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## DOES THE ECONOMIC CRISIS AFFECT OLTENIA'S ENVIRONMENT (II)?

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### **Abstract:**

*Economic development means creating something in one place and destroying something in another place. The crisis started in the middle of 2007 rapidly developed and spread into a global economic shock, resulting in a number of European bank failures, declines in various stock indexes, and large reductions in the market value of equities and commodities. The financial crisis is also felt in Romania. In the current macroeconomic context, Romania is exposed to the effects of economic and financial crisis, which may materialize in the plan of real economy, by slowing down the economical growth and reducing the number of work places. In the event of a financial or economic crisis, environmental concerns are put on the back burner. One factor driving this behavior is the perception that the decline in production will automatically lead to a lower level of pollution, but the reality shows that the pollution problem may become worse during the crisis period.*

*The analysts have made several predictions about crisis. It's been two years since the crisis began in Romania. Predictions came true? Environmental degradation and economic crisis are urgent global issues that have a lot in common. Was the crisis bad or good for the Oltenia's environment?*

**Keywords:** economic crisis, environment, social life, Romania

**JEL Classification:** K4, O1, O2, Q5

### **1. Introduction**

In the 80s capitalism triumphed over communism. In the 90s capitalism wins over democracy and market economy. For those of us who grew up in the idea that the foundation of democracy and free market is capitalism, the realizations of the fact that under capitalism, democracy is sold to the one the market who pays more and that the market is planned by corporations that are bigger than most states, was a cruel awakening. Freed from the control of public opinion, capitalism is the disease of democracy and market economy (Korten 2003).

Despite the optimistic expectations and the international community's decision to act together in order to decrease the crisis, this has expanded more and more, affecting mostly the emerging economies, such as those in Eastern Europe.

The last statements made by world leaders tend to confirm the expectations of the international community. Americans, Europeans, Russians and Asians have come to a common denominator – the need for reform of the global financial system, so as to create protection mechanisms.

After the beginning of the New Year brought an avalanche of negative news concerning the evolution of global economy, the latest period brought the first positive signs. The most interesting information comes from the United States, the place where, in fact, the crisis began. After pumping hundreds of billions in the banking system and launching a new anti-crisis plan, valued at 787 billion dollars, Americans now speak of the 'light at the end of the tunnel.'

Global economy could gradually recover, beginning with the second semester of 2010, the first signs of recovery being expected in the U.S., later this year. The effect of the hundreds of billions of Euros pumped by authorities in the economy can already be seen, the big problem being the further crisis of confidence, as experts say (Negrescu 2009).

The negative impact of the crisis on the environment is more obvious: First, participants fear that the momentum in the global environmental movement has been diverted amid the economic crisis. As attention is elsewhere, government policies will prioritize quick economic development and employment fixes. Second, there is the fear that approved policies will be shelved because of cost. Third, although the effect of the regime's stimulus investment in major industries has yet to be

measured, participants predict that heavy pollution, heavy energy consumption and weak regulatory oversight will likely occur (Zhang 2009).

Despite the fears relating the deepening recession, encouraging signals also come from Europe. According to an EU document quoted by Reuters, more states will begin to recover towards the end of and others a year later. European ministers are decided, once the economy will give the first positive signs, to take measures of tightening the budget, so as, in the future, Europe to be much better protected against crises.

Beyond the necessity of changing the international regulations regarding the movement of capital, the world leaders have already decided what measures will be taken to help the economies strongly affected by the crisis, such as the emerging markets.

Being dependent on trade with industrialized countries, these currently feel the crisis most powerfully, as the blocking of markets and of the access to funding collapse the emerging economies. In the context of the global financial blockade, the main solution became external borrowing, and the IMF became 'the world savior', as it was referred to by the Financial Times.

For the poor, their economic crisis didn't start because rich banks made risky bets. The poor have known little other than a constant economic crisis, but they have never received a bail-out. As banks and insurance companies are saved at public expense, capital and currency is transferred from the non-rich to the rich, accentuating the gap between the rich and the poor (Chronic 2010).

## **2. What did the crisis mean on a global scale?**

Adrian Negrescu notes that in according to a recently released World Bank report, 94 of 116 developing countries experienced a slowdown in the economic growth, exacerbating poverty in 43 of them.

Bank experts estimate that all these countries have registered an unhealthy economic growth, based mainly on credit and consumption, and now, under the credit blockade, these countries risk 'to stifle'.

'Developing countries have been affected by tighter credit conditions, the withdrawal of foreign direct investment and lowering remittance of their citizens working abroad' said Justin Lin, World Bank chief economist, who declared that 'developed countries should transfer part of their aid packages to poorer countries, where they would be more effective in stimulating demand.'

## **3. What did the crisis mean for Romania?**

At the end of 2008, in Romania there were less than 400 000 unemployed. After half a year, the number had increased to almost 550,000 and the unemployment rate climbed sharply from 4.4% in December, up from 6.3% in July. But economists say that the relatively low level of unemployment (among the lowest in Europe), could rise to 8% at the end of this year and up to 9.5% in late 2010 (Forecast made by the Raiffeisen Bank).

In just two years, the number of unemployed could rise from 400,000 to at least 800,000, of which at least 100,000 in 2010, mainly due to massive layoffs in the public sector. The unemployment rate in Romania in July was 6.3%, 0.3 percentage points higher than the previous month and 2.7 percentage points over the same month of 2009. The unemployment rate in Romania in July was 6.3%, 0.3 percentage points higher than the previous month and 2.7 percentage points over the same month of 2009.

One million Romanians will be thrown into poverty because of the financial crisis, so the number of those who barely make ends meet will double.

According to a study led by the Institute for Research on Quality of Life, the most affected will be the farmers and unemployed from the villages and small towns located in the south and east of Romania.

The economic and financial crisis is a big pressure on the shoulders of the Romanians, therefore the poverty rate will reach 10% at the end of 2010.

In 2008, when the world entered the crisis, in Romania there were already 1.25 million people living below the absolute poverty threshold. Experts estimate that by the end of 2010 their number could jump up to 2 million.

Quality of Life Research Institute has drawn a portrait of the indigenous poor man: he comes from households with many children, has a low education, works in agriculture, in his own house or is unemployed.

The most exposed to poverty are the inhabitants of villages and small towns in the south and east of the country.

### **3.1. The crisis in Romania on an economic level**

Drastic drop in sales with over 50% in some areas, decreased liquidity and increased funding costs have led to the deepening of the financial crisis.

Zaman and Georgescu (2009) write that the second quarter of 2009 saw another decline of GDP, by 1.1 percent compared with the previous quarter and by 8.8 percent compared with the same period of 2008. So, according to the technical definition of a recession, i.e. a decline in GDP for two consecutive quarters, Romania has entered recession in 2009.

The financial crisis has affected the Romanian economic environment by increasing the number of delays in payment and increasing default. According to national estimations, in early 2009, 20% of the debtor companies went insolvent, and in early 2010, another 30% of the companies over the previous year.

Also, Zaman G. and Georgescu G. (2009), consider that another notable effect of the crisis is the worsening of the business climate. The most affected sectors by the delay in payment are constructions, transport, IT, textile and furniture industry.

### **4. What does the crisis mean for Oltenia?**

At the end of June 2010, the number of employees in the economy of the Development Region South-West Oltenia was 386,069 persons, 32,906 persons less than at the end of June 2009. The unemployment rate was above the national unemployment rate, the largest share being held by Dolj County, with 36.5 percent', says the analysis of the Regional Department of Statistics Dolj.

In addition, compared to same period of 2009, the industrial production fell by with over 17 percent, which actually means that the economic crisis in Oltenia is deepening.

Along with the increasing number of unemployed, Dolj County also registers declines concerning the industrial production in June 2010 compared with June 2009. In other words, companies also produced less, bringing at the same time less money in the county. But this doesn't surprise anyone since the traditional resistance pillars of the economy of Dolj, Doljchim Plant and Electroputere Craiova, are in a deep coma.

To the disappointment of the authorities, who had put him all their hopes in the coming of the Americans from Ford, the production of cars was officially postponed for another two years. This means that until 2012, the economy of Dolj will not rely on the support of Ford, which has the merit of not having contributed with any person to the list of unemployed in the county.

### **5. What does the crisis mean for the environment?**

Prof. Paul E Hardisty considers that the part of the problem is that we continue to treat the economy and the environment as mutually exclusive and in conflict. He thinks that saving the planet will hurt the economy, and that saving the economy means we cannot save the planet. This is perilous thinking. In fact, the economy and the environment are inextricably linked – the economy cannot exist without a healthy robust environment. Prof. Hardisty continues that from a purely economic cost-benefit perspective, investing in preventing climate change and arresting global environmental degradation is a very good deal for taxpayers (assuming that they would be asked to foot the whole bill, which of course they would not).

Magdoff in 2002 argues that the industrial production will be adversely affected by the crisis through both price effects that increase the cost of production and income effects that decrease the demand for products in the markets. For Magdoff it is unclear how large and widespread the impact is. It is also possible that some enterprises may benefit from the crisis; for instance, sectors that utilize domestic raw material and export all their products. The financial crisis and climate change share some fundamental characteristics. Both are a consequence of speculative and narrow interests superseding the common interest, both evolved dramatically over the current decade and both have



global implications. Both are also about risk and how it is priced and managed - and the consequences when risk management goes wrong.

Garnaut in 2008 shows that the pollution problem may become worse during the crisis period. The net effect on pollution is determined by the interactions of three factors: decline in production, increase in the abatement cost due to the higher input prices, and decrease in the expected cost of non-compliance due to the lower inspection and enforcement rate caused by budget cuts. As a result, the reduction in pollution due to lower production is cancelled out by the increase in pollution resulting from higher pollution abatement cost and lower inspection and enforcement rates.

The authorities from Romania believe that the signs of crisis are not very visible in environmental protection, the Romanian analysts provided that this is not a priority in Romania. The environment is not of age not even when actual constraints have appeared, nor when the budgets haven't been adapted to the current weak economic situation. Deleanu (2008) believes that once the crisis installed in Romania, the green will be even more left aside.

The emissions of greenhouse gases worldwide fell by 1.3%, to a total of 31.3 billion tons in 2009 and to 29.2 billion tons in 2010 [German Institute for Renewable Energy (IWR)].

This is the first year when such a decline in global emissions has been registered, as shown in an analysis made by the German Institute for Renewable Energy (IWR). Reducing carbon dioxide emissions has emerged from the global crisis, but also from the investment in alternatives to conventional energy.

According to the IWR Director, Norbert Allnoch, given the scale of the crisis, global emissions could have dropped further if the reductions in Europe, Russia, Japan and the U.S had not been 'compensated' by the increased emissions from the factories in Asia and the Middle East.

Increased CO<sub>2</sub> emissions in China, amid increasing the industrial production, brought the country at the level of emissions with the factories in the U.S. and Russia, said Norbert Allnoch.

Last year, in 2009, China was ranked the first among the big polluters, with 7.43 billion tons of emissions, after it scored 6.81 billion tons of emissions in 2008. This is followed by the U.S., with 5.95 billion tons, Russia, India and Japan.

In Oltenia County anthropogenic activities with the most important share in generating greenhouse gas emissions are combustion processes. In Oltenia region are high power energy complexes: CE Turceni and C.E. Rovinari C.E. Isalnita, C.E. Craiova II ROMAGPROD-Tr Severin. Other emission sources for greenhouse gases are: Rm OLTCHIM, UM Govora, Doljchim, SC Alro SA SLATINA [[Planul de Dezvoltare Regionala Sud-Vest Oltenia 2004-2006](#)].

The main pollutant generating activities that significantly affect the quality of the environment in the Region 4 South-West Oltenia are:

In Dolj County: Energy industry based on fossil fuels, mining industry, chemical industry, wood processing activity, Manufacture of machinery and equipment, building materials, railway, road and water, transmission, storage and gas distribution, oil and fuel.

Electroputere is on the brink of closing, hundreds of people being laid off regularly since the taking over of the plant by the Saudis from Al Arab Contracting Company Limited. Aircraft SA Craiova has temporarily laid off employees. The plant is in a coma.

Although there is no finalized plan concerning the layoffs program, until December 31, 2012 all employees of Doljchim must go home. Rail and road traffic have lowered quite much compared to 2008. Along with the decrease of the economic activity, the transport activity has also decreased.

In Olt County, the most developed industry is the metallurgical one. The aluminum producer, Alro Slatina, is the largest in Central and South-Eastern Europe, with the exception of Russia and the economy of Slatina is based mainly on it. At the end of last year, the majority shareholder announced some of the production halls will be closed.

The main pollutant generating activities that can significantly affect air quality in Mehedinți County are: energy production based on fossil fuels, cars and shipbuilding, heavy water chemical industry, wood processing activities, agro-food industry, traffic by rail, road and water, transmission, storage and distribution of gas, oil and fuel.

Many of the pollutant-generating businesses in Mehedinți have closed some sessions, especially regarding the chemical industry and shipbuilding.

The main industries existing in Gorj county are: coal, oil and gas extraction, electricity production in power plants from Turceni and Rovinari, building materials (Tg.Jiu, Tg. Carbonești)

wood exploitation and processing (Targu Jiu, Novaci, Baia de Fier, Tismana Pades), car building, mining equipment (Targu Jiu, Rovinari Motru, Jilt.).

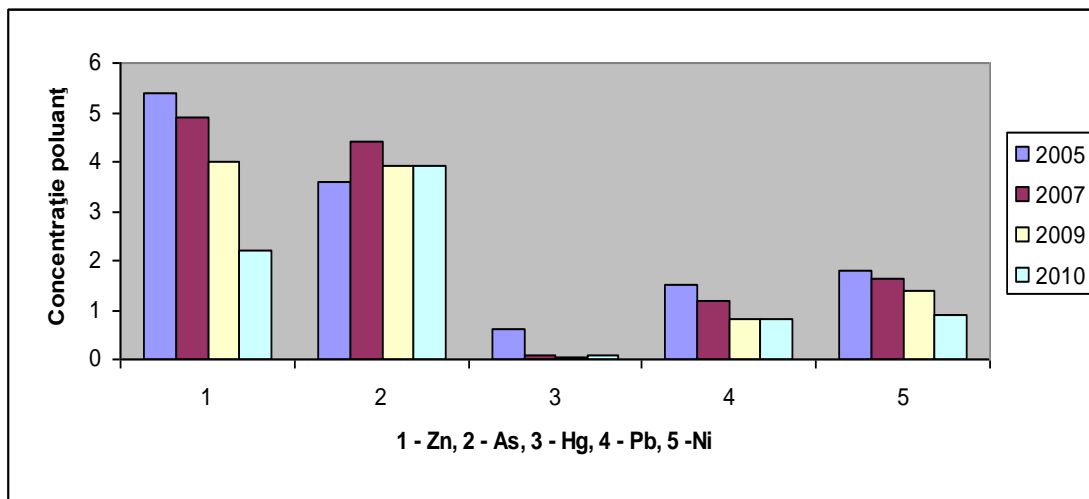
Due to the drastic reduction of orders for coal, in the mines Rovinari and Motru the activity is much lower. The same happened with the energetic activity and the building materials industry.

In Valcea County, the main industries are chemical industry and power generation, mining of salt deposits, limestone, mica, and processing - wood, plastic etc. Oltchim Ramnicu Valcea is one of the leading industrial giants of Oltenia and the biggest polluter in the area. Currently, Oltchim works to 60% of its capacity due to the financial crisis.

**6. Case study**

During 2000-2008, the intensity of economic activities lead to further pollution of water, air, soil and subsoil SV Oltenia region.

Figure 1 shows the level of heavy metals in the Jiu River in 2005, 2007, 2009 and the first two quarters in 2010. Measurements were made at Malu Mare harvesting point. Malu Mare is the point where wastewaters from Craiova City are discharged. The analyzed heavy metals were: Zinc, Arsenic, Mercury, Lead and Nickel. It can be seen, that, in general, the level of pollution with heavy metals decreased from 2005 to 2007 and fell further in 2009 and 2010. In 2010, compared to 2009 the level of zinc and nickel massive falls. These two metals are widely used in industry. Decreased levels of zinc and nickel are due to contraction in economic activity in cities located on the Jiu, in this case, the city of Craiova. Heavy metal pollution still remains but due to waste dumps. Measurements were made in August 2010, using mass spectrometry with inductively coupled plasma.



**Figure 1.** The level of heavy metals in Jiu River

**7. Conclusions**

The leaders of some Eastern European countries indicated that due to the current crisis, they were no longer able to finance the high costs of attaining the 2020 goal and so weren't prepared to adopt a detailed plan.

The extreme poor countries- are the most vulnerable to the effects of financial crisis.

Some developing countries that had seen strong economic growth saw significant slowdowns.

The good conclusion is that economic crisis will cause people to drive less, and otherwise consume less energy, thus lowering expectations for greenhouse-gas emissions.

Greenhouse gas (GHG) emissions from human activities – mainly fossil fuel use, deforestation and agriculture – cause climate change. During the crisis the emissions of CO<sub>2</sub> are diminished and this is good for the environment.

In Romania, the road traffic and thus, air pollution has increased, but in our country environmental infrastructure is still insufficient.

There is still a lot of pollution from agriculture, energy, and transportation.

Half of industrial wastewater, containing mercury, lead, chromium, zinc, and other toxins, is still being discharged untreated into rivers and coastal waters;

The crisis contributed to important shifts in the underlying processes behind environmental change as well as the relative environmental costs.

Some of the measures proposed target the green economy.

Another measure, instituted through a government's emergency ordinance, is the resumption, in 2009, of the renewal of the automotive fleet, also aimed at abating pollution.

As a general conclusion, short-term crisis had a beneficial effect on the environment by reducing emissions of pollutants into the atmosphere, by reducing discharges into the main rivers of Oltenia, following cut down mining operations, tourism, economic, generally, to the Oltenia region. But long term, the economic crisis could have a negative impact on the environment, due to the reduction of funds and investments in the green industry.

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## BASES FOR MANAGERIAL ACCOUNTING AND COST CALCULATION

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### Abstract

*Modern society, that constantly go through now, requires companies to act in an unstable environment more complex and risky. These features, not encouraging for 'health' of economic agents acting on the market, is due to structural changes affecting transactions, accelerating technical progress especially through automation, competition between economic blocs, changing consumer preferences with sufficient speed, reducing the average life cycle for some products. The changing environment in which evolving, requires companies, through the pressure they bring, to improve their ability to respond to external factors, in order to ensure maximum security.*

*In these circumstances, managers are first called to assume responsibility browsing paths as sinuous, more flexible, but also calculated best so expensive and limited resources to achieve maximum results. One of the major orientation, effective leaders have successfully used this fluctuating environment, it is analytical or management accounting, whose main component is information on costs. This presents three elements, related in an inseparable unity, as a result of objective conditions of society: costing, information circulated in the management and economic decision - first task of any manager.*

**Keywords:** costing, management, economic environment

**JEL Classification:** M41, L60, L66.

### 1. Information and enterprise information system

The starting point in defining the concept of information must be represented by the notion of time. Data is defined as 'groups of symbols that represent quantities, events, actions or things'.

Information is processed in date which has been a certain way so that it can be understood by its users.

Information appears as the result of a complex process by which certain data are given meaning state or dynamics of an object, phenomenon or event in the formal processing procedures. Is the element that binds the different phases of the process makes rational coordination and control, adds uncertainty increases the knowledge of the individual in relation to the environment

Information is the basis of information, which is a complex of knowledge, investigation and analysis of the objectives, phenomena and processes occurring in nature and society. Information is a characteristic of all areas of activity, being present in the thinking process and creativity in the process of systematic training and updating knowledge in basic and applied research.

In terms of cyber information can be viewed under three aspects:

- semantic meaning based on information transmitted signal;
- pragmatically, taking into account the scope or use the information to the receiver;
- syntactic, appreciating the extent to which signals received by the receiver eliminates the uncertainty and indeterminacy.

The notion of information is a complex organizational purpose. Information is data that is interpreted and understood by the receiver of the message. User information, as well as the issuer information is involved in the transformation of data into information. This approach is essential to produce results and messages should consider the position in the organization, education and user requirements as well as his familiarity with the language used, the context in which it will use the message in order to increase the information reliability.

Information provides a range of functions such as:

- reducing uncertainty - uncertainty arises where there is little knowledge. Basically you can not achieve a perfect knowledge and therefore relevant information is the cornerstone of reasoning, that what can be done is only a reduction of ignorance. This is relevant in matters of planning and support of their decision.

- support to monitoring and control - this is accomplished by providing information relating to performance, and extensions of deviations from planned levels of performance, which has the effect of enhancing the ability of management and operations relative to control and verification.

- means of communication - appears as a relative need to establish contacts for information, control, evaluation.

- add memory - that the information relative to performing transactions relating to results of past actions may imply predictive mechanisms by linking them with the changes, which may lead to a correct decision by management.

- support for simplification - reducing misunderstanding leads to clarify issues that are complex may even be more easily managed.

