessary) and is a tool for controlling if our chosen therapy is opportune.

In fact BI is:

- *Integrated*
  which means that it is integrated into all systems of a company. It is not a stand-alone system because it needs data out of all available operational systems and it has to provide data and results to reporting and decision systems of a company or institution.

- *Specific to an enterprise/company*
  which means that BI has to fulfil all requirements of information needs which are requested by decision makers of a company/enterprise and therefore it has to be specific to each company.
- *IT-based*
  because of large sets of information and the requirement of efficiency and sufficiency it has to be based on IT-systems.

BI is an overall attempt to get a base for decision at operational level. and it is more than:

- storing data in a database
- creating reports
- finding errors or inconsistency within data.

Business Intelligence Systems have to support the management of a company in taking decisions and provide with all necessary reports (Fig. 1).

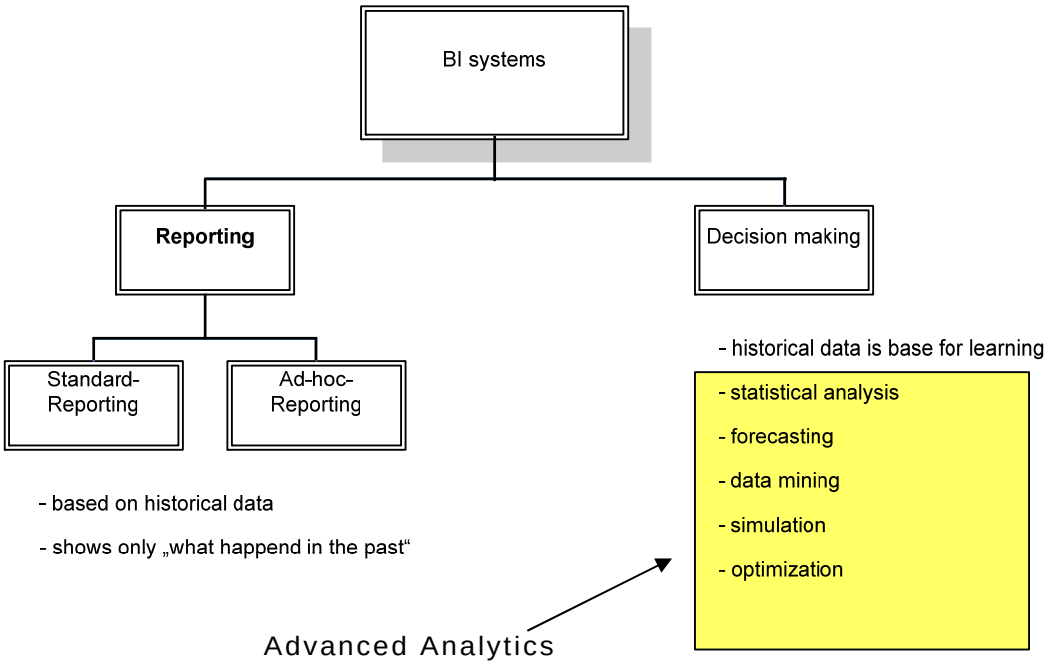

Figure 1. BI Systems function diagram.

So this paper will show how business intelligence can be enhanced by statistical methods in order to transform information into knowledge.

2. Reporting

A report provides an overview of a well defined topic and is based on historical data. Visualisation techniques like diagrams and graphs improve the way of understanding of the information transported by the report to the receiver.

In many cases a reporting system is required by a national regulator, e.g. in banks, insurance companies, companies noted on the stock exchange.

There are several processes within reporting as shown in the graphic below (Fig. 2).

