BABEȘ-BOLYAI UNIVERSITY

FACULTY OF ECONOMIC SCIENCES AND BUSINESS ADMINISTRATION

PhD THESIS SUMMARY

THE IMPACT OF THE GLOBAL CRISIS ON COMPANIES' PERFORMANCE AND INVESTORS' BEHAVIOR – EMPIRICAL EVIDENCE FOR CENTRAL AND EASTERN EUROPEAN STOCK MARKETS

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-Key words-

- Stock market
- Financial crisis
- Financial performance
- Capital structure
- Stock returns
- Herding behavior
- Investors' sentiment
- EGLS panel model
- CSAD method
- *State space model*

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Introduction

Stock markets' evolution is influenced by the economic cycle phases, and within them a special attention should be given to the appearance of the financial crisis, which generates a major impact on corporate performance and lead to a reconfiguration of investors' behavior. Changing thoughts, attitudes and behavior of investors in stock markets are influenced by their perception on the surrounding events and on the one hand, is reflected by their sentiments, ranging from euphoria, optimism, greed, temerity to panic, pessimism, fear, anxiety, mimicry and on the other hand, resizes the risk profile of market participants, ranging from risk tolerance to risk aversion.

Each investor tries to find an answer to the following question: *What is the best opportunity to invest?*, which is often influenced by the desire to obtain short-term gains, financial culture and subjective perception on the relationship profitability - risk. The results of the decision-making process varies from one investor to another, depending on the interpretation of market information, therefore, experienced investors will base their investment decision on their own technical and fundamental analysis, and less circumspect investors will imitate the actions of other market participants and ignore their own information hold, thus generating herding behavior, which constitutes a source of price distorsions in stock markets.

Analysis of human capacity to reason is an ongoing challenge for economists and psychologists in their attempt to decipher the human mind and the interaction with the environment. Focusing on stock markets, the research conducted so far failed to identify a model that can forecast an exactly trend for financial assets prices, whereas the formation process its not just arithmetic operations and probability calculus, it includes psychological factors - sentiments- pervasive information within the investment process.

The thesis entitled *"The impact of the global crisis on companies' performance and investors' behavior – empirical evidence for Central and Eastern European stock markets"* put a solid base in investors' behavior profile analysis, which performs capital investments in Central and Eastern Europe stock markets. This research aims to provide, on the one hand, a perspective on the impact of global financial crisis on the relationship financial performance - leverage for companies listed on Central and Eastern European stock markets and on the relationship

dynamics between investors' confidence in the economic environment, measured by sentiment indicators and stock performance and, on the other hand, examines the favorable conditions and identifies new valence of the explicative factors of herding behavior.

Research motivation arises from the need to investigate the determinants of corporate performance and conditions that influence the appearance of investors' herding behavior, as an explanatory variable of financial assets price deviations from fundamental value and as a triggering factor of speculative bubbles. Taking this into consideration, the main unknown is to offer an argued answer to the question: *Do herding behavior of investors constitutes a determinant of corporate performance?*. In this scientific approach we focused on the analysis of companies' performance and investors' herding in Central and Eastern European stock markets. Considering the early stage of research of investors' herding behavior in CEE stock markets and the contradictious results obtained, according to the research methodology used: CSAD, CSSD or state space model, we consider it appropriate to realize a study on the conditions and the explanatory factors of investors' behavioral biases.

The aim of the research is to examine the primary role of financial crises in shaping the relationship between financial performance - financing decision and the reconfiguration of investors' behavior profile in Central and Eastern European stock markets. The results of this research will find a wide range of applicability in the portfolio managers' activity, who will use the information about the investors' tendency to pursue a collective behavior on the market in their activities regarding international portfolios' diversification, in the financial analysts' activity, who base their recommendation to buy / sell / maintain a financial asset in the portfolio, according to studies conducted at market, industry and company level and for statisticians who have the develop advanced models for valuation of financial assets.

In order to achieve the main objective, we focused on the following specific issues:

- Causes and mechanisms of the global financial crisis analysis and similarities with great economic crises in history;
- Identify the determinants of financial performance of the companies listed in CEE stock markets;

- Examine the impact of investors' confidence about the economic outlook, measured by a sentiment indicator on stock performance;
- Presentation of the main behavioral deviations of investors, with particular attention on herding behavior in order to establish the conditions and to identify its presence on Central and Eastern European stock markets;
- Analysis of the explanatory factors of herding behavior through empirical studies at portfolio level in different conditions of stock performance.
- Highlighting the impact of the investors' sentiment, measured by sentiment indicators and technical analysis indicators on herding behavior.