Information has not value in itself, its value derived from the exchange value of the decision-making behavior. The dominant trend is to have more information available, more accurate, more updated, but it should be noted that better information can be positive only if it involves decision-making, otherwise the information is missing value. User information is most important. Data collection, handling them, recording and processing involved costs and do not produce direct value. Only after notification by understanding and interpretation of data by the receiver thereof, with the transformation of their information value may occur through the increased use of information in decision making processes. Information quality can be defined as that information which is used as a source of value creation. Overall quality information must have the following qualities: be relevant for the intended purpose, to be sufficiently precise purpose, to be sufficiently complete for the problem to be solved, to come from an untrusted source; to be communicated to the properly agent, to be announced in due time to the event, to be placed on the appropriate level of detail, to be communicated through appropriate channels of communication, to be well understood by the user.

Economic information is generated and used by business, processes and phenomena developed in this field. This category of information allows the knowledge of how are used the material, human and financial resources at company level. All this information are indispensable decision-making.

American economist Hybe found that the total information transmitted at a company level, 80% are economic information, and of these 47% are capable of carrying information.

In the companies „information is considered as a factor in overall activity, allowing the elimination of disturbances that might cause irreparable deterioration of general equilibrium. Knowing deviations and their causes in terms of phenomena through information analysis, decision-making body gives the possibility to adopt control measures in accordance with predetermined values, to determine a fair correlation between the needs - resources - objectives.’

Diversity of economic information that can be handled in an undertaking leads to the necessity of their structure after several criteria. The most important criteria by which economic information can be classified are:

Depending on the level to which they are handled:

- information on the microeconomic level - information found at the company, firm;
- macroeconomic information - information contained in a branch of the economy, national economy or the global economy.

Depending on how the expression of economic information:

- oral information transmitted through direct communication;
- written information, as outlined in various documents or records
- audiovisual information transmitted through specific methods: radio, telephone, movies, internet etc.

Depending on the direction in which information is transmitted:

- ascendent information – information that circulates from the operational departments, to decision-making departments;
- downward information - information that circulates from the upper to the lower departments;
- horizontal information - information that flows between departments located on the same hierarchical level.

Depending on their content, economic information can be:

- planning or programming information – that information concerning the company future activities of the, its objectives;

- actual information - information that showing the real development of economic processes and phenomena. The actual information consist mainly of accounting information;
- control information - that allows comparison of plan information with the real or actual information in order to determine deviations, generators causes and responsibilities.

Depending on the scope or complexity, economic information can be:

- summary information recording the general knowledge, the overall knowledge at enterprise or economic branch level;
- analytical information detailing the work done on structures and components.

Depending on their origin, economic information can be:

- internal information from enterprise internal environment;
- external information from outside the economic environment of business.

Depending on the relationship between information content and time of the economic process, information can be:

- active information - information that contain elements of economic activity development while it reported;
- passive information - information that relates to economic phenomena consumed. A significant part of the information outlined in the annual accounts are part of passive information;
- forecast information - information that relate to future activity of the enterprise.

All economic data are transmitted in an undertaking and its external environment through a computer system. An information system is 'an organized and integrated set of data and information, including procedures and methods used for collecting, processing and transmission.' (Horomnea 2001).

Information system at company level can be decomposed into subsystems based on their structure, namely: the financial accounting system, production system, marketing system, human resources system etc.

Information systems have a number of major roles at the enterprise level, such as:

- operational role - leading to more efficient conduct of business at a higher productivity, the information in a timely and effective information management;
- role in supporting decision-making - an efficient information system is able to provide the necessary information;
- strategic role to help strategic decisions in terms of competitiveness, innovation etc.

An information system is composed basically of three components:

- processes, actions on objects that the system uses to achieve objectives;
- objects, things or entities necessary to system;
- relationships between objects and processes.

The processes of an information system are described actions of those characteristics or attributes of interest in the context of the system. These characteristics include: descriptive (whose value is given by the description of an object identified) and associative (whose value is given by the correlations between two objects).

System objects can be grouped into classes consisting of objects with common properties. An object is identified through one or more attributes whose values identify single object in the class.

Relations that exist between processes, objects or between objects and processes are: structural (highlighting the role of each object or process in the system) and communicative (which identify correlations that exist between the system and its environment, or between system and its components).

Accounting is an important component of management information system. So Quantum Accounting, process and transmit financial information about an economic entity. This information allows the department decision to choose wisely between alternative consumption of scarce resources in the activities related to production and trade.

Basically, accounting will link economic activities and policymakers. First, the accounting measure economic activity, recording the data concerning them for future use. Second, the data are stored as long as necessary, and then processed to become useful information. Thirdly, information is communicated through reports, policy-makers. For these reasons it can be concluded that the raw data

related economic activities is an 'input' into the accounting system and processed information useful for decision makers, is 'the output'.

In economic practice, promoting accounting as a management tool, information and communication regarding Heritage statement and obtained results of state property and is related to the functions they perform accounting:

- function of collecting and recording information - reflects the ability of accounting to collect, record and reflect the comprehensive economic processes and phenomena in terms of value in all phases of production.

This function is performed by chronological and systematic recording, processing, publication and preservation of information about the patrimonial situation and results both for the needs of the unit (management accounting) and in its relations with associates, customers, suppliers, banks, tax bodies, etc. (Financial accounting).

- function of information - what is the communication of information on various structures existing users who have interest in knowing the economic situation. As the user is inside or outside the enterprise, information can be comprehensive or may consist only of certain information communication, which have a standardized formalization after normalization principles and accounting rules imposed by legislation in the field;

- control function - derive from the information, facilitates user-paced business relationship with management or condition of the existence and how to store values;

- forecasting function - the exact look and multifunctional information provided by accounting firm.

In the new Romanian economic, managerial accounting, as a management tool used in the competition, gain new dimensions through empowering them and share information both on the dashboard of the company and the management company.

Currently, management accounting information provided too late, too aggregated and too distorted reality to be relevant for managers in work planning and decision making.

Features a modern and efficient accounting information system management in a business activity should have the following characteristics:

- information system to be both complex and dynamic system, ie a system with multiple components, with exits and user-specific information and communication interfaces work with complementary information systems in an enterprise;

- Information System should be an open and interactive. These features complement the dynamics and complexity. The fact that the accounting information system records the facts of everyday reality company supports an open system, because if it were otherwise, nobody would use results information system. The fact that the accounting information system records the facts of everyday reality company supports an open system, because if it were otherwise, nobody would use results information system;

- accounting information system should be a system in real time, which means that both management accounting and financial engages the concept and virtually all modern information and communication technologies. This means that in future modern information technologies are widely used in economics, leading to replacement decisions largely unknown and speculative in terms of taking decisions based on real knowledge.

In modern society, are more often used two words that characterize the situation of a business: complexity and instability.

These features can be explained by structural changes affecting trade; struggle for influence between the economic blocs; changes in traditional relationships between individuals, professional groups and state; acceleration of technical progress which is the most spectacular form automation; reducing the average lifespan of products; rapidly changing consumer needs.

## **1.2. The necessity and importance of the information generated by accounting**

### **1.2.1. Genesis and evolution of management accounting**

Activity scope of management accounting has an evolution consisting of 'four successive phases'. (Tabără 2006, 15). This structure of management accounting evolution is apparent from a study published by IFAC (IMAPS 1 – Management Accounting Concepts).

The first phase of development refers to the period before 1950, when the main concern was related to determining the full cost and financial control due to application of budgeting techniques and full cost accounting.

The second phase of development begins in 1965, when the dominant interest is linked to production planning and control information necessary for management, using techniques such as decision analysis and responsibility accounting.

The third phase of management accounting evolution begins after 1985, when concerns, primarily, reducing wastage of resources used in business operation, making calls to the analysis of processes and cost management techniques.

The fourth phase of management accounting evolution begins after 1995, and is characterized by 'interest to create or produce value through effective and efficient use of resources, both inducers of techniques to analyze customer value to shareholder, through organizational innovation.' (Tabără 2006, 15).

Management accounting evolution from one phase to another reflects the fact that the main concern has grown for the production of information to resources management, primarily by reducing waste and subsequently through the creation or production value.

Despite the transition from one phase to another interest for the production of information was maintained, but began to be increasingly seen in more than one organizational resource.

Like any other resource, the information may have a strategic benefit, or pose a fundamental responsibility to expand the field of business opportunities. Basically, the current phase of the development of managerial accounting, information in the areas of organizational activities designed to enable strategic management of resources.

Another important aspect that arises from changes in managerial accounting, which is how it as a field, is positioned inside the enterprise:

- the first phase, managerial accounting was considered a necessary technique to pursuing business activity;
- in the second phase, it is held as a leadership activity, with functional role - functional people support operational decision that produce the information needed to plan and control
- the third and fourth phase, managerial accounting is considered 'an integral part of leadership, decision-makers with direct access to information in real time, and the distinction between functional and hierarchical people are gradually diminishing' (Tabără 2006, 17). Using information resources in order to create value is an integral part of management in the enterprise.

Currently, management accounting is increasingly concerned over the needs of businesses and activities in dynamic and competitive environments, and present new features such as:

- waiver of functional specialization to focus efforts on the business processes that support their strategic portfolio of products and services;
- experience of other activities to better understand the role that skills and have the scale of values, becoming more and more virtual in their response to the accelerated evolution of life cycles of products and services to competition;
- integration of their information systems at the same time removing access foreground to oriented information in real time;
- waiver at the support of financial control forms at distance and creation of some individualized control systems in real-time, and is preferably based on non-financial indicators;
- treatment of ambiguity and paradox as the realities that must be overcome by greater investment in information and rationality;
- prevention of cultural integration by developing a shared and accepted vision by the acceptance of cultural boundaries associated with traditional forms of work or professional training.

Regarding the evolution of managerial accounting in Romania, we can say that it did not go all the four phases listed above, there are some gaps in its organization at the enterprise level, reason for not fully meet the necessary information as a tool for making management decisions that lead to maximizing profitability.



### **1.2.2. The functions and role of managerial accounting**

The role of management accounting is more closely related to the exercise of strong competition between undertakings. In the past 40 years the general trend that manifested itself in the world has been to reduce tariffs and other trade barriers and creating free trade areas between the countries.

While international markets have become more sophisticated facilitating international trade exchange, this trend has been felt most strongly in the European Economic Community countries.

Reducing trade barriers between countries has allowed some strong companies to expand global market sales.

To face competition, these firms have had to develop a management accounting system to effectively determine and control production costs.

At the beginning of last century American economist JM Clark considered that the management accounting functions should be the following:

- to help determine a normal or satisfactory price for the goods sold by firm;
- to assist in determining the limit of price reduction;
- to determine which products are most profitable and that creates a deficit;
- to control stocks;
- to define value stocks;
- to test the effectiveness of different processes;
- to test the effectiveness of different departments;
- to detect losses, wastage and theft;
- to split sub-activities cost by the production costs;
- to ensure consistency with financial accounts.

Currently how the cost determination meets several functions in enterprises resulting from their work requirements of modern management.

The most important functions of managerial accounting are:

- function of measuring the consumption of production and its dissolution;
- forecasting function;
- optimization function;
- tracking function, control and adjustment

The first function of managerial accounting *function for measuring the consumption of production and its dissolution* is seen in the literature and the most important resulting from the fundamental principle of economic efficiency 'minimum effort, maximum efficiency' (Oprea 2002, 7) and involves measuring the consumption of factors of production process, carried out in order to produce the goods, works and services.

In the process of measuring the consumption of economic factors, the most often used indicator is 'production cost', indicator to be set correctly by economic calculation.

Production cost calculation used specific expression formula in contrast with the analytical data; with them help the productive consumption express them value, by types, by destination, by sector of expenditure and cost carriers and recorded in appropriate documents.

Costs calculation process should be characterized by the comparability so there is a perfect line not only of the used formulas, but of their coverage in all stages of creating information on how training module costs.

Analytical measurement of the consumption of factors of production process in value terms comprises business functions. These functions are carried out in organizational and technical structures that influence the size, behaviour and development costs due to reverse connection existing between the degrees of organization of activities generated by the functions of 'business costs' system.

Modern management of economic activity requires measurement of productive consumption, in all relevant aspects, both before and concurrently with the process of producing goods that are cost carriers.

Forecasting function occurred due to the dynamic character of indicator of cost and is administered in two forms: planning and forecasting their costs. Cost planning is carried out in particular at the micro level.

It basically involves level antecalculation and cost structure for each product and for the whole production scheduled to produce by the enterprise. So costs are part of the general system of indicators on which work is organized and managed the production of the company.

The used method for expressing default quantities in terms of cost is different: cost of production and sales planning, standard costs, planned costs etc. It is essential that these quantities to be set correctly, their level should reflect the influence of all determinants factors and expressing the actual conditions under which it will evolve its production and marketing business. Therefore, costs antecalculation are based through time standards, regulatory or financial standards, as well as prices and tariffs set as close to reality.

To achieve greater efficiency of business activity is necessary to achieve and planning costs at a lower cost compared to the previous year. But there are cases where some joint action factors such as rising commodity prices, to impose higher planned costs than in previous years.

The second aspect of the forecast function of cost calculation namely forecast occurs mainly due to macroeconomic sub-branches and branches of material production and service economy. There may be situations in which prospective studies refer to a single company, or only to certain products or activities.

Costs forecast operating with the need for the following reasons, mainly:

- direct connection between costs and prices that their quality of measurement and sizing each other;
- indicators intercorelation regarding future development of national economy and above all the branches and sub-branches of material production.

Given the cost structure and behavior in relation to their determinants factors through mathematical models of forecasting is established the future evolution of the value of productive consumption in the form reached sizes that should be optimal.

Another function of management accounting is the optimization function, which is closely related to the forecasting function.

In general, cost optimization refers to allocating scarce resources, distributed according to priorities, requirements and competitive execution.

Cost being an internal factor of the profitability, its optimization models is mainly based on mathematical functions that assess the company's internal reserves. These reserves once they are identified and exploited will determine precisely the profit growth and the rate of return.

Reducing overall costs, particularly material expenditures, is an essential problem of the Romanian enterprises economy during the transition to a competitive market economy.

Optimization function is closely linked by antecalculation as a way of thinking size cost and financial results. This function can not ignore follow-up costs, because on such a basis judgments can be made in antecalculation.

Another important aspect that the optimization function must take into account is the knowledge and analysis of the manufacturing technology, as well as its parameters and inputs have a dynamic technology that size and value, in terms of technology improvements.

Costs in their primary form, are not related only to products manufactured, and therefore their development is dependent on other factors reasonable 'in consumption' and can be optimized: business functions and how to attain them through organizational factor, the production capacity of each unit and its utilization, size factor device (device management, organization, planning, accounting and control), current and future tasks of the enterprise, information system and decision.

Tracking, monitoring and control function of managerial accounting and cost calculation is done simultaneously with that side of the measurement function for tracking and recording production and sales costs in management day periods, related to requirements of used calculation methods.

Fulfilling the function of tracking, controlling and regulating is printing in the behavior of the whole technical, economic and social system, which is undertaking, the effects of forecast function and of cost optimization, being removed ongoing the causes which exercise negative influences along the predetermined quantities.

Cost control has planned to achieve planned objectives in a number of important areas to business such as: the report cost - physical production, production – profit, rate of return.

Report established by control between the proposed and actual size of these indicators remains a mere finding if that regulation occurs not as a process that takes place in the 'centralization' and self-management systems.

By making the calculation of total production costs, especially for each individual product, it creates the possibility of comparing the cost of the same product or similar products manufactured by

enterprises of the same group, in order to emerge from this comparison the degree of organization of production, technical endowment level, the degree of utilization of the time, the degree of qualification of labor, management how each unit.

Achieving production with minimum-cost is the ultimate goal of the exercise management function in terms of provision, rational organization, information, analysis, prompt decision and permanent control.

Based on pre-calculated costs in enterprises is creating a tool for internal financial planning; planned costs are the programming base of indicators such as profit, rate of return and value added.

The cost, as an indicator and means of measuring expenditure made by the enterprise for obtaining and selling its products, play an important economic role only if it is determined in a realistic and appropriate.

### **1.3. Place and role of managerial accounting in an integrated information system cost**

#### **1.3.1. Accounting Reform and its implications in the complex process of calculation, control and cost analysis**

Adaptation business needs to economic environment changes can be met through efficient decision-making, based on relevant information. „Functional analysis of accounting information system, conceived as the inseparable unity of the two components accounting (financial accounting, managerial accounting), is a way of improving the information phenomenon, of increasing the information efficiency in operative and strategic enterprise management.’ (Cojocaru 2002, 81)

The two components of accounting information systems have specialized and separate databases are it complements each other in the preparation of information with different purposes and destinations.

Managerial Accounting is intended for the information needs of the enterprise. It is part of the enterprise information system, providing an economic modeling in order to meet targets to measure performance and aid in decision making. Managerial Accounting has two essential components:

- a performance measurement process by providing complete account as specified sufficiently precise to enable an assessment of the operational performance of business entities;
- methods underlying the decisions that are operating in more than planned, according to the particular needs of the moment or in more specialized according to the operational entity without necessarily requiring the systematic coherence of all enterprise.

These two components of managerial accounting emphasize its major role to produce information to enable modeling the relationship between resources deployed and consumed and results in return. This modeling is in service firm management.

Managerial accounting, as the accounting information system should be organized to benefit the reliability of any information, even if it is projected data.

Knowing the cost of a product is essential, but not the major objective of management accounting. There are other categories of costs, to be known for issuing decisions.

#### **1.3.2. Criteria for evaluating the place and role of management accounting in the integrated information system costs**

Measuring the performance of management can be based on systems and methods developed in close relation to the objectives of production and business strategy. The new business strategy led to the need for reviewing the accounting management, so that it can generate all the information managers need, adjusting economic modeling strategic development requirements.

Developments in technology have had influence on management accounting, changing the analysis of tradition, for the purposes within its coverage and other data than those strictly related cost calculations. The decision-making process appeared increasingly more the need to knowledge quantitative and physical data, their weight has a tendency to increase the volume of valuable information. At the same time the decision was influenced by the new cost structure, the ratio is changing in favor of those not directly concerned with the actual production. „So indirect costs far ahead them of the direct, and in total product costs, cost structure approaching sensitive to material costs.’ (Aslău 2001, 109)

Although during the current Romanian companies face problems other than the organization of management accounting in the conceptual plan should not be neglected.

The main factors that determine the limits of management accounting change are:

- changing market policies as a result of displacement of economic power from producers to consumers and drawing attention to the client, following the elimination of non-quality costs;
- emergence of new methods of production organization;
- increasing the role and importance of activities taking place before and after the actual production deployment;
- decentralization of activities and the emergence of a new type of management which needs, in terms of information on costs, have evolved considerably;

With the desired setting of new targets for management accounting, it is necessary to address more complex sides of economic activities which require in-depth knowledge to explain such processes.

#### **1.4. Organizational factors of managerial accounting and cost calculation in industry**

Organization of managerial accounting and cost accounting of a company in the industry is dependent on several factors such as: production technology, type of production and organization of its, company's organizational structure, size of enterprise, continuity of production, degree of mechanization and automation of production, concentration degree, profiling and specialization degree, the degree of integration. (Oprea, Cârstea 2002, 76)

Production technology, defined as all operations it is subjected to the raw material to finished product, is a determining factor for the organization of managerial accounting and cost calculation.

Production of industrial enterprises can be classified into the following categories:

- Simple production
- complex production

Peculiarities of the production process and its complexity determine the organization of managerial accounting and cost calculation on generating places of costs and in terms of gathering and sharing expenses.

Complex production requires managerial accounting organization and cost calculation both distinct phases of the technological process and the each part of the finished process obtained.

Calculation is complex because the unit cost is calculated initially by groups of parts, components or semi-finished, then for the finished product.

The specifics of manufacturing technology influence the decision on the method of calculation to be used. Also, the variability of production and complex technological process, requiring a certain way to organize the registration of production costs, the organization which must match to chosen calculation method.

*Type of production and organization way* of its is another factor with multiple implications in organizational managerial accounting and cost calculation.

Type of production differs depending on the differences in nomenclature and the volume of manufactured products in three categories:

- mass production
- producție de serie
- individual production

Type of production and organization way of establishes the calculation method to be used. Thus, if mass production is used, in general, the method of calculation phases, and in the case of individual production may be used the method on orders.

In the case of serial production, located between mass production and individual production, it can use one of the methods set for the other two types of production. Where pursued objectives by enterprise management required, it can be arranged during the course of business the calculation and deviations reporting from default costs (standard costs, normal costs, etc.).

*Organizational structure of the company.* The production of material industrial goods is complex, including both the actual production and a number of other activities directly related thereto. The production in industrial enterprises is through the production process, whose complete definition requires characterization of socio and economic aspect as well as material and technical report.

Work processes within companies in the industry can be grouped according to how participating in the finished product in three categories:

- basic processes;
- ancillary processes;
- maintenance processes.