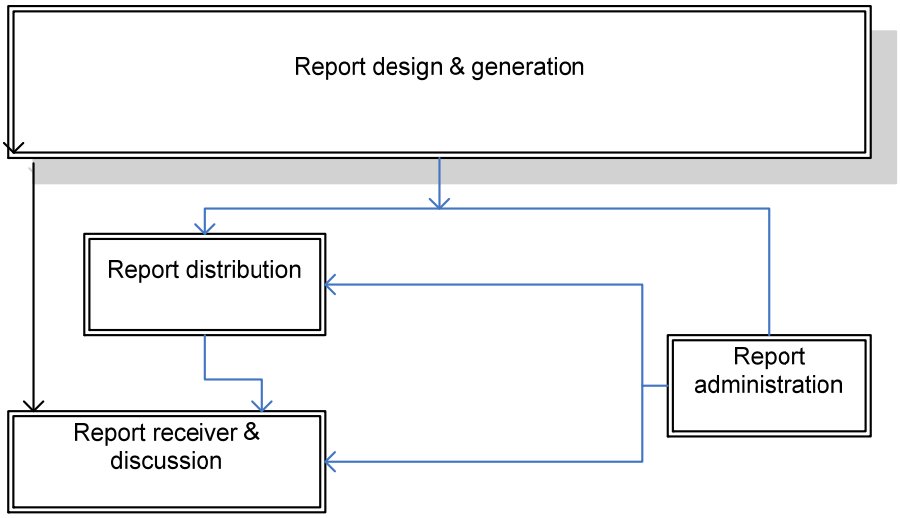

Figure 2. The processes within reporting system.

Report design and generation

In the process of “report design and generation” layout and content of the report are defined and fixed. The content of the report (and of course the layout) has to fit to the needs of the receiver.

Report distribution

In this process the receiver of the report and the frequency of the report delivery to the receiver are defined. At least even the mode of delivery (e.g. e-mail, EXCEL sheet, …) is defined here.

Report administration

This process takes care of the quality assurance and the availability of the report. Also the access rights to the report are defined and administered

in this process. And last but not least it has to take care about accessibility and availability of historical reports.

Report receiver and discussion

This process handles the receiving and the interpretation of the delivered information. And of course it should start discussions among the report's receivers.

Standard-/Ad-hoc reporting

These two subsystems are categorized into

Active

Reports of this subsystem are generated periodically by the system. This means that the event to generate a report is triggered by the system itself. This subsystem is called ***Standard-Reporting***.

Passive

Generation of reports of this subsystem is triggered by a person who needs specific information at a non-predefined time. This subsystem is called:

Ad-hoc-Reporting

Following graphic shows that a reporting system consists of two subsystems (Fig. 3).

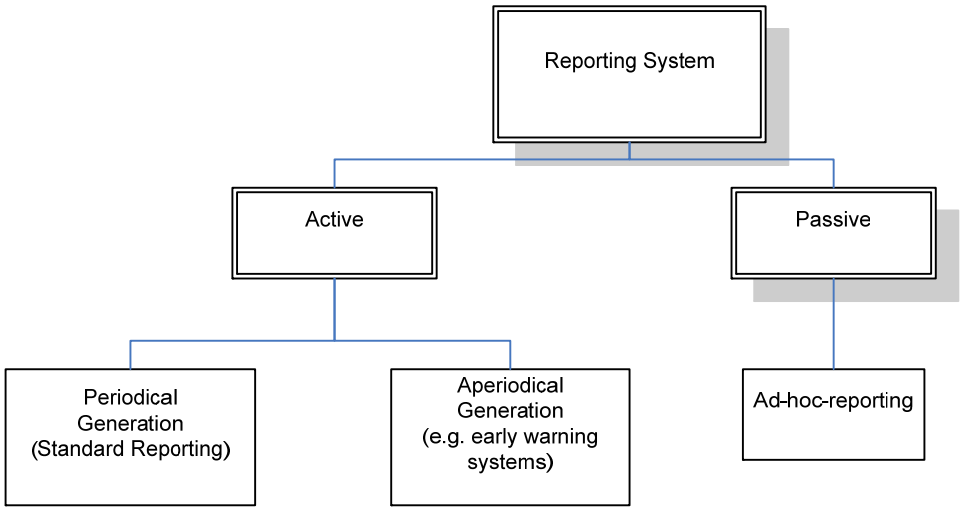

Figure 3. Structure of Reporting Systems.

3. Advanced Analytics

During the last 10 years there has been an explosion of systems of information technology. We are collecting a huge amount of data every

day. These data are used in a variety of fields such as: medicine, biology, finance, marketing, controlling etc. and new areas such as data mining, machine learning and bio informatics has been developed.

In the past those data have been collected for reporting purposes. Up to now reporting means “looking back into the past”.

We think that these times are gone and we have to spend money – maybe more money as we like to spend now – to analyse data of the past to be able to predict future events in order to be able to get better decisions.

Therefore all classical methods of statistics and forecasting have to be combined with traditional reporting techniques in Business Intelligence Systems of the future. Let us call this new generation of Business Intelligence “Advanced Analytics”.