Company size is a factor that influences the choice of how the general principle of organization and execution of the work of accounting and costing.

*Nature of the production process* (continuous or seasonal) is another factor influencing the organization of management accounting and cost calculation.

*The degree of mechanization and automation of production.* Mechanization and automation of production processes within companies in the industry positively affects production subsystems.

Developing technology, mechanization and automation of production determines the emergence of large industrial facilities, and diversifying production. This activity complexity has implications for managerial accounting and cost calculation, by increasing volume and weight of production costs.

The degree of business integration related by rational concentration and production specialization, unit profit improving has implications for the managerial accounting and cost calculation organization.

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# THE COMPARATIVE ANALYSIS OF THE MONETARY POLICY STRATEGIES BEFORE THE ADOPTION OF THE EURO CURRENCY AND THE IMPACT UPON THE MAASTRICHT CRITERIA

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## **Abstract**

*In the way towards the euro, the monetary and exchange rate policy must follow, in parallel, the achievement of the nominal and real convergence. The purpose of this work paper is the analysis of the monetary policy strategies in Slovenia and Slovakia before the adoption of the euro on two periods: pre-ERM II and ERM II.*

*On the one hand the two forms of the inflation targeting strategy have been efficient in the pre-EMU period through the adjustment of the interest rate so that the real rate would not stimulate the crediting, while on the other hand the monetary authority has followed the reduction of the interest rate differential in order to assure the stability of the exchange rate.*

**Keywords:** monetary policy strategy, euro, interest rate differential, exchange rate, inflation

**JEL Classification:** E31, E52

## **1. Introduction**

The achievement of the nominal and real convergence in the candidate countries to the euro zone represents a difficult task of the monetary and exchange rate strategies, the nominal and real convergence being two processes that influence themselves reciprocally. Thus, finding the balance between economic growth and the disinflation represents a challenge for the candidate countries (Nerlich, 2002, 17). But, this isn't the only contradiction between the convergence criteria, the price stability criteria threatening the fulfilment of the other nominal convergence criteria. The greatest challenge in the acceding countries to the EMU is simultaneous achievement of the price stability and exchange rate criteria.

The management of the monetary policy in the euro adoption process is analysed in two stages:

- the post-accession and before the participation to the Exchange Rate Mechanism II and
- the second stage which starts from the ERM II entry until the euro adoption.

Some of the countries which acceded to the European Union on 1<sup>st</sup> of May 2004 (Slovenia, Estonia and Lithuania) have expressed their option to join the euro zone as soon as possible, which means that they have joined ERM II immediately after the accession (28<sup>th</sup> of June 2004).

## **2. Literature review**

Choosing of the monetary policy strategy depends on the characteristics specific to each economy. For instance, Estonia being a small and open economy, and thus, more vulnerable to the volatility of the exchange rate, has opted for the Currency Board.

In the case of a country with a small, open economy, any fluctuation of the exchange rate reflects itself in a significant way in the price level. Thus, a fixed exchange rate eliminates the influence of the exchange rate on the rate of inflation.

Some authors (Buiters and Grafe 2003 or Coricelli 2002) opt for the adoption of the fixed exchange rate conditions in these countries, because it increases the credibility of the monetary policies, and, also, consolidate the links with the EU and EMU.

Sepp, Randveer (2002) evaluate two alternative monetary policy strategies at the Currency Board in Estonia:

1. pegged exchange rate arrangement together with inflation and output gap targeting;
2. floating exchange rate with targeting without any monetary policy target.

Because the Estonian economy is very open and small, it is influenced significantly by the external environment, the inflation being an important function of the imported inflation. In this case,

the inflation rate is the main monetary transmission channels, the tradable goods sector holding a relatively large share. Given the fact that the non-tradable goods sector is relatively small in Estonia, and the afferent demand of this sector is influenced by the interest rate, the effectiveness of this monetary policy instrument is low. The author concludes that the arrangement based on a Currency Board is the best monetary policy strategy for the Estonian economy, capable of fulfilling the Maastricht criteria.

Examining the pro and cons arguments of the Currency Board, Gulde et.al (2000) have the opinion that the countries which apply for this strategy are capable of fulfilling the convergence criteria.

Opposing them, Salater's opinion (2002) is that the fixed exchange rate regime (including the Currency Board) are less effective than the inflation targeting strategy together with floating exchange rate in fulfilling the price stability criteria, because of the manifestation of the Balassa-Samuelson effect in the candidate countries for the euro area. The author concludes that, in the case of a rapid economic growth, only a flexible exchange rate could achieve the fulfilment of the inflation criteria. Because the Balassa-Samuelson effect is absorbed by the nominal appreciation of the exchange rate, the risk of growing a current account deficit appears.

Choosing the exchange rate regime depends on a multitude of factors which are, for the most part, specific to each and every country, such as the expected equilibrium real appreciation, the previous monetary policy, and the capacity and availability of the government to coordinate the fiscal policy (Filáček et. al., 2006, 30-31).

Thus, a fixed exchange rate can be incompatible with the inflation criteria in the case of the manifestation of the Balassa-Samuelson effect. The expected rapid growth can lead to capital inflow, and thus to the necessity to choose between:

- larger deficits of the current account and
- the inflation rates above the reference value.

On the other hand, in the case of operating a flexible exchange rate (fluctuation band  $\pm 15\%$  around the central parity during the ERM II), the nominal appreciation leads to current account deficits, but with the possibility of fulfilling the inflation criteria.

The participation in the ERM II implies the modification of the monetary policy framework, given the stability of the exchange rate. To assure a slow transition towards ERM II, Orłowski, Rubinski (2006) point to changing the monetary strategy in Poland with the relative inflation forecast targeting. In this context, the inflation rate is adjusted so that it can steer the internal inflation forecast towards that of the euro zone, while the exchange rate stability is realized through interventions on the exchange market.

Inflation forecast targeting has been proposed by Orłowsky (2005) as being the operational framework of the monetary policy for the adoption of the euro currency in the new member states and is based on the reduction of the differences between the domestic and the foreign inflation forecasts on a pre-established period of time, becoming the main operational objective of the monetary policy. This advanced form of the direct inflation targeting strategy can contribute to an efficient monetary strategy of the candidates to the euro zone.

Choosing of the monetary policy strategy depends on the characteristics of the economic and financial structures of the states, including the extent of economic openness.

### 3. Pre-ERM II period

The transition to the Economic and Monetary Union implies the management of the monetary policy according with the necessity of fulfilling the convergence criteria provided in the Maastricht Treaty, but also the creation of the institutional conditions necessary for the implementation of the common monetary policy.

Although the inflation rate must not exceed the value reference set according to the Maastricht Treaty during a period of one year before the examination, and the exchange rate stability must be realized during the participation time in the ERM II, it is necessary that in the pre-ERM II period very large fluctuations of the exchange rate must not be registered so that it does not create difficulties at the setting of the central parity. On the other hand, for the two criteria to not enter into conflict in the Exchange Rate Mechanism II period, the fulfilment of the inflation and the entrance into the ERM II criteria is recommended (Jonas, 2004, 11).



Next, we shall compare the euro adoption strategies and their impact upon the inflation and the exchange rate in two states: Slovenia and Slovakia.

If in the transition period towards the market economy Slovenia opted for the monetary targeting strategy, starting with the year 2001, it was changed to a similar one to the inflation targeting strategy, being identical to the monetary strategy policy used by the European Central Bank. Thus, the monetary policy of Slovenia was based on two pillars: the first is represented by the volume of money in circulation, and the second refers to other economic indicators which exerts influence upon the price stability: the exchange rate, the foreign interest rate, the salaries and the administered prices (Bank of Slovenia, 2001, 15). The Bank of Slovenia has led the monetary policy in the context of the managed floating exchange rate.

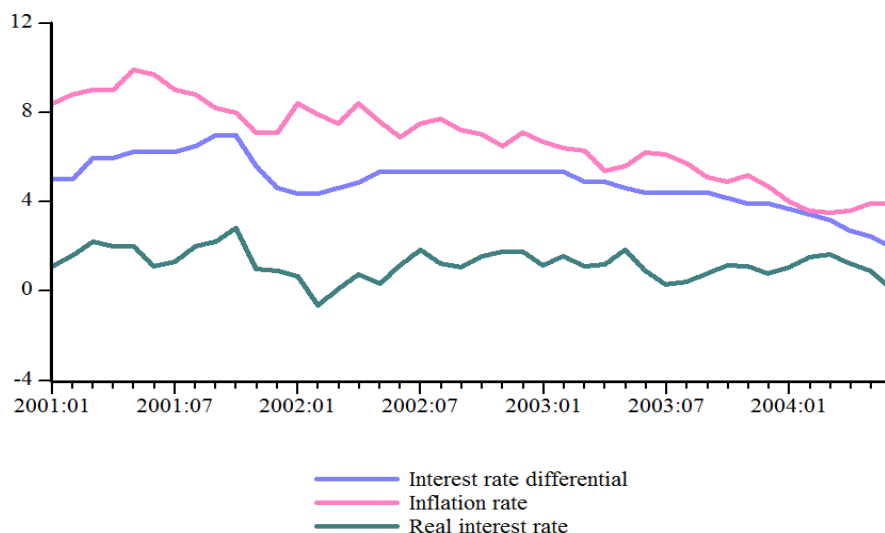
Although monetary policy strategy can not be defined in a ‘monolithic’ way (the exchange rate targeting strategy, inflation targeting or monetary aggregate targeting) because of its complexity, of the interference and instability of the monetary transmission channels, when it declares the objective of the monetary policy on a short term, the Bank of Slovenia defines the range of the growth rate of the monetary aggregate (the monetary aggregate M3 from 1997) (Bank of Slovenia, 2001, p.14).

Similarly to the majority of states in transition to the market economy in Central and Eastern Europe, Slovakia has opted for a fixed rate regime until October 1998, as a nominal anchor for the inflation stability, given that the exchange rate has constituted the primary monetary transmission channel. From 2000 a new monetary strategy has been implemented: the implicit inflation targeting, given that Slovakia did not fulfilled the criteria requested by the explicit form of the strategy.

The objective of the Slovenian monetary policy was that of a moderate increase of the monetary supply, the Central Bank of Slovenia acting upon two variables: the interest rate afferent to its instruments and the exchange rate.

According to the ‘Programme for ERM II entry and adoption of the euro, 2003’ the monetary policy of Slovenia has sought to reduce the inflation in a sustainable way before the participation at the Exchange Rate Mechanism II. The gradual and sustainable decrease of the inflation was based on the adjustment of the interest rates according with the inflationary expectations.

Although the interest rate decrease was necessary, for the decrease of the ecart between the domestic and foreign interest rate, it has been limited by the high rates of inflation. Thus, as we can see in Figure 1, the interest rate and inflation rates followed similar trend, which means that in the period previous to the ERM II, the exchange rate stability objective has been subordinate to the price stability.



**Figure 1.** The evolution of interest rate differential, inflation rate and real interest rate in Slovenia, in the pre-ERM II period (%)

**Source:** Bank of Slovenia, <http://www.bsi.si/en/financial-data.asp?MapaId=64>, European Central Bank, author’s calculations

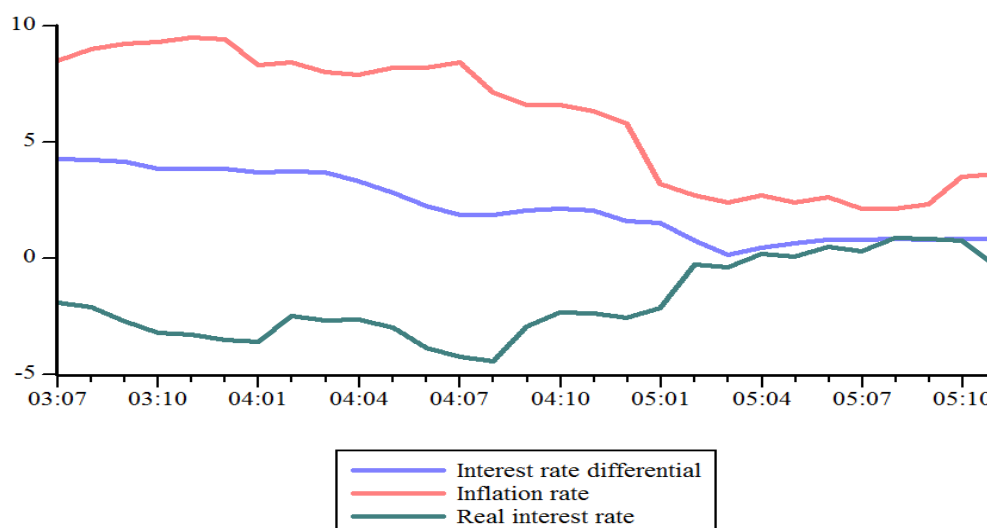
In the first half of the year 2001, the interest rate has registered a one percentage point increase, as a response to the high inflation rates, maintaining itself at the 11% level until the end of the year. The decreasing trend of the inflation rate permitted, beginning with the year 2003, the continuous decrease of the nominal interest rates, while the real interest rate has been maintained at a constant level. The gradual decrease interest rate in the same time with the decrease of the inflation has determined the maintaining of the real interest rate at the wanted level, which means that it prevented the excessive crediting associated with the inflationary pressures.

In the pre-ERM II period, the Bank of Slovenia has maintained the interest rate at a level which has determined the decrease of the inflation rate in a sustainable way, according to the provisions of the Maastricht Treaty, although it has been in contradiction with the exchange rate criteria.

Unlike it, Slovakia adjusted the interest rate, so that it can maintain the exchange rate stability, but also the inflation target. The liberalization of the capital account in Slovakia subsequently to the accession to the European Union has led to massive speculative capital inflow under the existence of the difference between the domestic and the euro zone interest rates. In this case, according to the 'Euro adoption strategy in Slovakia', the National Bank of Slovakia has had the possibility to implement in the period prior to the ERM II entry one of the following procedures (or a combination of them):

- ✓ to perform intervention operations in the currency market to avoid a much too strong appreciation of the national currency, but it is not an option because it encourages the capital flows;
- ✓ to permit the appreciation of the Slovak koruna;
- ✓ to reduce the interest rate with the price of a high inflation.

Thus, the decrease of the interest rate to a level close to that of the euro zone would not have permitted the realisation of the inflation rate in the established level. Thus, in the pre-ERM II period, the inflation rate on the inter-bank market (BRIBOR- three months) decreased gradually, following a trend similar to that of the inflation rate. Thus, under the conditions to maintain the euro zone interest rate approximately constant (EURIBOR - three months), the interest differential has registered a decreasing trend from 4.26% (July 2003) to 0.15% (March 2005). Because the offset between the domestic and foreign interest rate has been relatively high in this period, the Slovak koruna was appreciated with approximately 9%, the exchange rate reaching a minimum value in February 2005 (38,051 SKK/EUR).



**Figure 2.** The evolution of inflation rate, real interest rate and interest rate differential in Slovakia in the pre-ERM II period

**Source:** National Bank of Slovakia, Monetary Survey 2003-2005, European Central Bank <http://sdw.ecb.europa.eu/>, Monthly Bulletin ECB 2003-2005

Due to a strong real wage increase, larger than the productivity one, and a fast economic growth, the inflationary expectations have increased, and consequently, the National Bank of Slovakia decides to increase the interest rates. But, this has not lead to a significant increase of the interest differential, maintaining itself below a 1% level (figure 3), which means that the volatility of the exchange rate has diminished. If in the February 2003 - February 2005 period the variation measured through the standard deviation has been 1.02, during the period until the ERM II accession, a 0.3 variation has been registered.

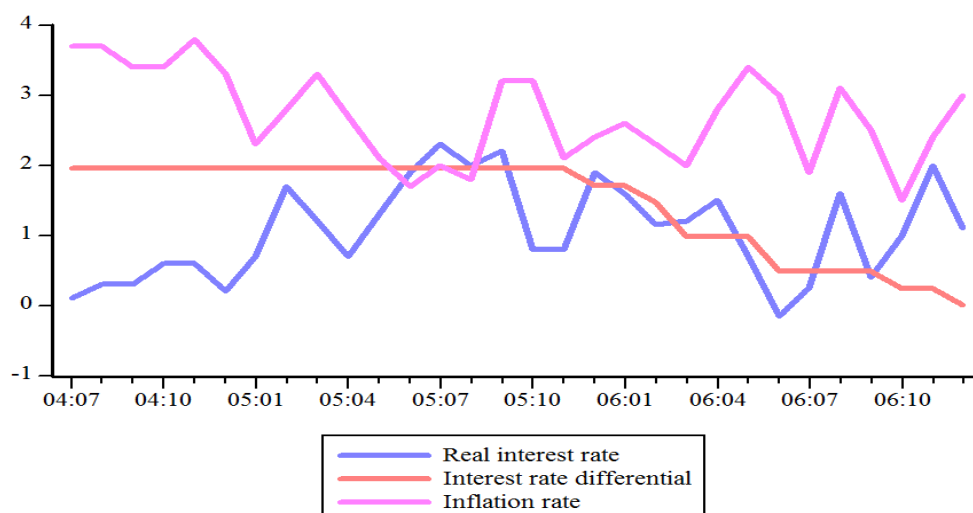
We can notice that in the prior accession period to the ERM II, the monetary policy has adjusted the interest rate, so that the inflation rate approaches the Maastricht reference level, but at the same time to assure the exchange rate stability, necessary to establish the central parity when entering into the Exchange Rate Mechanism II.

Comparing the monetary policy conduit in the period prior to the Exchange Rate Mechanism period in the two states, we note that the Bank of Slovenia sought the decrease of the inflation rate through adjusting the interest rate according to its evolution, in the detriment of the exchange rate stability, unlike Slovakia, which reduced the interest rate gradually so that the inflation target would not be missed and at the same time to avoid a too strong appreciation of the Slovak koruna.

#### 4. ERM II period

From the ERM-II entry, the exchange rate of the tolar has been set at 239.640 SIT towards the euro, the monetary policy focusing on the exchange rate stability. Given that the monetary policy can be considered as an instrument either for the management of the inflation, or for the exchange rate stability, the participation to the ERM II limits its use in the maintaining of a low inflation. Although a set exchange rate can be a stable anchor of the antiinflationary expectations, it is inefficient in managing the domestic demand. In the case in which the monetary policy is focused on the exchange rate stability, the interest rates can't be adjusted at a level which would calm the demand excess. Thus the risk of a new inflationary cycle appears in the national economy. After the ERM II entry, the aggregate demand management and, implicitly of the inflation has been taken over by the fiscal policy through the planification of the public expenses.

In this period, although it maintained itself at a low level, the inflation rate has been very volatile. The interest rate was no longer adjusted in order to stabilize the price variation, similarly to the previous period, because this monetary period is less independent, as a result of the mandatory compliance of the fluctuation band at  $\pm 15\%$  around the central parity.



**Figure 3.** The evolution of the inflation differential, inflation rate and real interest rate in Slovenia in the ERM II period

Source: Bank of Slovenia, <http://www.bsi.si/en/financial-data.asp?MapaId=64>, European Central Bank

Although the nominal interest rate in Slovenia has decreased starting with February 2006, the real interest rate maintained itself positively, except for June 2006 when the real rate decreased slightly below 0%.

Slovakia's entry in the Exchange Rate Mechanism II on the 28<sup>th</sup> of November 2005 has had implications upon the monetary policy: on the one hand the exchange rate variation must fit the  $\pm 15\%$  fluctuation band around the 38,4550 SKK/EUR central parity, while on the other hand the fulfilment of the inflation criteria was necessary. Thus, in order to fulfil the two nominal convergence criteria, the National Bank of Slovakia has opted for a specific form of the inflation targeting strategy named the inflation targeting in the conditions of the ERM II (National Bank of Slovakia, 2005, p. 110). The targeting regime has had a positive influence upon the inflationary expectations, leading to the decrease of the inflation rate

The fulfilment of the exchange rate criteria has implied the reduction of the differential between the domestic and euro zone interest rate, the National Bank of Slovakia modifying the interest rate according with the euro zone evolution. Although the nominal interest rate has increased during the December 2005 - October 2006 period, the real interest rate has been negative, and thus the established target of inflation for 2006 was missed (an annual inflation rate lower than 2.5%). The registering of the inflation rate on a decreasing trend starting with December 2006 has permitted the decrease of the inflation rate in Slovakia, while it increased in the euro zone, which means that the inflation differential became almost null in April 2006 (0.07%), so that from August the euro zone interest rate would overtake the one in Slovakia.

We notice that during the ERM II, the interest rate in Slovakia was established so that the interest differential would maintain itself at a low level, considering the objective of the monetary policy in this period, although the first Maastricht criteria wasn't ignored either. As a response to the high inflation rates in 2006, the National Bank of Slovakia has increased the interest rates, and therefore the interest differential, the last one overcoming 1%.

**Table 1.** The degree of fulfilment of the price stability criteria in Slovakia in the ERM II period

Year	Average inflation rate (HICP)	Maastricht criteria	Annual inflation rate (HICP)	Inflation target
2006	4.26	2.86	3.7	< 2.5%
2007	1.89	2.80	2.5	< 2 %
2008	3.93	4.06	3.5	< 2%

**Source:** ECB, author's calculations

Regarding the exchange rate volatility, it respected the variation interval in the year 2006 (32.6868 – 44.2233 SKK/EURO), but from the ERM II entry the Slovakian economy has passed through many significant structural changes related to the catching-up process. The productivity increases necessary for the real convergence have had a negative impact on both the inflation rate, and the exchange rate. Thus, the central parity was no longer in accordance with the state of the economy, being revaluated at 19<sup>th</sup> March 2007 at 35.4424 SKK/EUR.

If in the pre-ERM II period Slovenia registered a high volatility of the exchange rate, the participation at the Exchange Rate Mechanism has implied the adjusting of the interest rate considering the reduction of the interest rate differential and, implicitly, the stability of the exchange rate around the central parity, which means that it no longer responded to the inflationary shocks. The implementation of the new monetary strategy in Slovakia once with the ERM II entry was based on an interest rate increase rhythm higher than in the euro zone in the first part of the period considering the moderation of the inflation rate, but without generating fluctuations higher than  $\pm 15\%$  around the central parity. Although in the August 2007- September 2008 period the inflation rate has followed an increasing trend due to the food and energy price increase on an international level, the interest rate maintained itself constant.

Both in Slovenia and Slovakia when entry the ERM II period the inflation rate was above the reference value, which means that the central banks were confronted with the problem concerning the adjusting of the interest rate so that the two criteria (price stability and exchange rate) can be fulfilled.

A set exchange rate under the capital account liberalization (requirement of the European Union) couldn't control the monetary supply and implicitly the inflation rate.

The implementation of the inflation targeting strategy, regardless of the adopted form (the strategy based on two pillars - Slovenia or the inflation targeting strategy in the ERM II- Slovakia) has had a favourable impact upon the fulfilment of the monetary convergence criteria, but also upon the entire economy so that it can function successfully after the adoption of the single currency under the influence of the monetary policy of the ECB.

## **5. Conclusions**

The euro zone candidate countries must choose the monetary policy strategy according to characteristics of the respective economy, so that the convergence criteria can be fulfilled, given the conflict between the two.

The adoption of a regime based on a fixed exchange rate would not be a solution for the analysed countries under the liberalization of the capital account and the manifestation of the Balassa-Samuelson effect. Before the euro adoption, it is necessary the approachment of the monetary policy of the candidate countries to that of the ECB so that it can benefit from the advantages of the single currency.

In our opinion, the catching-up process must be finalised at the moment of the EMU entry, because the impact of the manifestation of the Balassa-Samuelson effect upon the inflation is stronger, because of the impossibility of its absorption through the nominal appreciation of the exchange rate.

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## ON RESERVE HOARDING IN EMES: THE CASE OF TURKEY

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### **Abstract**

*The aim of this paper is to investigate the motives behind the accelerated reserve stockpiling in Turkey. To that end, the paper investigates the long-run equilibrium relationship and Granger causality for the periods of 1974-2009 between international reserves of Turkey and a set of variables put forward by the models of reserve demand. The results of the bounds test for cointegration within the ARDL modelling approach of Pesaran et al. (2001) reveal level relationship between international reserves of Turkey and trade openness, exchange rate volatility, real exchange rate appreciation, financial development, domestic financial development, financial openness, current account volatility, export volatility, public debt, opportunity cost, foreign liabilities and short term debt. Granger causality tests display bidirectional causality between exchange rate volatility and reserves and also unidirectional causality that runs from financial openness, short term debt and domestic financial development to reserves. In addition to the Greenspan-Guidotti rule of short term external debt, the 'Financial-Stability Model' seems to better explain the accelerated demand for reserves in Turkey.*

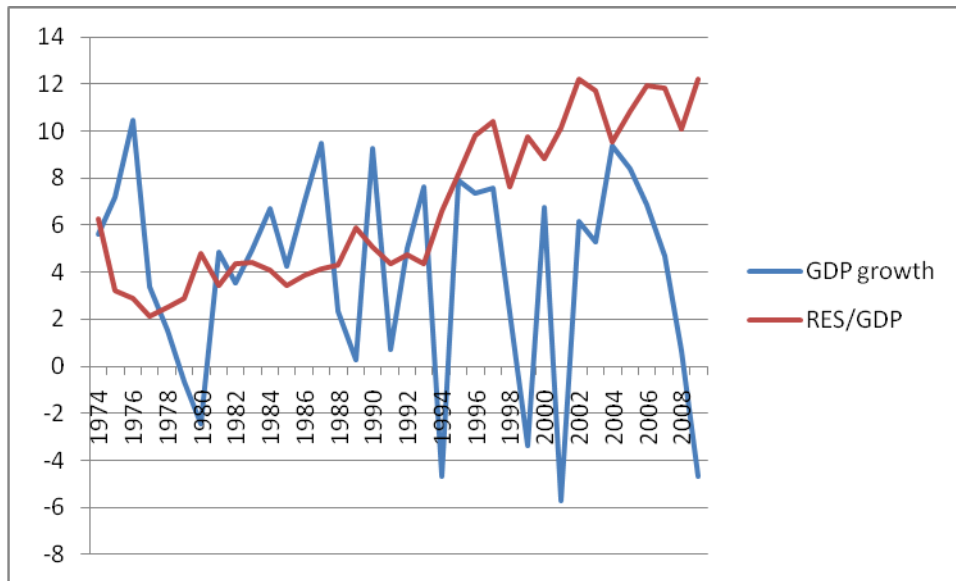
**Keywords:** international finance; open economy macroeconomics; central banks and their policies; bounds test; granger causality

**JEL Classification:** F30; F41; E58; C22

### **1. Introduction**

The international foreign exchange reserves of the world economies were rather steady after the collapse of the Bretton Woods system and throughout 1980s. The international reserves in the emerging market economies (EMEs) accelerated sharply after the financial crisis in Mexico (Cruz and Walters, 2008) and the 1997-1998 Asian crises further sped up reserve hoarding in the Southeast Asian countries. Since 1990s reserves to gross domestic product (GDP) ratios of EMEs have increased from 4% to more than 20% levels, whereas that of advanced countries continued to be steady at the levels of 4% (Obstfeld et al., 2008). Initially, the main reason behind the increase in reserve accumulation was the capital inflows to EMEs from industrialized countries that carried the risk of crises. However, the accelerated international reserve hoarding during the past decade affected also the direction of capital flows that started to run this time from EMEs to developed countries, fuelling the global imbalances.

In Turkey, the first steps of financial liberalization started by 1980 with the structural adjustment program that aimed financial liberalization and export-led growth. The period then after is marked by deregulation of financial markets, trade liberalization and the final step of capital account liberalization in 1989 (Esen, 2000). The first financial crisis that hit Turkey after the financial openness was in 1994. Yet, the most devastating one, due also to the existing distortions and weak institutional settings, was in 2001. In Turkey, reserves that were steady during 1980s started to increase after the financial liberalization but showed an upward trend mainly after these two crises as depicted in figure 1. As of 2009, reserves are almost twice the short term debt; cover 5.5 months of imports and reserves to M2 ratio is at 20% levels in Turkey (WDI, 2010).



**Figure 1.** GDP GROWTH vs. TOTAL RESERVES TO GDP in TURKEY

**Source:** World Development Indicators (2010)

The aim of this paper is to investigate the motives behind reserve hoarding in Turkey. To that end, the paper employs the bounds test for cointegration, to search if reserve accumulation is in a long run equilibrium relationship with trade openness, exchange rate volatility, real exchange rate appreciation, financial development, domestic financial development, financial openness, current account volatility, export volatility, public debt, opportunity cost, foreign liabilities and short term debt in Turkey. On the other hand, Granger causality tests are employed to investigate the direction of causality between reserve hoarding and the concerned variables that are put forward by a number of for reserve demand models.

The paper is motivated, to the best knowledge of the author, by the following voids in the literature: First, the inconclusiveness on theory for reserve hoarding necessitates the topic to be scrutinized on the country level. Second, there is no empirical investigation that explains the motives of reserve stockpiling in Turkey. Third, this paper investigates the long-run relationship and direction of causality between reserve hoarding and a set of variables by employing the rather new technique of Bounds test for co-integration within the ARDL (Autoregressive Distributed Lag) modelling approach. The rest of the paper unfolds as follows: Section 2 reviews the literature. Section 3 describes the data and the methodology for the empirical analyses. Section 4 discusses the empirical results. Section 5 comments on policy implications and concludes.

## 2. Literature Review

The optimal level of reserves is determined by the marginal benefits and costs of reserves. The benefits of reserve hoarding includes prevention of currency crisis, installing confidence in the economy, self-insurance against volatile capital flows, reduction of exchange rate volatility, avoiding currency depreciation, allowance to repay external liabilities, insuring against 'sudden stops,' helping countries to cope with the speculative attacks and possible reduction in foreign currency borrowing. Although the costs of reserve hoarding may be small when compared with the cost of illiquidity and crises, one of the main costs related to reserve accumulation is inflation.

The issuance of local currency by the central bank to purchase foreign currency causes inflation due to the increase it leads in the monetary base. To sterilize the inflationary impact of reserve hoarding, the withdrawal of liquidity from the market by the issuance of domestic liabilities may lead to fiscal costs if the central bank pays a higher interest rate for the bonds issued than the interest



earned from the reserves piled. Higher interest rates may be another costly outcome of reserve accumulation since the demand for sterilization bonds may be weak. Other costs of reserve stockpiling include the valuation losses due to the appreciation of the domestic currency; asset price inflation due to the excess liquidity created by incomplete sterilization and the social cost of reserve hoarding (Rodrick, 2006) due to the higher interest rate payment of the government to its external debt compared to the interest earnings from the foreign assets of reserves. Also, holding reserves incurs an opportunity cost, which is the difference between what the reserves could have earned and what they actually earn (Green and Torgerson, 2007; Cruz and Walters, 2008, Park and Estrada, 2010). Besides, excessive prolonged reserve hoarding may also entail lending and asset market booms, monetary imbalances and distorted banking systems as claimed by Mohanty and Turner (2006). Some studies (i.e. Rodrick, 2006) suggest that the excess of international reserves has a cost of around 1% GDP.

Given the costs of reserve stockpiling, economists have long been searching for the level of reserve adequacy, on which there is no theoretical consensus. However, some informal rules of thumb exist for levels of reserve adequacy. The first one of these rules is the ratio of reserves to short-term external debt, 'the Greenspan-Guidotti rule' which is an important determinant of an economy's vulnerability to financial crisis. The critical value of this ratio is equal to one and it indicates that a country with reserves equal to external debt, maturing within one year, is expected to service its foreign exchange obligations even during a crisis period. The other reserve adequacy measure is the reserves to M2 ratio with critical values ranging between 5% and 20%. Higher reserves to M2 ratios convey greater confidence in the domestic currency and lessen the possibility of 'flight to liquidity,' whereas 5% is assumed to be adequate for countries with floating exchange rates. The third rule for reserve adequacy is the months of imports that reserve holdings of a country can cover for. The critical value for this measure is between three to four months with the assumption that stocks covering three to four months of imports reduce the vulnerability of the country to unfavourable current account shocks (Green and Torgerson, 2007).

On the other hand, the two traditional views that explain the reasons behind reserve stockpiling are those of 'Precautionary' and 'Mercantilist' models. The optimal level of country specific level of international reserves is first investigated by Heller (1966) with a focus on the current account and based on precautionary motive as he named it. The demand for reserves, according to Heller (1966), was based on the trade-off between the benefits in terms of more gradual balance of payments adjustments and the opportunity cost of holding them. Frenkel and Jovanovic (1981) developed the 'Buffer Stock' model, which is a more formal approach for the precautionary motive of reserve stockpiling and this model is further reinterpreted by Flood and Marion (2002). Buffer stock model suggests that the optimal level of reserves may increase with the volatility of reserves (in conjunction with i.e. current account shocks, capital inflows), the opportunity cost of reserve hoarding and the fixed costs of rebuilding reserves. Precautionary or 'Self-insurance' demand for reserves also considers reserves as a substitute for developed financial markets in absorbing the risk of sudden stops. Hence, current account volatility, exchange rate volatility and financial openness are the variables that affect the reserve demand positively whereas cost of reserves in terms of interest rate differences between the reserve and domestic currency and financial depth in terms of M2 to GDP are the variables that affect the reserve demand negatively according to the precautionary model for reserve hoarding. Aizenman and Marion (2003), Aizenman and Lee, (2007) are amongst the economists who explain the recent reserve accumulation with the self-insurance or precautionary demand for reserves.

On the other hand, the 'Mercantilist' view relate the trend of reserve hoarding to outward-oriented growth strategy since reserve accumulation is also used to prevent the appreciation of the domestic currency to promote exports. The mercantilist motive also underlines the collateral role of reserves to purchase credibility in attracting capital flows. According to the mercantilist approach, trade openness, export volatility and exchange rate appreciation are supposed to affect positively the demand for international reserves. Dooley et al. (2004) and Summers (2006) explain the stockpiled reserves in Asia with the mercantilist motive as they argue that the huge reserves is the unplanned outcome of large current account surplus.

Actually, these two conventional models are rather complementary as the empirical investigation of Aizenman and Lee (2007) depicts. Aizenman and Lee (2007) used some of the variables that are associated with the mercantilist and the precautionary approaches and found out that

the variables associated with both of the approaches yield statistically significant results, yet the precautionary approach variables play a more important economic role. However, the recent accelerated expansion in EMEs' reserve hoarding, far exceeding the necessary levels, is not fully explained by neither of these traditional models (Jeanne, 2007). Based on these two models, there are now revised versions that try to explain the accelerated and extensive reserve stockpiling in EMEs.

Amongst the recent endeavours, Jeanne and Ranciere (2008) developed an 'Insurance model' which is based on the traditional 'Precautionary' model. The insurance model explains the international reserve demand with the national consumption smoothing role of reserves when faced with sudden stops associated with a fall in output. The optimal level of international reserves in this insurance model depend on the probability and size of sudden stops, as well as consumers' risk aversion and the opportunity cost of reserve hoarding. Jeanne and Ranciere (2008) find that the probability of sudden stops increase with currency's level of real appreciation, the ratio of public debt to GDP, and the country's openness. Hence, public debt to GDP, the real appreciation and openness are the variables that are supposed to affect the reserve demand positively according to this model. The insurance model justifies the extensive reserve stockpiling of EMEs over the past decade but can't solve the puzzle of less risky countries holding more reserves.

Again recently, Obstfeld, Shambaugh and Taylor (2008) developed the 'Financial-Stability Model' which has financial openness and financial development as the key determinants to explain the reserve hoarding in the globalized world. The financial-stability model explains the demand for reserve stocks with financial openness, financial depth in terms of M2 to GDP and exchange rate volatility. The prediction of the financial stability model is that there is a positive relationship between financial development and reserve demand. Obstfeld et al. (2008) claim that compared to M2, neither trade nor debt criteria is capable of explaining the large reserve stockpiling since the treat of quick and large reserve drain in a sudden stop is much higher in the case of M2 outflows. Obstfeld et al., (2008) argue that the primary reason for reserve accumulation is to protect the domestic banking sector during periods of capital flight. This financial stability model is based on the crises scenarios of most of the 1990s with internal and external drain of reserves due to the 'flight for quality' that activate central banks' lender of last resort (LLR) role. Obstfeld et al., (2008) claim that their model explains reserve hoarding better than the traditional model and the short-term debt rule of Greenspan-Guidotti.

Yet, Dominguez, (2010) developed the 'Undeveloped Financial Markets' model which explains the accelerated reserve accumulation with the role of the reserves in loosening financial constraints for countries with less developed financial markets.<sup>1</sup> Dominguez (2010) advocates that in the EMEs with less developed financial markets, the firms are under-insured against financing constraints that may arise in the future. In such a setting, sterilized reserve hoarding result in mitigating the under-insurance problem of private firms against possible future financing constraints by stimulating them to save by purchasing the government bonds that are sold for sterilizing purposes. The empirical analyses to test for the underdeveloped financial markets model employ M2 to GDP; the sum of domestic private credit creation and stock market capitalization to GDP to proxy for the size of domestic financial markets and the sum of foreign portfolio equity and debt liabilities divided by GDP to proxy for external liabilities as the three alternative measures of financial market development. Contrary to the financial stability model, the undeveloped financial markets model predicts that countries with less developed financial markets hold more reserves.

There are also a few other models like 'Policy Autonomy' that explain the drivers of reserve hoarding with the policy autonomy demand of EMEs to replace for the conditional assistance provided by the IMF. On the other hand, the results of the empirical analyses depict that the motives of EME are rather diverse for EMEs. Jo (2011) finds empirical evidence for the mercantilist motive to be the main driver of reserve accumulation in Korea. Cifarelli and Paladino (2009) empirically prove that in 9 EMEs in Asia and Latin America, precautionary model explains the reserve demand. They find that the excess reserve stockpiling of the previous period, relative competitiveness, fear of floating, mercantilist motives and US monetary stance stimulate reserve hoarding in these countries. Bastourre

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<sup>1</sup>In theory, the precautionary motive for reserve hoarding is to smooth consumption fluctuations and the underdeveloped financial market motive for reserve hoarding is to offset a tightening of a financial constraint. However, as suggested by Dominguez (2010), in practice, it is hard to separate them as financial market constraints affect consumption smoothing.

et al. (2009) find for a panel of 136 countries that openness, financial deregulation, flexibility of exchange rates and an inverted U-shaped relationship between reserves and income level are amongst the factors that drive reserve piling. Hence it seems that as Park et al. (2010) suggest ‘the optimal reserve level differs from country to country and changes over time for a given country.’

Yet, the empirical analyses bring forth some important facts regarding reserve piling. Steiner (2009) provides empirical evidence that the financial crisis affecting the country stimulates a new increase in reserve building in the EMEs. Mohanty and Turner (2006) suggest that the low inflationary environment since 2001 limited the countries’ cost of reserves. Aizenman and Lee, (2008) underline that whatever the motive may be, excessive reserve stockpiling entails ‘competitive hoarding’. On the other hand, Summers (2006), Bird and Rajan (2003); Rodrik (2006) Torgerson and Green (2007) suggest that the distortions which cause vulnerabilities should be removed rather than developing costly strategies of reserve stockpiling to fight against them. Aizenman, and Sun (2010) find that during the global crisis, EMEs were more held back by fear of losing reserves than by fear of floating and suggest that prudential supervision should discourage banks going for short term external borrowing in order to mitigate the deleveraging risk it entails. Yet, for the collective management of reserves amongst EMEs, Aizenman and Lee (2008) propose the establishment of an Asian International Fund. Jenne and Ranciere (2008) advocate for the IMF relaxing credit limits to EMEs at crisis periods. Also, Aizenman et al. (2010) suggest that deepening swap agreements may lessen the precautionary motive for reserve piling.

For Turkey, on the other hand, there is no empirical investigation which examines the reasons behind the increasing demand for reserves. Yet, Kasman and Ayhan, (2008) analyze the relationship between reserves and nominal as well as real exchange rates and find that foreign exchange reserves reduce the volatility of exchange rates in the short run and nominal exchange rates determine the foreign exchange reserve level in the long run. Parlaktuna, (2005), on the other hand find the existence of a relationship between exchange market pressure and reserves. The lack of consensus on the optimal reserve level and on the motives of accelerated international reserve hoarding and the lack of empirical analysis for Turkey render the country specific empirical investigation of the Turkish case indispensable.

### **3. Data and Methodology**

The paper employs annual data covering the period from 1974 to 2009. The ratio of reserves to GDP (RES) is used as the dependent variable to proxy for the demand of international reserves. (CAV) proxies for Current Account volatility; (FXV) stands for Exchange Rate volatility; (EXPV) proxies for Export Volatility; (FXA) stands for real exchange rate appreciation and (IR) stands for the opportunity cost of holding international reserves. On the other hand, for financial development three proxies are employed, which are (FDP) for financial depth, (DFDP) for domestic financial development and (FL) for Foreign Liabilities. (FO) stands for Financial Openness, (TO) stands for Trade Openness, whereas (PUBD) and (STD) stand for Public Debt and Short term debt respectively. Evidently, there are some overlapping variables in the models, yet each model has certain key determinants that explain the demand for reserves. The data source for all the variables employed is the World Development Indicators (WDI, 2010) except for IR and FL which come from International Financial Statistics (IFS) of IMF and foreign exchange rates from OECD statistics. Figure 2 depicts the abbreviations, explanations, estimation methods and the sources of the variables.