Maybe the current “economic crises” could have been avoided if more advanced analytical methods had been used in monitoring risks.

3.1. We have a lot of data – and now?

Most of the companies store a lot of data out of their daily business. These data are used for creating reports and finding information when they are running queries on their databases. But all those reports and query results provide data which gives us information of the past.

On the other hand companies spend a lot of money to be able to store all the data. These money is spent for the:

- physical storage systems
- operational handling of these storage systems
- backup and recovery handling of these storage systems
- availability of the data.

So if we consider all these efforts in order to be able to answer the questions:

- Did Mrs. Miller buy a new car 5 years ago?
- Did she like a red or a blue or a green car?
- Did we sell 500.000 cars to women during the last 5 years?

These questions raise up if all these money which has been spent is really a **R**eturn **O**f **I**nvestment for this information.

Is it really necessary if a company or institution retrieves information out of expensive information systems in order to see what was done in the past and how much profit could be got in the past or is it more important to be able to predict what will be in the future? Is it satisfying if databases are not more than **graveyards of data**?

3.2. Requirements

Regarding the considerations we did the reality is as follows. In fact a company needs:

- *historical data*
  in order to be able to store all the knowledge which could be retrieved in the past;
- *"clean" data*
  in order to be able making good decision for future activities and to become better and in order to be able to report consistent results of the past;
- *a workaround for missing data*
  in order to be able to report if there is something missing in the stored information and to be able to substitute the missing information;
- *aggregated data*
  in order to be able to do calculations and provide results within a timeframe which can be accepted by a decision maker;
- *base of information for making decisions*
  in order to have reliable data where the decisions are based on:
- *algorithms which gives support in decision making,*
  in order to be able to combine scientific knowledge and available data.

All these can be done using a methodology which is called Data Warehousing. This methodology will be explained in the next section.

3.3. Data Warehousing

A Data Warehouse is a dispositive data storage system which is separated from all operative databases and data files.

The architecture of a data warehouse depends on the used technology and has to be designed to retrieve information in a very short time using a huge size of data.

The data warehouse database(s) collect(s) information out of several separated data sources and so there must be a lot of interfaces provided. The process to get data into a data warehouse is called ETL process (**E**xtract – **T**ransform – **L**oad). After this process is finished data has to be cleaned in order to get a "unique truth". All information after the data cleaning has to be without contradiction.

The attributes of a data warehouse are:

- *Subject oriented,*
  which means that such kind of system are always based on the needs of management of a company.
- *Integrated,*
  which means that a data warehouse has to be able to work together with all other data storage systems in a company.
- *Referenced to time periods,*
  which means that all the information which were imported by ETL are dependend on a time based snapshot (e.g. every day, every week, …).
- *Non-volatile,*
  which means that the values of a data record will not change over time.

  In general we distinguish two architectures of data warehouse:
- *Centralized,*
  is physically based on one server system.
- *Decentralized,*
  which means that more than one physical data warehouse exist. Here it can be that the information is spread over the data warehouse systems and all these systems together shows the complete information e.g. of a company.

4. Advanced Analytics in a banking application

After all this theory and lot of ideas it is time for showing a real application of “advanced analytics”.

In the daily business a bank has to consider the risk of a customer who asks for a credit or loan. So following problem has to be solved.

The bank has to know if a customer who asks for a credit has to be categorized as a potential defaulted borrower or not.

This problem should be solved by developing a data mining algorithm. Therefore based of the existing historical data we will need a training set and a evaluation set.

Let us assume that the data set which will be the base of the decision has following attributes:

- Home owner
- Marital status
- Approx. annual income.

So if we consider each record as a stochastic variable X and the class (default or no default) as stochastic variable Y we have to calculate if:

$$P(Y = \text{yes} \mid X) < P(Y = \text{no} \mid X)$$

or:

$$P(Y = \text{yes} \mid X) > P(Y = \text{no} \mid X)$$

and based on this the bank has a base for the decision of giving the loan to the customer or denying it.

In order to be able to develop a good data mining algorithm we have to take a sample of the existing records as a training set and we will do following categorization:

- *Class = YES*,
  if loan owner has defaulted of her/his payments;
- *Class = NO*,
  if loan owner has repaid the complete loan,

e.g. the training set looks like in Table 1.

Table 1

ID	Home Owner	Marital Status	Annual Income	Class
1	Yes	Single	125K	NO
2	No	Married	100K	NO
3	No	Single	70K	NO
4	Yes	Married	120K	NO
5	No	Divorced	95K	YES
6	No	Married	60K	NO
7	Yes	Divorced	220K	NO
8	No	Single	85K	YES
9	No	Married	75K	NO
10	No	Single	90K	YES

In this example we have two categorical attributes:

- Home owner (= X_1),
- Marital status (= X_2)

and one attribute which is continous,

- Approx. annual income (= X_3).

If we choose a Bayesian approach we have following relationships between prior, conditional and joint probability functions:

$$P(X,Y) = P(X \mid Y) \cdot P(Y)$$

and:

$$P(X,Y) = P(Y \mid X) \cdot P(X).$$

From this we get:

$$P(Y \mid X) = \frac{P(X \mid Y) \cdot P(Y)}{P(X)}.$$

If we select n independent observations from the historical $\{X_1, X_2, ..., X_n\}$ data we can calculate:

$$P(X \mid Y = y) = \prod_{i=1}^{n} P(X_i \mid Y = y).$$

And it is easy to understand that we derive:

$$P(Y = y \mid X) = \frac{P(Y = y) \cdot \prod_{i=1}^{n} P(X_i \mid Y = y)}{P(X)}.$$

So we have to consider this for the categorical attributes and get for:

- Home owner (= X_1);
- Marital status (= X_2):

$$P(X_i = x_i \mid Y = y) = \frac{n_i}{m_i}$$

where:

n_i is number of records with value (x_i, y);

m_i total number of records having y.

And based on the previous formulas we get for the categorical attribute “Home owner”:

$$P(X_1 = Yes \mid Class = NO) = \frac{3}{7}$$

$$P(X_1 = No \mid Class = NO) = \frac{4}{7}$$

$$P(X_1 = Yes \mid Class = YES) = 0$$

$$P(X_1 = No \mid Class = YES) = 1.$$

Based on the previous formulas we get for the categorical attribute "Marital status":

$$P(X_2 = Single \mid Class = NO) = \frac{2}{7}$$

$$P(X_2 = Divorced \mid Class = NO) = \frac{1}{7}$$

$$P(X_2 = Married \mid Class = NO) = \frac{4}{7}$$

$$P(X_2 = Single \mid Class = YES) = \frac{2}{3}$$

$$P(X_2 = Divorced \mid Class = YES) = \frac{1}{3}$$

$$P(X_2 = Married \mid Class = YES) = 0.$$

Last but not least we choose for the continuous attribute:

- Approx. annual income (=X_3)

a Gaussian distribution.

If we take following consideration into account:

$$P(x_i < X_i < x_i + \varepsilon \mid Y = y_i) = \int_{x_i}^{x_i + \varepsilon} f(X_i \mu_{ij}, \sigma_{ij}) \mathrm{d}X_i \approx f(X_i \mu_{ij}, \sigma_{ij}) \cdot \varepsilon$$

we get:

$$P(X_i = x_i \mid Y = y_j) = \frac{1}{\sqrt{2 \cdot \pi} \cdot \sigma_{ij}} \cdot \mathrm{e}^{-\frac{(x_i - \mu_{ij})^2}{2 \cdot \sigma_{ij}^2}}.$$

The estimation of the parameters for this distribution is:

- in Case of Class = *NO*:

$$\mu_{ij} = 110000, \sigma_{ij}^2 = 2975$$

- in Case of Class = *YES*:

$$\mu_{ij} = 90000, \sigma_{ij}^2 = 25.$$

If e.g. a Customer has the attributes:

- Home Owner = *No*
- Marital status = *Married*
- Approx. annual Income = 120.000;

we get following:

$$P(X \mid Class = NO) =$$

$$= P(X_1 = No \mid Class = NO) \cdot P(X_2 = Married \mid Class = NO) \cdot$$

$$\cdot P(120000 \mid Class = NO) = \frac{4}{7} \cdot \frac{4}{7} \cdot 0.0072 = 0.0024$$

and:

$$P(X \mid Class = YES) =$$

$$= P(X_1 = No \mid Class = YES) \cdot P(X_2 = Married \mid Class = YES) \cdot$$

$$\cdot P(120000 \mid Class = YES) = 1 \cdot 0 \cdot 1.2 \cdot 10^{-9} = 0$$

and:

$$P(Class = YES) = \frac{3}{10}$$

$$P(Class = NO) = \frac{7}{10}.$$

From all above we can calculate:

$$P(Class = YES \mid X) = P(X \mid Class = YES) \cdot P(Class = YES) = 0 \cdot \frac{3}{10} = 0$$

and:

$$P(Class = NO \mid X) =$$

$$= P(X \mid Class = NO) \cdot P(Class = NO) = 0.0024 \cdot \frac{7}{10} > 0.$$

And so in this example the bank decides that the customer will get the loan because the probability that he/she will do the complete repayment is greater than he/she will be defaulted.

Of course this example is a very simple one but it shows how statistical methods have to be combined with information which can be found in a data warehouse and can be derived from a huge amount of data records.

This paper should animate the reader to think about how a BI system has to be designed to get an efficient data base for a lot of decisions which have to be done in the daily business. It would be a very good exercise to design the part of a business intelligence system which will be necessary to solve the bank's decision problem which was described.

5. Conclusions

The usage of business intelligence tools offers a wide spectrum for controlling, forecasting and decision support to the management of a company. Combined with mathematical and statistical methods IT systems will become much more efficient.

Data are the “gold” of a company. We are living in a world of a lot of information. Humans changed from *homo sapiens* to *homo informaticus*. So we and our IT systems are asked to use data in a much more efficient way as it was done in the past 20 years.

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A NEW FRAMEWORK ABOUT THE EUROPEAN REGIONAL POLICY

Romeo IONESCU*

Abstract. *The regional policy implementation covers its specific measures and instruments. In order to select the adequate methods of action, it is necessary to study the typology of the regional policies. The paper deals with the analysis of the micro and macroeconomic regional measures. For the beginning, the paper is focuses on the ways of the regional restructuring of the labour and of the capital. It must be realise the difference between the spontaneity and stimulated developments, as well as between the exogenous development and the self development. The European tendency is to select the incentive measures more than to apply them automatically. The instruments of the regional policy are the fiscal, budgetary and monetary instruments which are divided into the direct interventions and the incentives for the local activities and development. The public administrations have to insure that there are respected all the conditions connected to the given assistance. This control covers the project period implementation and the post-implementation period, as well. The problem is that the regional policy isn't evaluated per ensemble; it is evaluated only as separate specific instruments.*

Keywords: *european regional policy, public administration, policy implementation, modern institutional structure.*

1. Introduction

The regional policy implementation covers its specific measures and instruments. In order to select the adequate methods of action, it is necessary to study the typology of the regional policies[1,2]. It can lead to diverse solutions and adequate instruments. Their target may become very large and they are different according to the dimension of the public intervention, the centralized and decentralized context of the regional policies' implementation and the macroeconomic and

* Dunarea de Jos University, 47 Domnească, St., 800008, Galatz, Romania

[1] Armstrong H., Taylor J., *Regional Economics and Policy*, Harvester Wheatsheaf, 1993.

[2] Armstrong H., Taylor, J., *Regional Economics and Policy*, Blackwell, 2000.

microeconomic orientation of the specific measures, as well. The impact of these policies are inter and intraregional and the main effect is focus on the labour and the capital's redistribution, the endogen and exogenous sources of the regional development and so on[3]. These are microeconomic measures.

On the other hand, the macroeconomic measures are focuses on: budgetary policy, monetary policy, imports' contingent, temporary regional assistance and production incentives, as well.

2. The analysis of the regional policy instruments

The macroeconomic measures action on the global revenues and expenditures and the microeconomic measures are focuses on the resources' repartition which are able to influence the behaviour of the economic agents. Their main objective is to solve the problems connected to the structural unemployment.

The options of economic policy are focuses on the redistribution process of the labour, the capital or both. In order to decrease the structural unemployment, we can move labour to new jobs (maybe to other regions) or to create jobs in those areas which have a labour exceeding.

The microeconomic measures try to regulate directly the inputs supply and they are interest into enterprises, households and persons.

The practical way of restructuration defines the microeconomic policies and measures in order to obtain an internal or external enterprises' adjustment.

The internal adjustment consist on new goods and technologies' implementation which are able to improve the use of the resources and labour from the public point of view or of the regional point of view, as well. This solution is the less expensive one and it ensures the labour activity's continuity in the same location.