Abbreviation	Variable name	Estimation Method	Data Source
RES	Reserves to GDP	The ratio of total reserves to GDP	WDI
CAV	Current Account volatility	The standard deviation of the ratio of current account balance to GDP	WDI
FXV	Exchange rate volatility	The standard deviation of returns of the CPI based real effective exchange rates of TRL per USD.	OECD
EXPV	Export volatility	The standard deviation of Exports to GDP	WDI
FXA	Exchange rate appreciation	The deviation in the CPI based real effective exchange rates of TRL per USD from a Hodrick-Prescott trend	OECD
IR	Opportunity cost of reserves	The difference between yearly nominal deposit rates of USA and Turkey	IFS
DFDP	Domestic Financial Development	The sum of private credit creation and stock market capitalization to GDP	WDI
FL	Foreign Liabilities	The sum of foreign portfolio equity and debt liabilities divided by GDP of Monetary Authority and banks	IFS
FDP	Financial Development	The ratio of M2 to GDP	WDI
FO	Financial Openness	The sum of FDI net inflows, FDI net outflows and net portfolio investments to GDP	WDI
TO	Trade Openness	The ratio of trade (exports + imports) to GDP	WDI
PUBD	Public Debt	The ratio of Public Sector long-term external debt stocks to GDP	WDI
STD	Short term debt	The ratio of short term external debt stocks to GDP	WDI

Figure 2. Estimation Method and the Data Sources of the Variables

All the variables employed are in their natural logarithmic forms except for IR, CAV, FXV, FXA and EXPV. The model to investigate for the drivers of accelerated reserve hoarding in Turkey may be demonstrated as follows:

$$\begin{aligned}
 & \text{Precautionary Model} \\
 \text{Mercantilist Model} & \\
 RES = & \beta_1 CAV + \beta_2 IR + \beta_3 FO + \beta_4 FDP + \beta_5 FXV + \beta_6 EXPV + \beta_7 TO + \beta_8 FXA + \beta_9 PUBD \quad (1) \\
 & \begin{array}{ccc}
 \text{Financial Stability Model} & & \text{The Insurance Model} \\
 \downarrow & & \\
 +\beta_{10} DFDP & +\beta_{11} FL & +\beta_{12} STD \\
 \text{Underdeveloped Financial Markets Model} & & \text{Greenspan-Guidotti rule}
 \end{array}
 \end{aligned}$$

where, with the expected signs of coefficients in parenthesis, CAV (+), FXV(+), IR (-), FO(+) and FDP (-) are related with the Precautionary; TO (+), FXA (+) and EXPV (+) with the Mercantilist motives for reserve demand. For the Insurance model, PUBD (+), FXA (+) and TO (+); for the Financial Stability Model, FXV (+), FO (+), FDP (+); for the Underdeveloped Financial Markets model FDP (-), DFDP (-), FL (-) and for the Greenspan-Guidotti rule STD (+) enter the equation.

The paper employs the Augmented Dickey & Fuller (ADF) and Phillips & Perron (PP) unit root tests to search for the integration level between RES and CAV, EXPV, IR, FO, FDP, TO, FXA, PUBD, FXV, DFDP, FL,STD. The integration level is searched to verify that the variables are not integrated of order two, I (2) or higher.

Then, the bounds test for cointegration within the Autoregressive Distributed Lag (ARDL) modelling approach, developed by Pesaran et al. (2001) is employed to investigate if RES is in a long-run equilibrium relationship with the above mentioned variables that are suggested by reserve demand models that try to explain the accelerated reserve hoarding in the EMEs. The ARDL modelling approach enables the empirical investigation of the level relationship between the large number of variables in this study as it can be employed irrespective of whether regressors are purely I (0), purely I (1) or mutually co-integrated. The ARDL modelling approach involves estimating the following error correction models:<sup>2</sup>

$$\Delta \ln Y_t = a_{0_y} + \sum_{i=1}^n b_{i_y} \Delta \ln Y_{t-i} + \sum_{i=0}^n c_{i_y} \Delta \ln X_{t-i} + \sigma_{1_y} \ln Y_{t-1} + \sigma_{2_y} \ln X_{t-1} + \varepsilon_{1t} \quad (2)$$

$$\Delta \ln X_t = a_{0_x} + \sum_{i=1}^n b_{i_x} \Delta \ln X_{t-i} + \sum_{i=0}^n c_{i_x} \Delta \ln Y_{t-i} + \omega_{1_x} \ln X_{t-1} + \omega_{2_x} \ln Y_{t-1} + \varepsilon_{2t} \quad (3)$$

In equations 2 and 3,  $\Delta$  is the difference operator;  $\varepsilon_{1t}$  and  $\varepsilon_{2t}$  are serially independent random errors with mean zero and finite covariance matrix. In the above equation with  $Y$  as the dependent variable, the null hypothesis of no cointegration is  $H_0: \sigma_{1Y} = \sigma_{2Y} = 0$  and the alternative hypothesis of co-integration is  $H_1: \sigma_{1Y} \neq \sigma_{2Y} \neq 0$ . In the second equation with  $X$  as the dependent variable, the null hypothesis of no cointegration is  $H_0: \omega_{1Y} = \omega_{2Y} = 0$  and the alternative hypothesis of co-integration is  $H_1: \omega_{1Y} \neq \omega_{2Y} \neq 0$ .

As the next step, the paper runs the Granger causality tests under the vector error correction model (VECM) for the cointegrated variables. The Granger causality test involves the estimation of the following error correction models.

$$\Delta \ln Y_t = \alpha_0 + \varphi_{11}^p(L) \Delta \ln Y_t + \varphi_{12}^q(L) \Delta \ln X_t + \delta ECT_{t-1} + u_{1t} \quad (4)$$

$$\Delta \ln X_t = \alpha_1 + \varphi_{21}^p(L) \Delta \ln X_t + \varphi_{22}^q(L) \Delta \ln Y_t + \delta ECT_{t-1} + u_{2t} \quad (5)$$

where,

$$\varphi_{ij}^p(L) = \sum_{n=1}^{P_{ij}} \varphi_{ijn} L^n \quad \varphi_{ij}^q(L) = \sum_{n=1}^{Q_{ij}} \varphi_{ijn} L^n$$

In equations (4) and (5),  $\Delta$  symbolizes the difference operator,  $L$  denotes the lag operator,  $u_{1t}$  and  $u_{2t}$  are serially independent random errors with mean zero and finite covariance matrix.  $ECT_{t-1}$  is the lagged error correction term derived from the long-run co-integration model. For bidirectional Granger causality under VECM, the F and t-test statistics for  $ECT_{t-1}$  in equations 4 and 5 should be statistically significant.

On the other hand, Granger causality tests are run under the vector autoregressive (VAR) framework at level forms when the variables are both integrated of order I(0), that is to say, naturally co-integrated. The existence of a statistically significant F-test would be enough to infer causation from X to Y in equation 6 and from Y to X in equation 7, as expressed below:

$$\log Y_t = a + \sum_{i=1}^p \alpha_i \log Y_{t-i} + \sum_{j=1}^q \beta_j \log X_{t-j} + \mu_t \quad (6)$$

$$\log X_t = b + \sum_{i=1}^r \gamma_i \log X_{t-i} + \sum_{j=1}^s \delta_j \log Y_{t-j} + v_t \quad (7)$$

<sup>2</sup> Formatting and styles of equations, tables and even some notations heavily draw from the various publications of Katircioğlu, S.T. (i.e. Katircioğlu, S.T., 2009; Katircioğlu, S., Yorucu, V., 2010) who, amongst his other publications, created an extensive literature on Bounds testing for cointegration.

where  $\mu_i$  and  $v_i$  are serially uncorrelated white-noise residuals and  $p$ ,  $q$ ,  $r$  and  $s$  are the lag lengths for each variable in each of the equations.

**4. Results and Discussions**

Table 1 illustrates ADF and PP unit root test results for RES and CAV, EXPV, IR, FO, FDP, TO, FXA, PUBD, FXV, DFDP, FL, STD. Both the ADF and PP tests show that RES, FXV, FXA, FO, DFDP, and CAV are stationary at level, or in other words, integrated of order zero, I (0). On the other hand, FDP, TO, EXPV, IR and FL are stationary at first differences, I (1) according to both the ADF and PP test results. PUBD and STD are the only two variables which are integrated of order zero according to ADF and integrated of order one according to PP unit root tests. Here, both the PUBD and STD variables will be considered to be integrated of order one, due first to the fact that PP test is sometimes superior to the ADF test as it computes a residual variance that is robust to auto-correlation. Second, the employment of Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test results with a drift and trend ( $\tau_T$ ) as well as with a drift and without trend ( $\tau_\mu$ ) both lend support to the rejection of the null hypothesis which suggest that PUBD and STD are stationary.

Table 1. ADF and PP Tests for Unit Root

Statistics (Levels)	lres	fxv	fxa	lfdp	lfo	lpubd	ldfdp	cav	lstd	lto	expv	ir	lfl
$\tau_T$ (ADF)	-5.36*	-6.53*	-4.87*	-2.58	-4.55*	-2.69	-4.42*	-3.54***	-2.66	-2.39	-2.61	-0.57	<b>-2.17</b>
$\tau_\mu$ (ADF)	-0.92	-6.36*	-4.91*	-0.13	-1.67	-3.95*	-0.41	-3.59**	-3.54**	-1.29	-1.31	-1.59	<b>-2.53</b>
$\tau$ (ADF)	0.21	-6.46*	-4.20*	1.15	-0.15	-0.04	1.23	-3.64*	-0.26	0.87	-1.34	-0.74	<b>-0.18</b>
$\tau_T$ (PP)	-5.27*	-6.56*	-4.08**	-2.09	-4.51*	-1.01	-4.42*	-3.70**	-2.58	-1.93	-2.69	-0.88	<b>-2.08</b>
$\tau_\mu$ (PP)	-0.95	-6.36*	-4.16*	0.51	-1.43	-1.59	-0.75	-3.75*	-2.55	-1.32	-1.20	-1.60	<b>-2.36</b>
$\tau$ (PP)	0.32	-6.46*	-4.22*	2.06	0.33	-0.10	3.00	-3.80*	0.08	0.84	-1.34	-0.73	<b>-0.13</b>
Statistics (First Diff.)	$\Delta$ lres	$\Delta$ fxv	$\Delta$ fxa	$\Delta$ lfdp	$\Delta$ lfo	$\Delta$ lpubd	$\Delta$ ldfdp	$\Delta$ cav	$\Delta$ lstd	$\Delta$ lto	$\Delta$ expv	$\Delta$ ir	$\Delta$ lfl
$\tau_T$ (ADF)	-7.07*	-4.85*	-6.89*	-5.64*	-8.22*	-4.27**	-9.69*	-7.25*	-4.78*	-4.14**	-5.16*	-7.63*	<b>-6.56*</b>
$\tau_\mu$ (ADF)	-7.21*	-4.90*	-6.95*	-5.48*	-8.26*	-4.33*	-9.75*	-7.16*	-4.91*	-4.13*	-5.15*	-7.11*	<b>-6.40*</b>
$\tau$ (ADF)	-7.12*	-11.70*	-7.07*	-5.33*	-8.32*	-4.43*	-9.57*	-7.29*	-4.97*	-3.98*	-6.12*	-7.20*	<b>-6.34*</b>
$\tau_T$ (PP)	-11.48*	-20.96*	-8.65*	-10.81*	-8.91*	-4.53*	-13.36*	-8.60*	-5.86*	-5.36*	-7.29*	-7.61*	<b>-7.05*</b>
$\tau_\mu$ (PP)	-11.14*	-21.00*	-9.22*	-6.23*	-8.93*	-4.44*	-10.94*	-8.36*	-5.52*	-4.93*	-6.57*	-6.98*	<b>-6.46*</b>
$\tau$ (PP)	-7.85*	-21.53*	-9.47*	-5.31*	-8.60*	-4.52*	-9.69*	-8.50*	-5.59*	-4.78*	-6.12*	-7.06*	<b>-6.34*</b>

Note:  $\tau_T$  represents the model with a drift and trend;  $\tau_\mu$  is the model with a drift and without trend;  $\tau$  is the model without a drift and trend. Lag lengths are chosen by Schwarz Information Criterion (SIC) but are not displayed here to save space. \*, \*\* and \*\*\* denote rejection of the null hypothesis at 1%, 5% and 10% levels respectively.

As the second step, the bounds test within the ARDL modelling approach is applied to investigate if RES is in a long run equilibrium relationship with the explanatory variables. Table 2 depicts the critical values for F and t statistics that are taken from Pesaran et al. (2001). The calculated F-statistics value is compared with two sets of critical values estimated by Pesaran et al. (2001), one assuming that all variables are I(0) and the other assuming that they are all I(1).

**Table 2.** Critical Values for ARDL Modeling Approach

k = 2	0.10		0.05		0.01	
	I (0)	I (1)	I (0)	I (1)	I (0)	I (1)
<b>F<sub>IV</sub></b>	3.38	4.02	3.88	4.61	4.99	<b>5.85</b>
<b>F<sub>V</sub></b>	4.19	5.06	4.87	5.85	6.34	<b>7.52</b>
<b>F<sub>III</sub></b>	3.17	4.14	3.79	4.85	5.15	<b>6.36</b>
<b>t<sub>V</sub></b>	-3.13	-3.63	-3.41	-3.95	-3.96	<b>-4.53</b>
<b>t<sub>III</sub></b>	-2.57	-3.21	-2.86	-3.53	-3.43	<b>-4.10</b>

**Source:** Pesaran et al. (2001) for F statistics and t ratios

**Notes:** k is the number of regressors for dependent variable in ARDL models. t<sub>V</sub> and t<sub>III</sub> are the t ratios for testing  $\sigma_{1Y} = 0$  in Equation 2 and  $\varpi_{1Y} = 0$  in Equation 3 respectively with and without deterministic linear trend.

Table 3 demonstrates the results of the bounds test for cointegration for each pair of dependent variable and its regressor for three different scenarios of Pesaran et al. (2001). F<sub>III</sub> is the first scenario without deterministic trends and unrestricted intercepts. F<sub>IV</sub> is with restricted deterministic trends and unrestricted intercepts. Finally, F<sub>V</sub> is the scenario with unrestricted deterministic trends and unrestricted intercepts.

**Table 3.** The Bounds Test for Co-integration

Variables	With Deterministic Trends			Without Deterministic Trend			Conclusion H <sub>0</sub>
	F <sub>IV</sub>	F <sub>V</sub>	t <sub>V</sub>	F <sub>III</sub>	t <sub>III</sub>		
<b>(1)</b>							
<b>F<sub>RES</sub> (RES/TO)</b>	11.93c	16.45c	-5.61c	3.85b	-2.68b		<b>Rejected</b>
<b>F<sub>TO</sub> (TO/RES)</b>	2.42a	3.27a	-1.74a	3.67b	-2.65b		<b>Accepted</b>
<b>(2)</b>							
<b>F<sub>RES</sub> (RES/FDP)</b>	10.08c	14.61c	-4.87c	2.19a	-2.09a		<b>Rejected</b>
<b>F<sub>FDP</sub> (FDP/RES)</b>	4.81c	6.28c	-3.40b	6.14c	-3.13b		<b>Rejected</b>
<b>(3)</b>							
<b>F<sub>RES</sub> (RES/PUBD)</b>	8.14c	1.96c	-4.89c	0.96a	-1.36a		<b>Rejected</b>
<b>F<sub>PUBD</sub> (PUBD/RES)</b>	1.12a	0.96a	-0.15a	0.68a	-0.97a		<b>Accepted</b>
<b>(4)</b>							
<b>F<sub>RES</sub> (RES/IR)</b>	10.29c	14.20c	-5.19c	1.99a	-1.47a		<b>Rejected</b>
<b>F<sub>IR</sub> (IR/RES)</b>	3.30a	2.77a	-0.81a	3.94b	-0.84a		<b>Accepted</b>
<b>(5)</b>							
<b>F<sub>RES</sub> (RES/EXPV)</b>	10.59c	14.74c	-5.43c	9.59c	-4.18c		<b>Rejected</b>
<b>F<sub>EXPV</sub> (EXPV/RES)</b>	2.55a	3.61a	-2.69a	3.44b	-2.56a		<b>Accepted</b>
<b>(6)</b>							
<b>F<sub>RES</sub> (RES/STD)</b>	9.86c	14.38c	-5.02c	5.80c	-2.81b		<b>Rejected</b>
<b>F<sub>STD</sub> (STD/RES)</b>	3.18a	4.68b	-2.73a	4.64c	-3.04b		<b>Rejected</b>
<b>(7)</b>							
<b>F<sub>RES</sub> (RES/FL)</b>	11.82c	15.48c	-5.38c	3.30b	-1.77a		<b>Rejected</b>
<b>F<sub>FL</sub> (FL/RES)</b>	3.59b	3.99a	-2.48a	4.71c	-2.86b		<b>Rejected</b>

Note: Akaike Information Criterion (AIC) and SIC are used to select the number of lags required in the co-integration test. <sup>a</sup> indicates that the statistic lies below the lower bound, <sup>b</sup> that it falls within the lower and upper bounds, and <sup>c</sup> that it lies above the upper bound.

Results in Table 3 depict that the application of the bounds F-test using ARDL modeling approach suggests the existence of long-run equilibrium relationships as F-ratios are statistically significant (according to FIII, FIV and/or FV scenarios). All the calculated F-statistics exceeds the upper critical value and the null hypotheses of  $H_0: \sigma_{1Y} = \sigma_{2Y} = 0$  and of  $H_0: \omega_{1Y} = \omega_{2Y} = 0$  are rejected at 0.10, 0.05 or 0.01 levels except for the cases when TO, PUBD IR and EXPV are the dependent variables. Yet, there is a long-run equilibrium relationship between each pair of dependent variable and its regressor. On the other hand, there is a natural long run equilibrium relationship between RES and FXV, FXA, FO, CAV, DFDP as both of the variables are integrated of order I (0). This is the reason why table 3 does not search for the existence of long-run equilibrium relationship for those pairs. The result from the application of the bounds t-test of each ARDL model also shows that trend restrictions may be imposed in (RES/TO), (RES/FDP), (RES/PUBD), (RES/IR), (RES/EXPV), (RES/FL) and (RES/STD) relationships according to the significance of the t-statistics. The results of the bounds test for cointegration under the ARDL approach reveal that reserves are in a long-run equilibrium relationship with CAV, EXPV, IR, FO, FDP, TO, FXA, PUBD, FXV, DFDP, FL, STD; that is to say with all the variables under scrutiny for Turkey.

As the last step, the Granger causality tests are run to search for the direction of causality between the variables. Granger causality tests are carried under the VAR framework for the naturally cointegrated pairs of RES and FXV, FXA, FO, DFDP, CAV, whereas under the VECM for the pairs of RES and TO, FDP, PUBD, IR, EXPV, STD and FL. The Granger causality tests are carried for up to 3 lags in line with Pindyck and Rubinfeld (1991) who suggest that it is best to run the test for a few different lags to assure that the results are not sensitive to the lag length choice. Results of the Granger causality tests under the VAR framework and VECM in Table 4 suggest unidirectional causality running from FO, STD and DFDP to RES and bidirectional causality between RES and FXV. Besides, the Granger causality tests also suggest unidirectional causality running from RES to FDP.

The findings of the empirical investigation suggest that the Greenspan-Guidotti rule of thumb for short-term debt explicates also the Turkish case as short-term debt Granger causes an increase in reserves. On the other hand, the traditional 'Precautionary' model does not explain the motives of reserve accumulation as current account volatility, opportunity cost and financial depth do not Granger cause reserve piling in Turkey. The empirical analysis also demonstrate that the traditional 'Mercantilist' model seem to run short to explain the Turkish case as exchange rate appreciation, export volatility and trade openness do not Granger cause reserve hoarding in Turkey. The same holds true for the 'Insurance' model of Jeanne and Ranciere (2008) as there exist no Granger causality between reserves and public debt, real appreciation of the currency and trade openness. The 'Undeveloped Financial Markets' model of Dominguez, (2010) also fails to fit to the Turkish case as financial depth and foreign liabilities do not Granger-cause an increase in reserves; whereas domestic financial development Granger causes a change in reserves, but not a negative one. Yet, Financial-Stability Model seems to explain better the motives behind reserve hoarding in Turkey as it explains the demand for reserve stocks with exchange rate volatility, financial openness and financial depth and the empirical tests depict that exchange rate volatility, financial openness and domestic financial development Granger cause reserve accumulation in Turkey. On the other hand reserve stockpiling in Turkey is also found to Granger cause an increase in financial depth, in other words in M2/GDP and also in exchange rate volatility.



Table 4. Granger Causality Tests under VECM and VAR

Lag Level	1		2		3		RESULT
Null Hypothesis	F – Stat	t <sub>ECTt-1</sub>	F – Stat	t <sub>ECTt-1</sub>	F – Stat	t <sub>ECTt-1</sub>	
(1)							
RES does not Granger cause TO	0.23	1.78***	1.98	1.17	1.19	1.01	
TO does not Granger cause RES	0.34	-3.31*	1.77	-3.95*	1.40	-2.87*	
(2)							
RES does not Granger cause FDP	5.17**	3.13*	3.03***	2.63**	2.13	1.86***	<b>R →FDP</b>
FDP does not Granger cause RES	0.29	-3.99*	0.56	-4.14*	0.39	-3.05*	
(3)							
RES does not Granger cause FO	0.82	-	0.03	-	0.84	-	
FO does not Granger cause RES	9.67*	-	8.50*	-	5.72*	-	<b>FO→R</b>
(4)							
RES does not Granger cause CAV	2.56	-	2.33	-	1.68	-	
CAV does not Granger cause RES	0.30	-	0.86	-	2.46***	-	
(5)							
RES does not Granger cause STD	0.34	3.09*	7.25*	1.67	2.03	2.47**	
STD does not Granger cause RES	5.71**	-4.24*	6.75*	-3.74*	4.46**	-2.30**	<b>STD→R</b>
(6)							
RES does not Granger cause FXV	5.30**	-	3.13***	-	2.44***	-	
FXV does not Granger cause RES	6.47**	-	2.72***	-	1.85	-	<b>FXV↔R</b>
(7)							
RES does not Granger cause FXA	0.10	-	0.88	-	1.21	-	
FXA does not Granger cause RES	0.82	-	0.74	-	0.83	-	
(8)							
RES does not Granger cause DFDP	2.00	-2.86*	1.26	-	0.70	-1.89***	<b>DFDP→R</b>
DFDP does not Granger cause RES	5.59**	-1.73***	4.46**	2.68**	2.56***	-2.25**	
(9)							
RES does not Granger cause IR	1.53	-0.31	3.98**	-0.19	2.59***	-0.00	
IR does not Granger cause RES	0.14	-3.77*	0.65	-4.05*	0.97	-2.86*	
(10)							
RES does not Granger cause FL	3.38***	-0.61	0.31	1.30	0.84	1.22	
FL does not Granger cause RES	0.70	1.94***	1.42	-0.24	1.15	0.18	
(11)							
RES does not Granger cause EXPV	0.33	1.80***	2.57***	1.19	2.14	2.23	
EXPV does not Granger cause RES	0.07	-3.54*	0.27	-3.62*	0.36	-2.24**	
(12)							
RES does not Granger cause PUBD	2.13	-1.29	2.98***	0.07	2.32	-0.84	
PUBD does not Granger cause RES	0.02	-3.64*	0.19	-3.81*	0.61	-2.87*	

Note: \*, \*\* and \*\*\* denote significance respectively at 1%, 5% and 10% levels. R refers to Reserves.

### 5. Concluding Remarks and Policy Implications

The international foreign exchange reserves of the EMEs have extensively and in an accelerated manner increased mainly since the Asian crises of 1997-98. Turkey is one of these EMEs with excess reserves, although the level of reserve hoarding in Turkey is much less significant compared to the

Asian countries and particularly to that of China. Despite the existence of several models put forward, there is no theoretical consensus concerning the motives behind this decoupling of EMEs from the advanced in terms of reserve stockpiling. Reserves are important for countries to fight against financial crises yet it should not lead to excessive reserve hoarding. The empirical investigation for the Turkish case in this study finds that reserves are in a long term equilibrium relationship with current account volatility, export volatility, opportunity cost of reserves, financial openness, financial depth, trade openness, exchange rate appreciation, public debt, exchange rate volatility, domestic financial development, foreign liabilities and short-term debt, which are the variables employed by the various reserve hoarding models in the literature. On the other hand, the empirical analysis suggests that financial openness, exchange rate volatility and domestic financial development as well as short term debt stimulates reserve hoarding in Turkey. This means that short term debt, FDI and portfolio flows, foreign capital inflows particularly to the stock exchange market and the fear of floating stimulates reserve stockpiling in Turkey. Consequently, the 'Financial-Stability Model' which is an extension of the Precautionary Models and the Greenspan-Guidotti rule of short-term debt seem to explain the motives behind reserve hoarding in Turkey. The findings also confirm that reserve stockpiling stimulates an increase in financial depth in terms of M2 to GDP, which may be attributed more to incomplete sterilization than financial deepening since this casual relationship is not supported by the two other financial development variables. Besides, reserves are also found to impact the foreign exchange rate volatility.

The policy implications of the paper for the excessive reserve stockpiling of Turkey are threefold. First, the low inflation since 2001 which limited the countries' cost of reserves seems will not persist for some time after the global crisis. Hence, reserve hoarding seems to become a rather costly endeavor. Second, the Central Bank of Turkey should attack short term foreign capital inflows more directly with the policies it employs like increasing the reserve requirements of banks and should leave the currency to float more freely than it does today. Besides, the Undersecretary of Turkish Treasury should refrain from borrowing at short term maturities. In addition, the Banking Regulatory and Supervisory Agency (BRSA) of Turkey should design the prudential supervision to discourage the banking system to borrow short term, despite the fact that the Basel framework offers privileges of less capital requirement to short term debt. Third, the Emerging EU who witnessed the merits of reserves in fighting against the global crisis may also start reserve stockpiling. This may introduce more of 'competitive hoarding' to the system, including Turkey. The global imbalances of the previous years, which also created the necessary conditions for the global crisis, may deteriorate even further in the near future. Hence, solutions should be sought more on the regional and international level which encompasses coordination between world economies. Turkey may take part in these international frameworks. Yet, since the primary reason of the Financial-Stability Model for reserve accumulation is to protect the domestic banking sector during periods of capital flight and since the Turkish banking system is more solid with the post-2001 structural reforms, the excessive reserve hoarding of Turkey seems will run short of being justifiable after the markets calm down also in the EU.

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## LINGUISTIC GLOBALIZATION CONSEQUENCE OF ECONOMIC GLOBALIZATION

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### Abstract

*Economic globalization has been a much debated phenomenon with consequences at all levels - social, economic, technical, scientific, cultural, every day life, in a word.*

*Linguistic globalization, obvious more and more all over the world, manifested itself by Anglicization or Americanization of most current languages which, at least in what concerns their basic stock of words, allowed English and American loans to enter their vocabulary.*

*The paper tackles the problem of linguistic globalization in Romanian and the reactions of the Romanian linguists and men of letters towards this phenomenon.*

**Key words:** globalization, linguistic globalization, Anglicism, Americanism, English, loans

Globalization - outcome of the spread of capitalism after the Soviet Union's dismemberment and the end of the cold war - that entailed political, economic, cultural, environmental consequences, generated numerous debates. The fact is supported by the very many definitions of the complex term and international phenomenon.

In the field of language study, the phenomenon of globalization points to the link existing between the dynamics of society and the need for communication in the framework of economic, political, cultural international contacts.

The use of English has lately spread so much around the world that it undeniably has become the tool for global communication. The phrase 'global English' is being used increasingly nowadays. English is a global, international language because the language of global politics, economy, academic life is English. The unparalleled achievements that science - computer science in particular, technique, economy knew in the last decades occurred in English speaking countries and they represented the reasons that imposed the use of English in every part of the world.

*Linguistic globalization*, part and consequence of globalization, regards the changes that national languages underwent in the course of time, particularly the latest decades, due to the deliberate acceptance of a common means of communication - English (Călărășu, 2003, 323). At the level of national languages linguistic globalization refers to the excessive use of English and American loans which was conditioned by the contemporary social, economic, political reality.

As it was pointed out (Graddol 2000, 8) English has become the lingua franca in twelve major domains: international organizations and conferences; scientific publications; international banking, economic affairs and trade; advertising for global brands; audio-visual cultural products (film, TV, popular music); tourism; tertiary education; international safety; international law; technology transfer; internet communication; relay language in interpretation and translation.

The *linguistic imperialism* of English was accepted worldwide even by the economic authorities of the world - except for some countries among which China, France and the Canadian province of Quebec that adopted laws to restrict the use of English - who overcame the national and cultural pride and obsolete competitive mentalities about linguistic supremacy (Călărășu, 2003, 324).

Political and economic changes caused by the collapse of communism in Romania, lead to the adjustment of the educational system to the new economic realities, among which the occurrence of foreign investors, who mainly recruited staff with English communication skills, counted most. English, perceived as a means to accelerate the timing and participation in the global economy (Călărășu, 2003, 324), became the first option, at least in urban areas, of the students from primary to high school and even Universities. If before 1989 English was scarcely studied in school, it was now given priority in Romania's foreign-language teaching. English came to replace to a great extent French and Russian which, during communism, had priority. Curricula have changed according to

needs because 'just as English was the language behind the Industrial Revolution, it is also the language behind advances in the press, advertising, broadcasting, movies, sound recording, transport, communication and information technology, including the internet (Crystal, 1997, 110–1).'

After 1989, Romanian, as a living language, started to adapt itself to meet all changes occurring in the life and culture of its speakers, and the main weight of such changes fell on vocabulary (<http://www.britannica.com>) that accepted new words - predominantly English loans - belonging to various fields: economy, agriculture, administration, finance, trade, computer science and internet communication. Language became a reflection of the new political, social, cultural realities Romania was facing: the transition to a market economy, the transfer of government-owned or government-run companies to the private sector, the occurrence of foreign investors and multinational corporations, the unlimited access to computer technology which opened new frontiers to other civilisation.

Many of the Anglicisms and Americanisms have no equivalent in Romanian, but there were cases where the loans were doublets of the native terms or phrases. There was noticed a minimum tendency to adjust these words to the national language system, probably under the influence of globalization which, from a linguistic point of view, means the creation of an international vocabulary and the imposition of some unique rules.

Under the new economic system where companies and enterprises synchronized their organizational structure with the ones in the West, linguistic globalization was obvious in the field of economy where some new job designations were and still are English: *auditor, babysitter, bodyguard, body-guard, broker, chief copywriter, executive coach, hair-stylist, head hunter, hostess, (senior) manager, market developer, program officer, sales manager, sales person, salesman, staff.*

Similar to other countries, France being the most vehement, linguistic globalization, generated in Romania too, an attitude of protest and lamentation (Avram, 1997, 7) in what concerns the borrowing of Anglicisms and Americanisms perceived, sometimes, as an invasive phenomenon that could endanger the language's national character, its very existence.

Though, as early as the second half of the XVIII<sup>th</sup> century (Pușcariu 1940; Iordan 1943) English loans entered Romanian vocabulary in most cases indirectly via French, German and Italian. Their number - in fields such as finance, sports, film and fashionable life - increased during the XIX<sup>th</sup> and even during the XX<sup>th</sup> centuries despite the restrictive measures of the communist regime (Marcu, Maneca 1978; Dimitrescu 1982; Graur 1987) and continues to grow nowadays with remarkable effects particularly in the field of scientific terminology.

Romanian linguistics, through specialized dictionaries (DEX 1998; DOOM 2005; Marcu, Maneca 1978; Dimitrescu 1982), recorded two categories of Anglicisms and Americanisms:

First there are the terms that came into use long ago, were adjusted according to the spelling and pronunciation rules of Romanian, being 'naturalized' and receiving 'Romanian citizenship' (Pruteanu 2006): *audit, auditor, blender (read as such), blugi, chicinetă, cliring, clovn, cocteil, computer, fotbal, hypermarket, interviu, lider, meci, miting, pulover (with the variant pulovăr), penalti, scaner, schi, sendviș, stres, tenis, volei.*

Secondly, there are the xenisms that continue to be used without any phonetic or graphic changes: *advertising, aftershave, airbag, all right, babysitter, background, bacon, banking, banner, bestseller, blues, body building, body, bodyguard, box-office, broker, blues, bluejeans (but also blugi) (DOOM 2005; 92), by-pass, cash, catering, chat, cheeseburger, chips, cool, country, copywriter, consulting, curry, cutter, dealer, desktop, discount, dividend, dumping, duty-free, e-mail, exit-poll, fast-food, fairplay, fashion, feedback, fitness, full-time, hamburger, hard-disk, hacker, horror, hotdog, hotline, ice tea, job, jogging, ketchup, know-how, laptop, link, leasing, live, look, mall, make-up, marker, modelling, mouse, management, manager, marketing, mini-market, mouse, part-time, pager, play-back, pole-position, prime-time, (car)rent, roaming, science-fiction, service, second-hand, show, showbiz, showroom, shopping, site, soft, skate, skating, skateboard, skinhead, slash, single, snack-bar, snow-board, staff, summit, supermarket, sticks, talk-show, training, T-shirt, walkman, web, weekend.*

Considering the great number of Anglicisms and Americanisms in Romanian, some of which needed, but also the alarming, eternal willingness to copy, imitate and adapt everything in a hurry, on the fly (Pecican 2007) one can easily understand the linguists' reactions.

On one hand there was the response determined by the tendency, noticeable mainly in the media but also with ordinary people, to use these words as they are, without any spelling or pronunciation change or adjustment according to the Romanian language rules, without any *imposition of the*

*Romanian language norms.* As long as these words were enlisted as such in the latest editions of the dictionaries, it seems that the very concern of those in charge was scarce, in this respect. As useful tools in the process of language standardization, dictionaries, by the norms they enforce, should help to minimize, if possible, a phenomenon already quite naturalized among Romanian speakers, that of borrowing and using Anglicisms and Americanisms without the slightest attempt to adjust them to the Romanian phonetic orthographic, morphological system. Spelling inconsistencies - *bodyguard*, *bodigard*, *biznes*, *bisnes* or, even worse, *busines* for *business* - or pronunciation mistakes - as stands the case with *management* and *rugby* uttered [ma'nadʒement] ['manedʒement] or ['meniʒmɛnt], [ruibi] or [regbi] - could be avoided.

It has also been brought into question the paradoxical risk of language impoverishment, because of the indiscriminate use of the more or less adapted Anglicisms and Americanisms, (*target*, *cool*, *advertising*, *OK*), the explanation being simple: one English word swallows, makes a nuanced range of Romanian words vanish. (Pârvulescu, 2007)

On the other hand there was the reaction against those Anglicisms and Americanisms used to convey notions for which Romanian has, in most cases, its own vocabulary;

As the Romanian linguists understood the importance and necessity of loans, there were not, of course, under discussion those words (*broker*, *futures*, *hard*, *joint-venture*, *leasing*, *management*, *marketing*, *soft*, *sponsor*), that the language lacked to render the new reality or to facilitate communication by their concision or international character as stands the case with *community acquis* (*acquis comunitar*) (Pruteanu 2006). Linguists turned against the gross evidence of sluggishness. Why should we say *site* (pronounced 'sait '), when the Latin term has been in use for long in Archaeology (Rom. *sit* (pronounced 'sit ') < 'situs')? (Pecican 2007)

It was a campaign against the so-called *luxury anglicisms* (Stoichițoiu, 2008, 115; Pruteanu 2006) or *cultivated loans* (*cultisme* in Romanian) (Guțu-Romalo, 1972, 161) that duplicate Romanian equivalents and bring no additional cognitive information: *advertising*, *agreement*, *band*, *board*, *brand*, *business*, *businessman*, *businesswoman*, *cake*, *chairman*, *cool*, *dealer*, *drink*, *fashion*, *food*, *goal-keeper*, *happy-end*, *horror*, *happy end*, *job*, *jogging*, *live*, *living-room*, *look*, *make-up*, *old fashion*, *part-time/full-time job*, *party*, *sales*, *sales manager*, *sales person*, *salesman*, *second hand*, *shopping* (*centre*), *showroom*, *staff*, *summit*, *talk-show*, *toast*, *trend*, *week-end*.

What was considered as damaging was that many of those who introduced these words in use and continued to disseminate them could hardly speak English correctly (Slama-Cazacu, 2005, 502), had only a smattering of English, displayed false intellectual pretence, linguistic snobbishness, wanted to seem informed and aware of what is fancy in the West (Paler 1997).

Attention was drawn especially on the latest Anglicisms, some of which very annoying, that propagate with astonishing rapidity, are used instead of words that are in use for a longer time, without bringing no further information or shade of meaning as stands the case with the Romanian *a (se) focusa* - (from the English *to focus* + the suffix *-a*) used instead of *a focaliza*, *determinat* (after the English *determined*) that replaced the Romanian *hotărât*, with *dedicat* (after *dedicated*), *locație* (after *location*) (Pârvulescu 2003) often used in contexts completely inappropriate. (Zafiu, 2007 a, b)

Other specialists (Avram 1997, 10; Stoichițoiu-Ichim, 2008, 110) assert that, paradoxically, the danger of the current linguistic globalization lies in the very fact that it happens through the instrumentality of cultivated people, who use English due to a good, solid knowledge of the language, and who, under the umbrella of dictionaries that maintain the loans' foreign appearance, operate as factors that *prevent* or even *delay* the naturalization of Anglicisms and Americanisms.

In 2004 the Romanian Parliament passed a Bill (No.500/November 11, 2004, Published in Official Gazette, Part I no. 1067 of November 17, 2004), initiated by the late Professor PhD. George Pruteanu, on the use of Romanian in public relationships, places and institutions; it states that any text written or spoken in a foreign language, regardless of size, being of public interest must be accompanied by a translation or adaptation in Romanian.

The Bill caused long debates. It was supported by those who considered that people were suffocated through all channels of communication by a torrent of variegated, ugly language abounding in Anglicisms - very popular in circles with a veneer of education (Paler 1997), by those annoyed that shops bear English names, by those exasperated because *bacon* was not *slănină* or *șuncă* any more or because of the massive proliferation of foreign terminology, sometimes to the detriment of the Romanian language (Grigorescu 2000; Stoichițoiu-Ichim 2001, 111, 117; Popescu 2006).

The Bill was challenged by those who found ridiculous or impossible to translate into Romanian, for example, the computer component called *mouse*, the English names of some discos or shops (Zarojanu 2002) or sports terms such as *set*, *game*, *deuce* (Manolescu 2002). The Bill also encountered 'violent rejection of specialists, half-learned, ignorant people who hardly speak foreign languages and hardly understand the foreign words which *bombard* them, of journalists, politicians, or *VIPs* who make and disseminate terrible mistakes... I add to this *snobbery*, *desire to shock* (the *I can speak English even if I do not know it* attitude), reckless *imitations* of some persons *promoted* by the mass-media'. (Slama-Cazacu, 2005, 502)

It seems that whether willingly accepted or not, linguistic globalization cannot be avoided, it advances with quick steps, since the vocabulary continues to be filled with Anglicisms or Americanisms these dictionaries no longer keep pace with to enlist. Newspapers, magazines, advertisements are imbued with new (or) untranslatable words: *blog*, *browser*, *facebook*, *folder*, *hands-free*, *iPad*, *iPhone*, *iPod*, *mix* (*company's entire marketing mix*), *touch screen*, *windows*, *wireless*.

### Conclusions

Speaking about the communication trends worldwide, strongly marked by linguistic globalization imposed by the use of English at international level, the influx of new words in Romanian is welcome - as long as these loans designate new notions and realities and are used in moderation. As a matter of fact the English influence cannot be more harmful to language than any other influences Romanian knew in the course of time. (Avram 1997, 7)

What matters is that speakers should not let themselves be carried away by the new spirit of the time, should not spoil their native language by indulging themselves in the linguistic pleasures that lead to monstrous offspring. (Pecican 2007)

Abusive use of Anglicisms and Americanisms is considered a sign of lack of education.

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# FINANCIAL MARKET SIMULATION BASED ON INTELLIGENT AGENTS – CASE STUDY

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## Abstract:

*We implement an agent-based financial market model simulation in which agents follow technical and fundamental trading rules to determine their speculative investment positions. We consider direct interactions between speculators due to which they may decide to change their trading behaviour. For instance, if a technical trader meets a fundamental trader and they realize that fundamental trading has been more profitable than technical trading in the recent past, the probability that the technical trader switches to fundamental trading rules is relatively high. In particular the influence of transaction costs is studied, which can be increased by the off-market regulation (for example in the form of taxes) on market stability, the overall volume of trade and other market characteristics.*

**Keywords:** agent-based, financial market, netLogo, direct interactions, technical and fundamental analysis, simulation

**JEL Classification:** G12; G14; G15; C63; C88

## 1. Introduction

This paper describes a multi-agent model of the transaction costs influence on the financial market. The transaction costs on the financial market are mainly the costs of the obtaining and the interpreting of the information, the time required for decision making, various types of fees, etc. Transaction costs according to (Burian 2010) are often viewed as negative phenomena, but there are cases where the increase in the transaction costs can be viewed positively and can contribute to the stability of the market. The increase in the transaction costs may also occur in the form of non-market regulation such as the taxes. In the early seventies the Nobel laureate in the economics James Tobin drafted the regulation of currency markets. Tobin suggested that all short-term transactions should be taxed at a low fixed rate (the proposal was later identified as the so-called Tobin tax). The results according to Tobin would avoid short-term currency speculation and stabilize the market. Currency speculation can lead to the sudden withdrawal of the currency from the circulation in order to artificially increase the price. The consequence for the economy of the countries that use this currency may be a temporary reduction in liquidity, problems in obtaining loans and other phenomena that can lead to the reduced growth or even to the recession.