The other solution (external adjustment) realises the capital and the labour's redistribution between the enterprises or sectors. The nature and the effects of these two ways of restructuring are present in table 1.

[3] Constantin D. L., *Fundamental Elements of the regional Economy,* ASE, Bucharest, 2004, pp. 123-136.

Table 1

The methods of restructuring[4]

Specific criteria	The way of restructuring	
	Internal	External
The type of the change	– new goods and technologies implementation; – labour internal redistribution.	Demand's decrease and the capital and labour's transfer from declining industries to those which are in expansion
The rhythm of the changes. Geographical effects.	– slowly; – the same enterprises' location.	Quickly enough; New firms in the region.
The sources of the financial support	– bearing funds; – bank loans	Usually, external sources, especially from the public decedents.

As a result, the microeconomic policy presents four possibilities: to be focuses on the labour, the capital, internal and external adjustments. If these four possibilities are implementing into a matrix, we can explain the types of programmes which result from every combination, as in table 2.

Table 2

The options of the microeconomic policy and their resulting programmes

Connection to:	Labour	Capital
The restructuration form		
Internal	The management of the human resources	Enterprise's viability
External	Reintegration on the labour market	Regional development

Labour restructuration is an adjusting solution connected to the market mechanisms. During recession, the less developed regions face to a great labour exceeding which has a low territorial mobility. The microeconomic measures operate when the labour exceeding isn't able to move to other better regions, as well. The first measure refers to the labour redistribution inside the enterprises using specific public and private recycling programmes, educational programmes and different subsidies activities. The second measure – the labour geographic redistribution – is focuses on the external restructuration supporting. This geographic

[4] MacKersie R. B., Sengenberger W., *Les suppression d'emploi dans l'industrie, responses possibles des politiques de main d'œuvres,* O.C.D.E., Paris, 1983, p. 46.

mobility is disturbed by the interregional wages disparities which have no correspondent to the labour marginal product. More, the labour can have a wrong perspective on this mobility or the costs of labour migration are too expensive. In order to decrease these obstacles, it's necessary to grow the labour markets' efficiency using local collective negotiations which must reflect the regional specific aspects. The public administration can offer a financial support for the new labour which migrated into a region and to decrease the revenue taxes for these persons, as well.

The financial costs of the migration imply important risks if the migrants become unemployment for a long term. The psychological costs are important too, especially those which affect the family unity. On the other hand, the migration labour can migrate to another region and the building markets aren't so efficient.

But the migration is able to grow the decline of a region according to its negative multipliers and it can accentuate the regional stagnation. As a result, the most competent elements leave the region and support an economic and demographic no equilibrate structure.

The difficulties connected to the labour migration need the idea of adopting specific measures if the capital mobility is exhausted.

The microeconomic measures connected to the capital are focus on internal or external restructuration. The internal restructuration supports the enterprise's viability, and the external restructuration supports the regional development, as in table 3.

Table 3

Measures for capital restructuration

Internal	External
Changes in the enterprise costs' structure	A differential manner (positive or negative) in taxes implementation
Efficiency improvement of the labour productivity and the costs	Assistance system
Initiation of the plans/programs which are able to maintain the enterprise's activity	Loans under favourable conditions
Enterprises' re-installing in the same sector	Incentives for investments

The first method is less expensive and it facilitates the restructuration before the moment in which the government will do great expenditures for regional development.

We talk about the measures of enterprises' structure costs change in order to maintain its viability. Other method, used in the high developed

countries, is to decrease the wages and the complementary advantages as an alternative to the unemployment increasing. As a result, the labour prefers these decreases than the enterprise closing.

The next internal adjustment method is focuses on the efficiency improvement of the costs and labour productivity. It is connected to the jobs' revision, the progressive adopting of the continuous function and the renunciation of incentives and other instruments in order to create an advantageous equilibrium between the labour management, the labour structure and the technical needs of the production process. All these are efficient solutions as long as the competition is not able to create impossible problems.

Other strategy consists of implementation of the new plans/programs which are able to maintain the enterprises' activities. We talk about the market prospection in order to find new efficient trade activities or to operate some reconversions. In order to realise this, we can use a supplementary capital from the redistribute profits or from the financial and credit institutions. This solution can be applied by those enterprises which haven't long term financial debts.