Tobin tax was never implemented. Against introducing a Tobin tax, however there are number of arguments. First, it would be very difficult to implement, since it would have to be introduced in sync throughout the world, because otherwise the market would be relocated to the tax-free exchange. Another argument is to reduce the volume. Finally, some authors argue that financial speculators, whose activity would be substantially reduced, are doing useful work, for example, they seek new possibilities to invest in emerging markets. There are also opinions that stability problems can be solved by improving the macroeconomic policies of central banks.

The model described here, however, need not be interpreted as a model for the introduction of taxes, but in general, as a model of the transaction costs influence on the market. The aim of the model described in this article is to explore the dependence market stability to the extent of transaction costs.

This paper is structured as follows. Section 2 briefly informs about the behaviour on real financial markets and introduces the agent-based methods for modelling and simulation. In section 3 the original agent-based model of financial market is presented. In section 4 we enhance the original model with transaction costs. Section 5 presents the original simulation results of the agent-based model of financial market.

## **2. The Use of Agent-based Methods for Modelling and Simulation the Behaviour of Real Financial Markets**

The behaviour of real financial markets shows some significant deviations from the efficient-market hypothesis, which argues that the market price reflects all information on the fair value of traded assets and should not deviate from it. In fact, the market price often differs from the fair value of assets, which is reflected especially in the so-called market bubbles (Ilie 2011). Market bubble is an artificial overvaluation of assets due to excessive demand, or on the other hand it is the market collapse due to the oversupply of the assets. Efficient-market hypothesis is according to (Schleifer 2000) based on three basic assumptions: the investors are able to rate the assets with unlimited rationality. If some investors are not rational, their purchases are random and therefore they cancel each other out, and finally the influence of irrational investors on the price of the assets is eliminated by rational agents. (Burian 2010).

The model described in this article is based on the agent-based model of financial market (Westerhoff, 2009), which, like many similar models (Brock and Hommes 1997, 1998; Gonçalves 2003; Kirman 1991, 1993; Lux 1998; Lux and Marchesi 1999) describes some typical characteristics of the real market. An agent-based model is a computerized simulation of a number of decision-makers (agents) and institutions, which interact through prescribed rules (Vymetal and Sperka, (2011). The agents can be as diverse as needed - from consumers to policy-makers and Wall Street professionals - and the institutional structure can include everything from banks to the government. Such models do not rely on the assumption that the economy will move towards a predetermined equilibrium state, as other models do. Instead, at any given time, each agent acts according to its current situation, the state of the world around it and the rules governing its behaviour. An individual consumer, for example, might decide whether to save or spend based on the rate of inflation, his or her current optimism about the future, and behavioural rules deduced from psychology experiments. The computer keeps track of the many agent interactions, to see what happens over time. Agent-based simulations can handle a far wider range of nonlinear behaviour than conventional equilibrium models. Policy-makers can thus simulate an artificial economy under different policy scenarios and quantitatively explore their consequences.

The cure for macroeconomic theory, however, may have been worse than the disease. During the last quarter of the twentieth century, 'rational expectations' emerged as the dominant paradigm in economics. This approach assumes that humans have perfect access to information and adapt instantly and rationally to new situations, maximizing their long-run personal advantage. Of course real people often act on the basis of overconfidence, fear and peer pressure - topics that behavioural economics is now addressing. (Farmer and Foley 2009)

But there is a still larger problem. Even if rational expectations are a reasonable model of human behaviour, the mathematical machinery is cumbersome and requires drastic simplifications to get tractable results. The equilibrium models that were developed, such as those used by the US Federal Reserve, by necessity stripped away most of the structure of a real economy. There are no banks or derivatives, much less sub-prime mortgages or credit default swaps - these introduce too much nonlinearity and complexity for equilibrium methods to handle. Agent-based models could help to evaluate policies designed to foster economic recovery.

We may use agent-based methods in the case of the financial market, which is a relatively balanced market (supply roughly coincides with the demand) with bubbles and busts. Furthermore, in contrast to the efficient-market hypothesis assumptions is more realistic to assume that (Burian 2010):

- Agents are limited only rational. They do not have all information or they are not able to interpret it correctly.
- Agents are heterogeneous. They react with varying sensitivity to the reports of the market developments and affect them differently strong random factors that influence their decisions.
- Agents make decisions influenced by the opinions of their close colleagues.

The model, which we describe in this paper, is based on these assumptions.

### 3. Original Model

The model developed by Frank Westerhoff (Westerhoff 2009) was chosen for the implementation. It is an agent-based model, which simulates the financial market. Two base types of traders are represented by agents:

- **fundamental traders**, whose reactions are based on fundamental analysis – they believe that asset prices in long term approximate their fundamental price – they buy assets when the price is under fundamental value

- **technical traders**, who decide using technical analysis – prices tend to move in trends – by their extrapolating there comes the positive feedback, which can cause the instability

Price changes are reflecting current demand excess. This excess is expressing the orders amount submitted by technical and fundamental traders each turn and the rate between their orders evolves in a time. Agents regularly meet and they are discussing their trading performance. One agent can be persuaded by the other to change his trading method, if his rules relative success is less than the others one. Communication is direct talk one agent with other. Talking agents meets randomly – there is no special relationship between them. The success of rules is represented by current and passed myopic profitability. It is very important to mention, that model assumes traders ability to define the fundamental value of assets and they are behave rationally.

The price is reflecting the relation between assets that have been bought and sold in a turn and the price change caused by these orders. This can be formalized as a simple log-linear price impact function.

$$P_{t+1} = P_t + \alpha(W_t^C D_t^C + W_t^F D_t^F) + \alpha_t \quad (1)$$

Where  $\alpha$  is positive price adjustment coefficient,  $D^C$  are orders generated by technical agents while  $D^F$  are orders of fundamental ones.  $W^C$  and  $W^F$  are weights of the agents using technical respective fundamental rules. They are reflecting current ratio between the technical and fundamental agents.  $\alpha$  brings the random term to the **Error! Reference source not found.** It is an IID<sup>3</sup> normal random variable with mean zero and constant standard deviation  $\sigma^\alpha$ .

As was already said, technical analysis extrapolates price trends – when they go up (price is growing) agents buy the assets. So the formalization for technical order rules can be like this

$$D_t^C = b(P_t - P_{t-1}) + \beta_t \quad (2)$$

The parameter  $b$  is positive and presents agent sensitivity to price changes. The difference in brackets reflects the trend and  $\beta$  is the random term – IID normal random variable with mean zero and constant standard deviation  $\sigma^\beta$ .

Fundamental analysis permits the difference between price and fundamental value for short time only. In long run there is an approximation of them. So if the price is below the fundamental value – the assets are bought and vice versa – orders according fundamentalists are formalized

$$D_t^F = c(F - P_t) + \gamma_t \quad (3)$$

$c$  is positive and presents agent sensitivity to reaction.  $F$  represents fundamental value – we keep as constant value to keep the implementation as simple as possible<sup>4</sup>.  $\gamma$  is the random term – IID normal random variable with mean zero and constant standard deviation  $\sigma^\gamma$ .

If we say that  $N$  is the total number of agents and  $K$  is the number of technical traders, then we define the weight of technical traders (4)

$$W_t^C = K_t/N \quad (4)$$

and the weight of fundamental traders

<sup>3</sup> independent and identically distributed

<sup>4</sup> in our implementation  $F = 0$

$$W_t^F = (N - K_t)/N \quad (5)$$

Two traders meet at each step and they are discussing about the success of their rules. If the second agent rules are more successful, the first one changes its behavior with a probability  $K$ . Probability of transition is defined as  $(1 - \delta)$ . Also there is a small probability  $\varepsilon$  that agent changes his mind independently. Transition probability is formalized as

$$K_t \begin{cases} K_{t-1} + 1 \text{ with probability } p_{t-1}^+ = \frac{N - K_{t-1}}{N} \left( \varepsilon + (1 - \delta)_{t-1}^{F \rightarrow C} \frac{K_{t-1}}{N - 1} \right) \\ K_{t-1} - 1 \text{ with probability } p_{t-1}^- = \frac{K_{t-1}}{N} \left( \varepsilon + (1 - \delta)_{t-1}^{C \rightarrow F} \frac{N - K_{t-1}}{N - 1} \right) \\ K_{t-1} \quad \text{with probability } 1 + p_{t-1}^+ - p_{t-1}^- \end{cases} \quad (6)$$

where the probability that fundamental agent becomes technical one is

$$(1 - \delta)_{t-1}^{F \rightarrow C} = \begin{cases} 0.5 + \lambda \text{ for } A_t^C > A_t^F \\ 0.5 - \lambda \text{ otherwise} \end{cases} \quad (7)$$

respective that technical agent becomes fundamental one is

$$(1 - \delta)_{t-1}^{C \rightarrow F} = \begin{cases} 0.5 - \lambda \text{ for } A_t^C > A_t^F \\ 0.5 + \lambda \text{ otherwise} \end{cases} \quad (8)$$

Success (fitness of the rule) is represented by past myopic profitability of the rules that are formalized as

$$A_t^C = (\exp[P_t] - \exp[P_{t-1}])D_{t-2}^C + dA_{t-1}^C \quad (9)$$

for the technical rules and

$$A_t^F = (\exp[P_t] - \exp[P_{t-1}])D_{t-2}^F + dA_{t-1}^F \quad (10)$$

for the fundamental rules. Agents use most recent performance (at the end of  $A^C$  formula resp.  $A^F$ ) and also the orders submitted in period  $t - 2$  are executed at prices started in period  $t - 1$ . In this way the myopic profits are calculated. Agents have memory – which is represented by the parameter  $d$ . Values are  $0 \leq d \leq 1$ . If  $d = 0$  then agent has no memory, much higher value is, much higher influence the myopic profits have on the rule fitness.

Implementation was done in NetLogo which author is Uri Wilensky – vide (Wilensky 1999). NetLogo is the environment for modeling problems or systems which have natural or social character. Its development has started in 1999 and is still in progress in Center for Connected Learning and Computer-Based Modeling in Northwestern University in Chicago (USA).

The tool is programmable – it is a variant of Logo language, into which the agent support was added. Because of the language the work with it is intuitive and easy<sup>5</sup>. It is not necessary to have very deep programmer knowledge and skills to be able to make simulations and visualize them. In Figure 1 it is possible to see one simulation process with its results. In the left part there are parameters (for values see the section 5) in the middle we can see the evolution of the key values (log price, returns as their changes, weights of technical traders) and in the right there is graphically shown the rate between fundamental (black) and technical traders (yellow).

<sup>5</sup> Logo is one of languages, which are used for thinking education, is used for children's programming learning

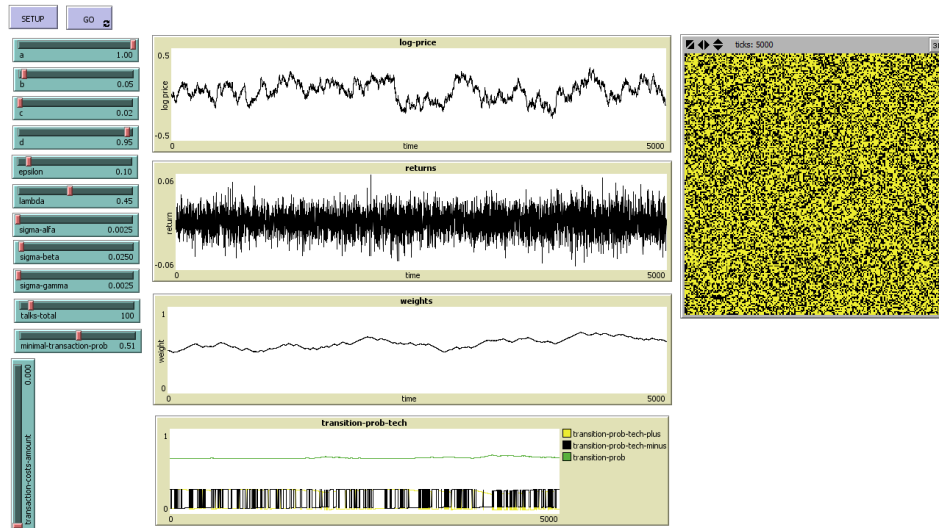


Figure 1. Results of the simulation process.

Source: own

#### 4. Enhancement of the Model with Transaction Costs

The aim of the model is to investigate the influence of the transaction costs on the market stability (which is measured by the price volatility – much more stable the market is, much less are price differences in a time). The entrance of transaction costs (TC) – e.g. a tax will have direct impact on the asset price. The model was little changed to adopt also this aspect into price. So the price is composed in this way:

$$P_{t+1} = P_t + \alpha(W_t^C D_t^C + W_t^F D_t^F) + \alpha_t + TC \quad (11)$$

Where TC is a value of the transaction costs, which is constant during all the simulation.

While the tax is out-of trade factor, all the agents will be affected in the same way. Generally there can be also different transaction costs than taxes – e.g. information obtaining costs.

The TC increase has following results:

- the price increase will stimulate technical rules usage, it's influence on the expected future profit opportunities (as the fundamental value of the asset) is irrelevant – they depend on the company state, rather than on transaction costs
- in a short time, the price growth will attract technical traders, but after the realized profits will fall down and the fundamental traders will start to dominate, it will lead to the market stabilization (price changes are falling – volatility of price is lower)

#### 5. Simulation Results

To be more accurate, 20 simulations were processed, averaged values are being plotted in the result graphs.

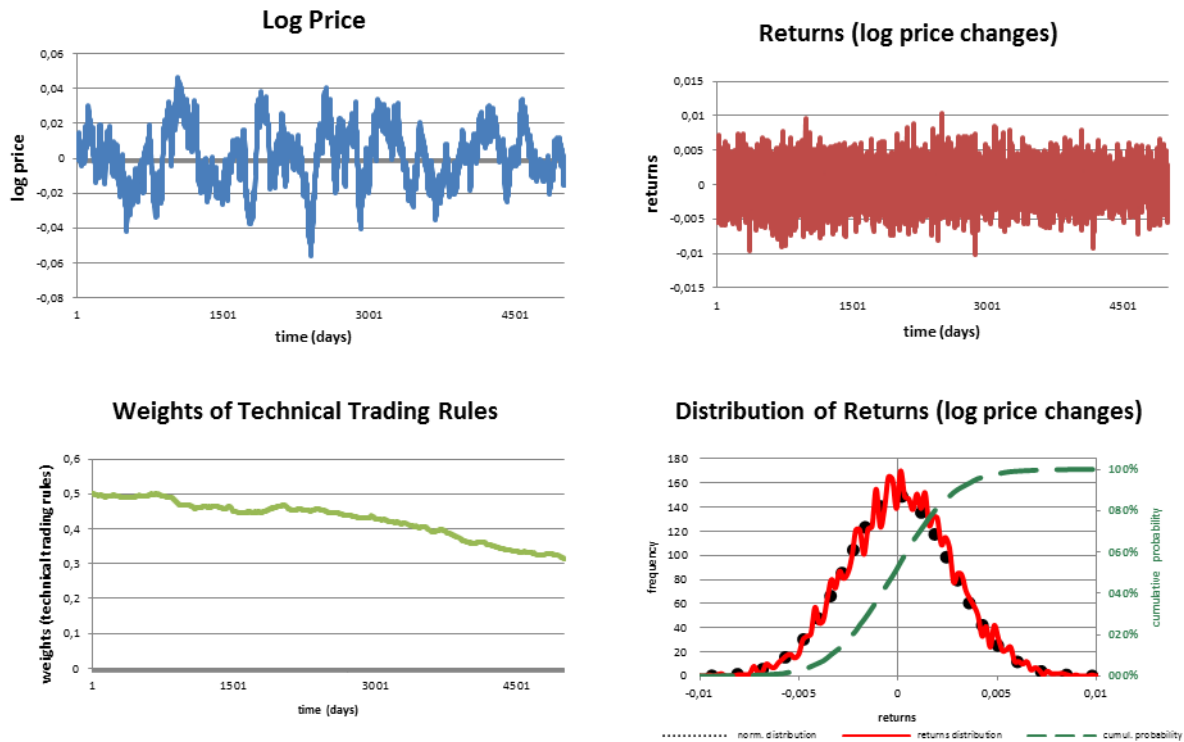
##### 5.1 Simulation in original model

Parameterization of the model was kept from original parameterization made by Westernhoff, only the number of agents (N) was set to 10,000 to obtain more relevant results. The parameters are:

$$a = 1, b = 0.05, c = 0.02, d = 0.95, \epsilon = 0.1, \lambda = 0.45, \sigma^\alpha = 0.0025, \sigma^\beta = 0.025, \text{ and } \sigma^\gamma = 0.0025 \quad (12)$$

With these parameters the model is calibrated to the daily data. Number of turns, resp. time steps is 5000 days, which presents more than 13 and half of year. (Westerhoff 2009) found that growing number of agents reduces the model dynamicity and the volatility of price, while agents

behavior is tending to be fundamental. This can be reduced by adding more communication turns. We have decided to give opportunity to talk to 1 %, which has positive influence on the model dynamicity.



**Figure 2.** Simulation results in original model.

Source: own

In Figure 2 on top left position the price values can be seen, top right graph represents changes of the price in a time. The bottom left graph shows the weights of technical trading rules (in a long time there is a tendency to prefer fundamental than technical trading rules). Bottom right graph includes the distribution of returns (which are log price changes) compared with the normal distribution.

### 5.2 Simulation with transaction costs

All the parameters stayed the same. Newly added TC is the constant value equal to 0.015. From the following graphs in Figure 3 is possible to see, that transaction costs have influence on the model – the price is growing in a short time, but in longer scope is falling. The technical weights evolution is similar – in a short time is growing, but after is starting to fall – as the agents prefer the fundamental strategy. With more fundamental traders the market stabilizes – which is readable from the returns (volatility of price changes is falling).

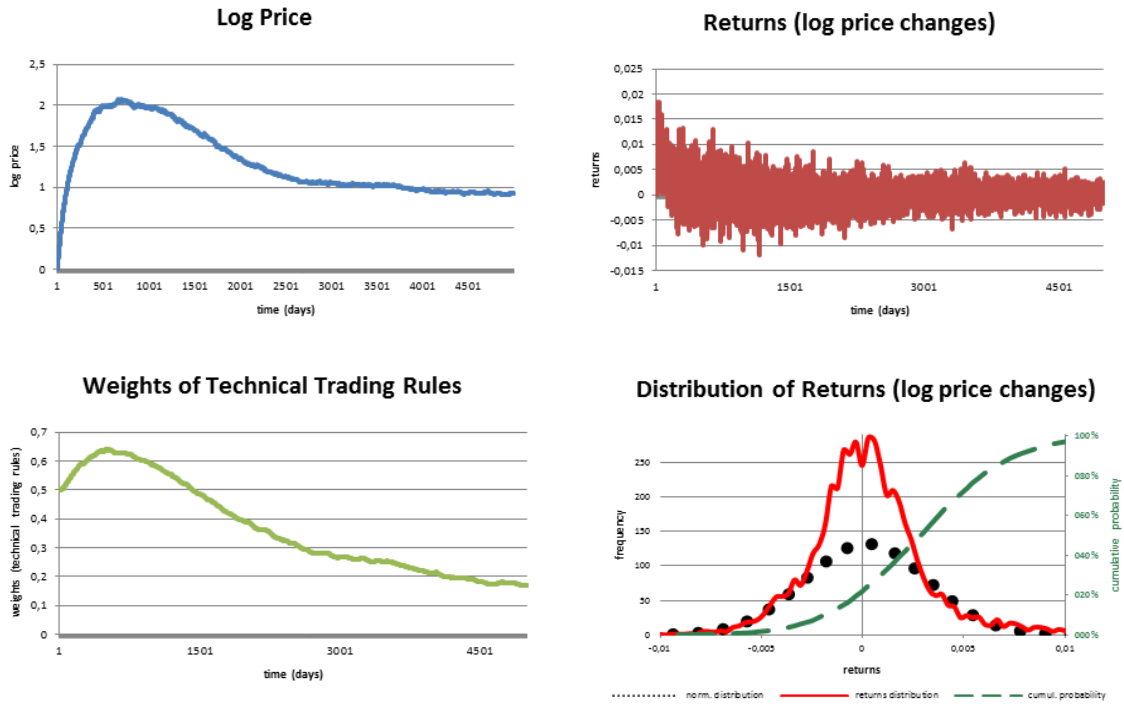


Figure 3. Simulation results with transaction costs.

Source: own

Big surprise was the last set of simulations. All the parameters remained the same; only the TC was doubled and became the constant value equal to 0.03. The higher value of TC made the model destabilization – technical traders rules won (weight = 1) and the price was growing without limit. Figure 4 demonstrates the contradictory effect on the market – instead of the stabilization, the market started to be unstable.

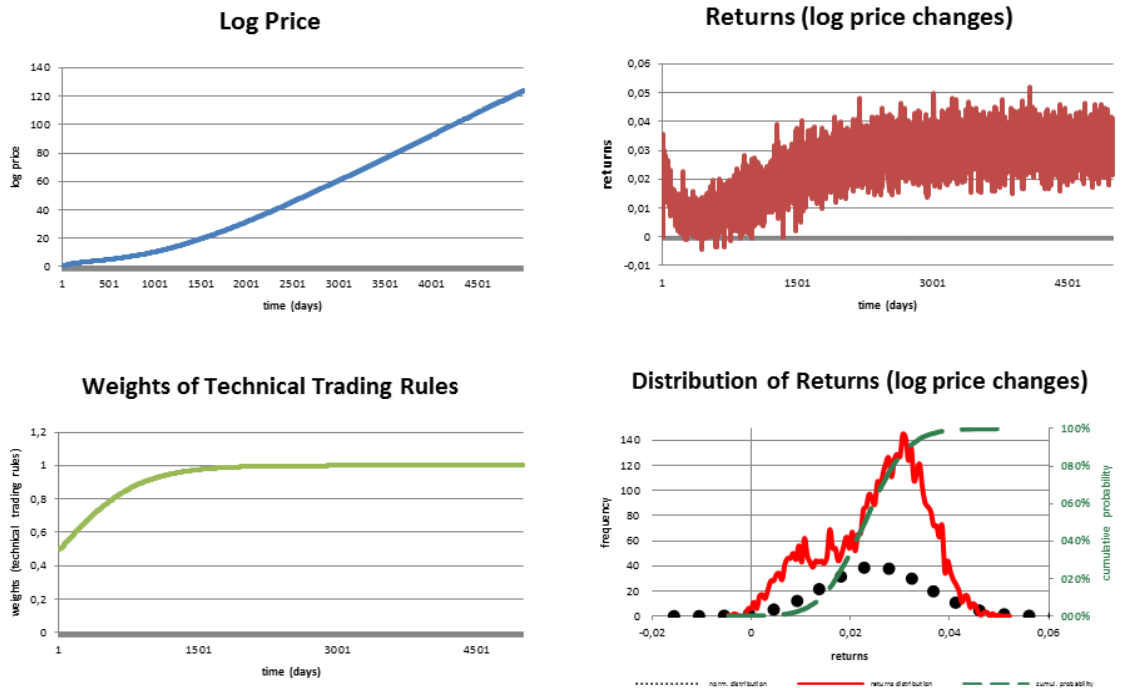


Figure 4. Simulation results with higher transaction costs.

Source: own



## 6. Conclusion

The agent financial model which was implemented (Westerhoff 2009) has (in our parameterization) tendency to stabilize itself in a long term – if the fundamental trading rules are overbearing the trading method, although the bubbles and the crashes occur, their values are going to be smaller because the price is targeting near the fundamental value and the volatility is going to be less too.

Once there is introduced the transaction cost influence on the price – the price is going up to the bubble while technical traders are overtaking the market, but the price starts to be falling according to the technical analysis growth. In this moment volatility falls down and the market stabilizes. The problem is the value of the transaction costs – as was seen in very last simulation, if is too high, the system destabilizes and the price grows without limit.

## 7. Acknowledgments

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# METHOD OF SUPPLY CHAIN OPTIMIZATION IN E-COMMERCE

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## Abstract

*E-commerce systems are tools meant to support the supply chain (SC), the quality of which as well as other parts of the e-commerce system largely depend on management processes representing supply chain management (SCM). The optimal way to ensure the success of SCM is to use the methods of modelling and simulation based on appropriate models and mathematical representation of a real SC. Such models are constructed with the use of process and value-chain oriented approaches or based on the concept of multi-agent systems. Different types of models in conjunction with a suitable mathematical representation allow us to perform the simulation process which outputs can help managers make suitable decisions. The paper aims at presenting contemporary approaches to the supply chain modelling within e-commerce systems. Moreover, the case study emphasized hereby is oriented to present the sample simulation approach in order to find the optimal allocation of resources which are meant to minimize shipping costs.*

**Key Words:** e-commerce system, supply chain, supply chain management, warehouse, allocation of resources

**JEL Classification:** C02, C51, C61, C69, M29

## 1. Introduction

Electronic commerce (e-commerce) has become an essential support for business activities carried out between all types of chain store operators. In a simplified form e-commerce is just buying and selling products online. In fact, it encompasses the entire online process of developing, marketing, selling, delivering, servicing as well as paying for products and services purchased by internetted, global marketplaces of customers with the support of the worldwide network of business partners (Sachenko 2011). Essential support for electronic commerce is understood as the so-called e-commerce system. E-commerce systems are, by their very nature, systems that allow quick and inexpensive entry of company doing business in the domestic and foreign markets. One of the key areas that could have a significant impact on cost is a supply chain (SC) and in particular its part focused on warehouses location. General objective is always to determine which warehouses to open and which of these warehouses should supply the various stores such that the sum of the maintenance and supply costs is minimized. Management of any flexible system including delivery routes is possible by means of a heuristic approach. Economic profits are generated by minimizing losses (Bucki 2010). In case of transportation goods, it is necessary to minimize the length of the defined delivery routes. The process of stocking with setting the locations for more distribution centres becomes even more complex by adding new limitations (Antonyová; Bucki 2010).

## 2. E-commerce System

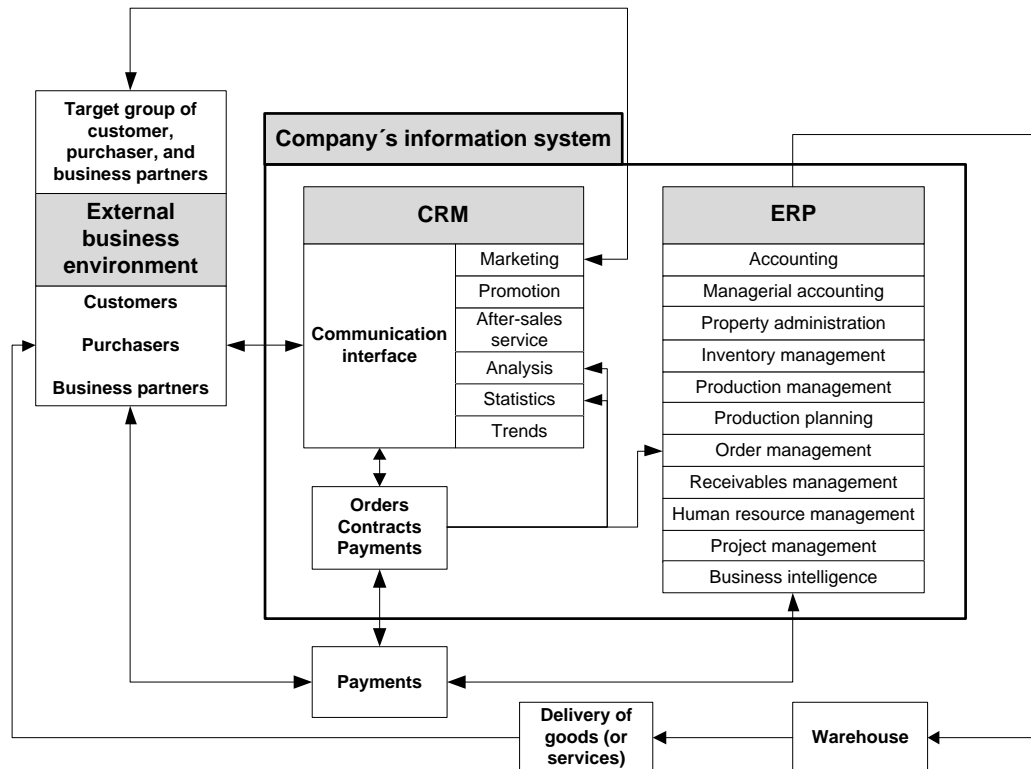
The e-commerce system is an information system with its own architecture. The architecture of an information system encompasses the hardware and software used to deliver the solution to the final consumer of services. The architecture is a description of the design and contents of a computerized system (Burd 2005). System architecture must be designed so that the whole system ensures support for all key areas which are administration, sales, production, finance, logistic, supply chain, personnel, planning, IS/IT, security and finally management. Each key area is usually supported by one defined subsystem. To achieve the efficiency of the whole e-commerce system, all subsystems from which the system is composed, must be efficient.

Main basic components of e-commerce systems are customers, Internet, web server, CRM (Customer Relationship Management), ERP (Enterprise Resource Planning), LAN (Local Area

Network), cooperating suppliers and customers, payment system, warehouse system, delivery of goods, after-delivery (after-sales) services (Figure 1) (Suchánek 2010).

Basic components of e-commerce system are supported and controlled by the management (SCM - Supply Chain Management, FRM - Financial Resource Management, HRM - Human Resource Management, MRP - Manufacturing Resource Planning, CPM - Composite Product Mapping, etc.), hardware, software, people, co-operative suppliers, legislation, Internet services and so on. The whole e-commerce system must be seen as a part of business environment.

All managements and decision-making processes have to be targeted to the customers and their needs and requirements. Today, customers are more sophisticated and have higher expectations than those in past decades. They demand better products and services. This intense, competitive environment forces companies to operate more efficiently.



**Figure 1.** E-commerce system

Source: adapted from (Suchánek 2010)

### 3. Supply chain in e-commerce

The term supply chain management is relatively new in literature, appearing first in 1982 by Oliver and Webber in book (Oliver; Webber 1982). Supply chain management is viewed by many as a highly novel management concept, but comparison with earlier work reveals similarities. The fundamental assumptions, on which supply chain management rests, are significantly older (Cooper; Lambert; Pagh 1997). Supply chain is one of the key areas in e-commerce. The supply chain is generally defined as multi-system of operators, manufacturers, distributors, resellers and customers, among which is a flow of goods, information and finance (Fiala 2005). The quality of the supply chain, as well as other parts of e-commerce system, largely depends on the set management processes. In this context, we speak of the SCM (Supply Chain Management).

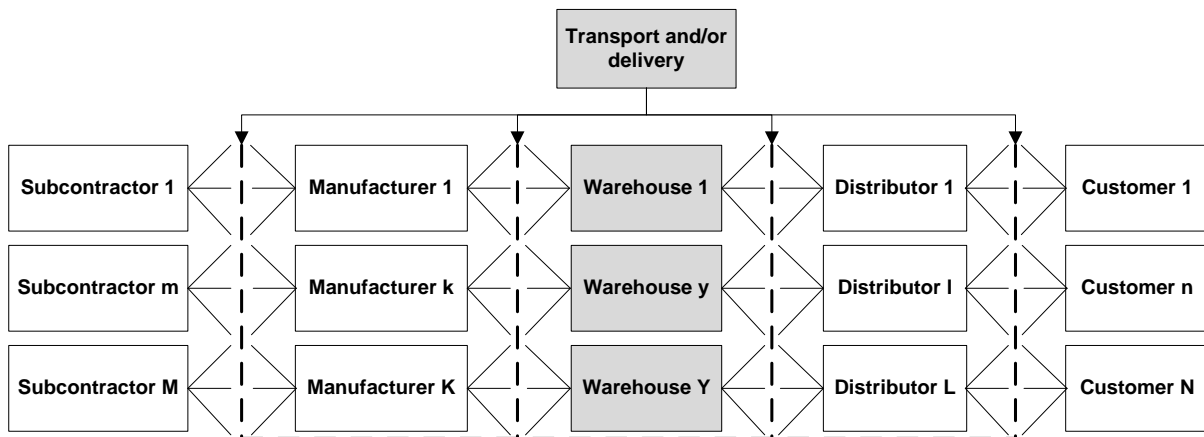


Figure 2. Supply chain network diagram

Source: own

SCM concept includes not only the logistics process as well as strategic management of the entire supply chain, including supplier selection, distribution of production functions, outsourcing of capacity or processing of customer requirements. Successful implementation of SCM concept is fully dependent on the integration of enterprise resources, and together with ERP and CRM is the basic building block of information and corporate strategy of company (Sixta 2004).

The aim of the supply chain is to deliver goods in the shortest time at the lowest possible price while ensuring the highest quality. Quality can depend, for example, on the safe transport appropriate to the nature of the goods and/or services and what is important, delivery of goods in the shortest time also leads to a reduction in storage costs. A characteristic feature of the supply chain is the network concept which contains a number of subjects, each with its objectives which are sought for in order to be achieved by means of the appropriate management system (Figure 2).

A network of manufacturers, distributors, and subcontractors must be appropriately mapped to a network of warehouses. Warehouses may be owned by individual entities identified in the diagram as shown in Figure 2 or entities (companies) specifically focused on warehouse activities.

Supply chain systems can be modelled by number of ways. In this context, the basic methods are process oriented and value-chain oriented approaches and for the purpose of simulation, multi-agents system approach is often implemented. The main difference between process modelling and value chain modelling is that process modelling specifies 'how' a process is realized and implemented while value chain modelling specifies 'why' the process occurs in terms of added value to the process participants. Specifying 'why' and 'what' is the main contribution of the value modelling approach compared to the process-oriented approach which focuses mainly on 'how' and omits the 'why'. Optimization of all these approaches can be performed using linear and mixed integer programming (Shapiro 2006). E-commerce is a direct sale which requires minimal number or zero intermediaries in the distribution of goods. The general objective should be that all members in the distribution channel work together toward an end goal of giving the best value to the final customer. One of the methods used in the SCM is the so-called ECR (Efficient Customer Response). The ECR principle consists in cooperation between retailers and their suppliers based on four pillars that are demand management, supply management, enabling and integrating factors. Ultimately, ECR allows us to achieve maximum cost reduction, improved service, optimization of stock management and production optimization. ECR benefit for suppliers is an opportunity for better planning of production and logistics cost savings. On the other hand, ECR help customers increase product availability and relative price decrease. Other methods for promoting SCM are CRP (Continuous Replenishment), QR (Quick Response), VMI (Vendor Managed Inventory) or CPFR (Collaborative Planning, Forecasting and Replenishment).

Thousands of companies around the globe now use supply chain simulation and optimization methods. A necessary condition for optimizing the supply chain is knowledge of business environment and properly defined corporate strategy. In order to adapt to current market needs, companies should focus on most significant improvements.

Improvements should be based on measurable quantitative indicators, which are:

- number of order entry points;
- number of inventory locations;
- amount of inventory;
- number of manufacturing sites or locations;
- storage costs;
- shipping costs;
- speed of information and material flow through the supply chain.

Generally, standard metrics for supply chain management performance include time, cost, and variability (Hausman 2004). High values for any of these metrics mean costly and inefficient supply chains.

#### **4. Selection of warehouse best location**

The warehouse location selection is processing of selecting the allocation centre in the economic region where there are some supply stations and the certain demand point. Generally, the warehouse location selection model has to match the principles of adaptation, coordination, efficiency and strategy (Xu; Zheng 2001).

Selecting the best warehouse location to minimize shipping costs in the e-commerce systems remains the issue which requires finding optimal allocation of resources and must be addressed carefully. The type of location which is chosen depends largely on the type of the e-business. However, there are various areas worth considering before making a final decision. The warehouse must be located correctly to efficiently meet clients and customers delivery requirements taking into account road access in the possible areas. Moreover, supply chain management is a high impact mission that must win market share and customer loyalty as well as result in reducing total supply chain costs and increasing in forecast accuracy. Another important issue is the need to improve in order-fulfillment cycle time and extend the strategic capability. Proper strategic logistics planning should unavoidably lead to reducing the costs of logistics operations in order to improve customer service levels. Distribution network design is a key business priority. Optimized distribution operations will significantly reduce distribution costs and product flows. These also let us model risk profiles and facilitate effective decision-making. Potential alternative distribution strategies must take into account customer locations while maintaining the present network design and consolidation of existing distribution depots (SCP 2011).

In the e-commerce systems there is the need to present an integrated model for the location of a warehouse, the allocation of retailers to warehouses and find the number of means of transport to deliver the demand and the required means of transport routing in order to minimize total transportation costs, fixed and operating costs and routing costs. Such models assume that the number of plants has already been determined and gives us the information what the number of warehouses to open is as well as how warehouses are allocated to plants. Moreover, we should know how retailers are allocated to warehouses and who the retailers really are. There is also the need to know in what order they will be visited and how many means of transport are required for each route. Minimum costs must be searched for. It is necessary to integrate location, allocation, and routing decisions in the design of a supply chain network (Lashine; Fattouh; Issa 2006) Relocation of the manufacturer has adverse side effects such as causing the readjustment of many existing systems and creating many imminent strategic problems. One of such problems is the warehouse location of freight forwarders: they have to decide whether they should locate their warehouses in the new place, in current locations, or in new locations. The freight forwarders have to make responsible decisions and evaluate some potential warehouse locations. (Wan; Cheung; Liu; Tong 1998)

#### **5. Problem formulation**

There are  $N$  shops given,  $n = 1, \dots, N$ .

There are  $M$  places for the location of warehouses  $m = 1, \dots, M$ .

The warehouse operating cost in the  $m$ -th point equals  $b_m$ ,  $m = 1, \dots, M$ .

The supply cost of the  $n$ th shop from the  $m$ -th warehouse equals  $a_{m,n}$ .

The capacity of the warehouse is marked by  $w_m$ ,  $m = 1, \dots, M$ .

The orders of the shops are represented by  $z_n$ ,  $n = 1, \dots, N$ .

Let  $x_{m,n}$  be the decision variable. The decision variable takes the following values:

$$x_{m,n} = \begin{cases} 1 & \text{if the } m\text{-th warehouse supplies the } n\text{-th shop} \\ 0 & \text{otherwise} \end{cases}$$

## 6. Mathematical model

There are the following allowable solutions:

$$\begin{aligned} \sum_{m=1}^M x_{m,n} &= 1 && - \text{ each shop is supplied by one warehouse only} \\ \sum_{n=1}^N x_{m,n} \cdot z_n &\leq w_m && - \text{ the warehouse accepts orders which can be realized} \end{aligned}$$

Let us introduce the criterion of minimizing costs:

$$Q = \underbrace{\sum_{m=1}^M \sum_{n=1}^N x_{m,n} \cdot a_{m,n}}_{\text{products supply costs}} + \underbrace{\sum_{m=1}^M b_m \cdot y_m}_{\text{warehouse operating costs}} \rightarrow \min$$

at the same time 
$$y_m = \begin{cases} 1 & \text{if } \sum_{n=1}^N x_{m,n} \geq 1 \\ 0 & \text{otherwise} \end{cases}$$

## 7. Heuristic algorithms

### 7.1 The choice of the cheapest warehouse ( $b_m$ )

$$b_m = \min_{1 \leq j \leq M} b_j$$

Not assigned shops with minimal costs are allocated to warehouses as follows:

$$a_{m,n} = \min_{1 \leq j \leq N} a_{m,j}$$

The shops allocated if the following condition is fulfilled:

$$\sum_j z_j + z_n \leq w_m$$

The allocated shops  $a_{m,n}$ ,  $m = 1, \dots, M$ ,  $n = 1, \dots, N$  are disregarded in calculations. The used warehouses  $b_m$ ,  $m = 1, \dots, M$  are also disregarded in calculations.

## 7.2 The choice of the cheapest transport ( $a_{m,n}$ )

The minimal elements  $a_{m,n}$  from the matrix  $A = [a_{m,n}]$  are chosen subsequently. If for the  $m$ -th shop the warehouse has already been chosen, we ignore it in the further calculations.

If no new shop can be added to the  $m$ -th warehouse, we ignore it in the further calculations. In this way, we get the  $N$ -stage calculation process. Moreover, if  $\exists_n x_{m,n} = 1$ , we add the cost  $b_m$  to the criterion sum.

## 8. Conclusion

To optimize the final goods prize and maximize the profit of the manufacturers, distributors and sellers mean to take into account many factors that may influence the process of stocking and distribution by varying degrees. Certain factors of the optimum distribution and stocking processes are easy adapted to changing circumstances but the others might signify high input costs for every modification. The distribution centre location is one of those that should be planned very carefully before the realization as every additional change usually means new input costs. It is necessary to determine proper distribution channels. The distance between the locations of participating companies and expected customers means to set the locations of customers' centers. Determination of proper locations of customers' centers might be quite a sophisticated task as it is based just on the current orders, previous experiences and marketing survey. One approach to the discussed problem is formulated in the paper hereby. Economic control of the distribution system can be optimized for instance by the distribution channel specification which requires another approach. It means trying minimizing the total production time so that ready products are delivered to the output store in a stochastic way. The aim remains to avoid extra costs generated by prolonged delivery times and other unnecessary delays. The heuristic approach to the problem is shown in order to make the correct decision regarding the means of transportation which plays the most important role. The paper deals with a logistic problem consisting in setting the proper location for stock of materials and products and their distribution in order to collect them in the store or directly deliver to the customer. Moreover, the optimal distances between participating companies and expected customers are sought by taking into account dependences that influence the shipping prize, the prize for stocking both materials and products and the other significant constraints too in order to minimize the costs of stocking and distribution.

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