Another important internal adjustment method is focuses on the enterprises' implementation in the same sector. There are a lot of elements which can stimulate an enterprise to adapt or to improve its installation in the same place. The problem is that this enterprise has an obligation to its labour to ensure long term jobs.

The external adjustment measures represent instruments used by the public sector in order to solve the local decline and the regional unequilibrium. This policy is based on the idea that an activity can be located in different locations and it can be efficient in different locations, as well.

The industry's redistribution represents a Keynesian solution for labour lack from some regions.

The programs of the capital redistribution represent: regulations, taxes, infrastructures' creation, subventions and incentives.

The regulations are measures able to limit investments in some specific regions in order to focus them to others which have a real need for. They have a double advantage: their cost in the government budget is practically zero and they are very efficient during the booms.

The microeconomic taxes can be used into a positive manner (as non-exonerates) or a negative one (as restrictions) in order to influent the industries' implementation. The exonerates operate in the same manner as the subventions, but the restrictive taxes stop the unwished activities.

The infrastructures' building represents a way for the regional development used in those countries which in which it's limited the public interference in the private enterprises' management. This method can cover labour training or insurance of the transport networks and telecommunications.

Other countries extend the infrastructure building to the creation of the public industrial areas or lands which have buildings which are sold to a good price. As a result, the government becomes an investor of the risk capital. The same government apply a rigorous selection of the beneficiary enterprises in order to obtain the guaranty of achieving its sector objectives and to edify stable trade complexes.

The assistance system has a lot of forms and categories and becomes a real pylon of the regional policy. The most popular measures are the loans in good conditions or the guaranties for the contracted loans, the subventions and the bonuses.

The advantage loans or with improved interests can be propose by the state or by the financial intermediaries financed by the state or by those intermediaries which have the state guarantor. These loans use lower interests and the postponement of the capital repayment. They can finance up to 70% from the cost of the investment project. An advantage of this kind of assistance is that the evaluation of the project cost is made by a public or private credit institute, which means greater guaranties for the regional authorities about the loans' uses by the enterprises. But some specialists consider that these loans aren't too transparent and their advantages aren't too facile and quickly evaluated.

The subventions are applied to the inputs or to the output and they are able to support the new enterprises. They can be giving once, as temporary or permanently.

The bonuses for investments are offer partial or integral using an automat or a discretionary manner. They have the advantage of being simple and explicit and of encouraging the investments in buildings, installations and equipments which are easier to control. These bonuses complete the regional capital stock and improve the regional efficiency.

When the capital stock comes from foreign sources in the assistance region, it will have just a limited effect by an interregional diffusion. More, the enterprises which have intensive capital utilization need less labour. As a result, the inverse solution can be the existing or the new jobs' subvention in order to encourage a capital re-distribution for those enterprises which present a high intensity in labour utilisation. More, it can

support the existing jobs and the temporary inefficient enterprises, as well. The result will be a revenues transfer from the developed regions to the less developed ones and a decreasing of the local production costs. These imply a high connection between the regional policy and the labour policy in order to eliminate the situations in which the subventions only grow the wages and don't create new jobs[5].

Another option for the regional policy is connected of the extra-regional control degree of a regional economy. The regional policy can be exogenous (supported by public intervention at micro and macroeconomic level) and endogenous (supporting by the own regional resources). Practically, there can't be an exclusive endogenous or exogenous regional development.

The exogenous development strategies and policies are focus on the labour and the support for the new enterprises which are located into the peripheral areas.

On the other hand, the endogenous development potential covers: the rare materials, the transport and telecommunication infrastructures, the urban structures and the physical and human capital. These factors must be coordinate in order to favour the regional development.

For the beginning, it must be realise the difference between the spontaneity and stimulated developments, as well as between the exogenous development and the self development. More, the endogenous development policies operate in industry, agriculture and services according to the regional particularities.

Using their endogenous development potential, the regions can be:

- ✓ regions with traditionally activities, high urbanized but in decline;
- ✓ isolate geographical regions;
- ✓ developing regions;
- ✓ agricultural regions which have to develop tourism and industrial food activities.

Every type of these regions benefit by specific regional policies and by general policies, as well. Such a general policy covers the technologic innovation in order to transform the production processes, to access new markets and to decrease the production costs. These elements vary very much between the regions. As a result, the endogenous development of the less developed regions must cover the subventions for R&D and professional training according to the new technologies. The subventions may

[5] Ionescu R., *Regional development* (in Romanian), E.D.P., Bucharest, 2008, pp. 67-68.

be accompanied by the credits and the risk capital market, in order to finance the investments in little firms and R&D institutions. In order to stimulate these investments, the firms will pay small taxes as long as they will re-invest their profits.

Other important element is a modern institutional structure which has to be able to support the acceleration of the new technologies' diffusion in the regions. This process can be improved using cooperation with the regional high educational and research institutes.

The R&D actions can be divided into: very important programs in applying research for a accelerate diffusion of the innovation in the traditional industries; valorisation of the regional accumulates experience, especially in its universities; implementation of the new SMEs; implementation of the techno-poles which cover the enterprises, the state and the territorial collectivises.

The endogenous regional development is connected of the markets' transformation and the passing from an economy based on good cycle and serial manufacture to an economy of variety, which is able to create continuously new goods. This new economy operates with the new technologies and creates new activities connected of the climatic resources (tourism and health), the natural resources (wood and marble industries), the agricultural and handicrafts resources, as well.

The third direction is connected of the SMEs' role in supporting and creating jobs and in using new technologies. They become a connection between the labour policy and the regional policy. The greatest percentage from the all enterprises is SMEs which are created by the local entrepreneurs in order to adapt them to the new technologies and the demand fluctuations. The SMEs' activities are strategically for the regional rebuilding.

On the other hand, the economic administration role is to identify the SMEs' needs and problems and to contribute to their creation and diversification. Practically, the presence and the absence of the important industrial sectors and the enterprises' quality and characteristics are able to influent the economic future of a region. As a result, the regional policy has a SMEs policy, as well. A lot of countries have special funds and institutions to support the SMEs. The local authorities support the SMEs by the basic education, energy provision and the local transport network.

The SMEs are connected to the local initiatives for new jobs. They are based on: the initiatives of those persons which decided to change their jobs or to initiate their own businesses, the transformation of some

enterprises into corporatist ones, the initiation of some government programs for local initiatives' supporting and the association of the specialists who propose alternative solutions in energy and ecology.

The regional development programs are based on clear economic and geographic criteria and use specific instruments, especially the potential assistances.

The European tendency is to select the incentive measures more than to apply them automatically. The instruments of the regional policy are the fiscal, budgetary and monetary instruments which are divided into the direct interventions and the incentives for the local activities and development[6].

The direct interventions imply the action of the central and local public administration in order to develop specific socio-economic infrastructure elements and the public-private partnership for investments in local interest services' development.

The incentives measures represent the financial bonuses and the compensation measures. The financial bonuses are: the bonuses and the subventions for investments, the transfer subventions, the loans in advantages conditions, the facilities for the lands sells and the special authorizations for the repayment regime.

The compensation measures are focuses on the elimination and the decreasing of the supplementary costs of the activities' location. These measures are: the subventions for the exploitation expenditures' decreasing, the subventions for labour, the supplementary indenisations for labour from specific areas, the bonuses for every new job, the subventions for the social protection, labour mobility and training, transport and public services.

3. Conclusions

Every country limits the assistance according to the applied program and the geographic area. These are established using the investments costs which open the right for assistance. Sometimes, it may be a global fix sum or a limit connected of the labour. Other countries use a limit for the total public expenditures connected to some specific assistance types (bonuses, investments, loans with preferential interests).

[6] Constantin, D. L., Frentz, G., Răducu, A., Folescu, Al., Voinea, M., *Socio-economic Coesion and the Reional Policy,* ASE, Bucharest, 2007, p. 123.

The conditions of according assistance are focuses on the similarity between the projects from the report and the initial approved plans.

More there must establish the specific organism which has to adopt the decision for assistance and its limit. These decisions are adopted by a ministry or a governmental service under the recommendation of a consulting council or an inter-ministry commission, as well.

When the some specific conditions are achieved, the greatest percentage of the incentives for the regional development has a selective characteristic. Other countries have specific automatic assistances connected with rigorous conditions.

The public administrations have to insure that there are respected all the conditions connected to the given assistance. This control covers the project period implementation and the post-implementation period, as well.

The problem is that the regional policy isn't evaluated per ensemble; it is evaluated only as separate specific instruments.

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