In order to provide an overview of the impact generated by global financial crisis on companies' performance and on investors' behavior from CEE stock markets we used a varied research methodology, including representative techniques of quantitative analysis: panel EGLS (Estimated Generalized Least Squares), OLS regression (Ordinary Least Square), quantile regression and state space model. In order to analyze the impact of the global financial crisis on the performance of companies listed on CEE stock markets, in general and on the performance-leverage relationship, especially and to identify the investors' sentiment role in the evolution of stock markets, we estimated an EGLS (Estimated Generalized Least Squares) panel model. Reasons for choosing this model can be attributed to the advantages offered, in comparison to cross-section analysis or time series analysis, among which: considers the heterogeneity of data and reduces multicollinearity between variables. On the other hand, we focused on the presence of investors' herding behavior in CEE stock markets, and furthermore, on the favorable conditions for its outbreak. In this direction, we estimated CSAD model (cross sectional absolute deviation) developed by Chang *et al*. (2000) and improved by Yao *et al.* (2014), in order to reduce multicolinearity. This model captures the presence of investors' herding behavior by examine the link between stock returns' dispersion and market return.

For the robustness of the results, given that investors' mimicry can be particularly at group level and under extreme conditions on market, a quantile analysis may be useful, because it takes into consideration the tail of the distribution and obtain higher performance in time series analysis, which does not have a normal distribution.

Identifying the presence of investors' mimicry and favorable conditions triggering it was only a first step in analyzing the herding behavior, so to investigate in depth the concept, in the model should be included a new variable, namely investors' sentiment, measured by sentiment indicators. Thus, we estimated the state space model proposed by Hwang and Salmon (2009), which identifies the explanatory factors of herding behavior and assigns to investors' sentiment a primary role. This model incorporates future biased expectations of market participants, which are defined by rational future expectations, influenced by the variation of the specific characteristics of companies and by investors' sentiment.

The research originality arises from the improvement of the most current models used in the quantification of herding behavior:

- estimation of an improved version of the CSAD model, in order to reduce the effects of multicolinearity and increase the predictive power of the model, it is the first study which use this technique for a sample of Central and Eastern European stock markets;
- improvement of the CSAD by inclusion of the ARMS sentiment index, in order to highlight the impact of sentiments on mass psychology and collective mentality of investors;
- estimations based on quantile regression and portfolio analysis, being the first study which use these statistical techniques for a sample of CEE stock markets, in order to provide a comprehensive picture of the existence of herding behavior**;**
- in order to express our own opinion about the explanatory factors of investors' herding behavior in CEE stock markets, we estimate state space model, developed by Hwang and Salmon (2009). We improve their analysis by an examination of herding behavior on portfolios level, constructed based on market capitalization and trading volumes;
- using state space model was a real challenge, is the first study in the literature, which in the estimation of the model includes technical analysis indicators to *"take the pulse of the market"* and to quantify investors' sentiment;

- the sample of capital markets and the analyzed period. This scientific approach takes into consideration a sample of ten CEE stock markets, namely Romania, Bulgaria, Hungary, Czech Republic, Poland, Slovenia, Croatia, Estonia, Latvia, Lithuania and examines their evolution over a period of ten years (2003-2013).

This thesis is composed by four chapters, including on the one hand, theoretical aspects, regarding typology, causes, mechanisms and the impact of financial crisis, in general and of the global financial crisis, especially, and on the other hand, empirical analysis of performance - financing decision relationship and of investors' behavioral deviations, as a main factor of anomalies on stock markets, being placed in the literature on the border between two sciences: psychology and finance. In the first part of the thesis, dedicated to the analysis of the causes, transmission mechanisms of financial crises and to the impact of the global financial crisis on performance-financing decision relationship, we try to offer answers to the following questions: *Were the lessons from past crises learned and will they be used as advice in order to limit the impact of future crises on the economy?, What was the impact of global financial crisis on the performance- leverage relationship?, "How was the financial crisis reflected in the variations of stock exchange performance indicators?", "What is the impact of investor confidence in the economic environment on stock exchange performance of companies?*"**.**

The second part of the thesis focuses on identifying favorable conditions for the occurrance of herding behavior and its explanatory factors. The results of empirical studies provide answers to the following subjects that require clarification: *"Is there a herding behavior of investors on the capital markets from Central and Eastern Europe?", "Which are the conditions that favor the triggering of herding behavior?",* "*What impact did the global financial crisis generate on investors' behavior?","Did investor sentiments constitute a trigger factor for herding behavior?", "Until what extent the companies' characteristics are explained by the stock market developments in general, and the manifestation of investors' herding behavior, especially?".*

The first chapter presents at theoretical level the concept and typology of financial crisis, on the one hand, they are generated by the interaction of a variety of factors including bursting bubbles, the collapse of the financial assets' price, bankruptcies, unfavorable evolution of exchange rates and balance of payments, increased public debt, on the other hand, occurs an interdependence between crises, known in the literature as the *"twin crises"* (Hutchison and Glick, 2011).

Looking back in the history of financial crises, there is evidence of early crises since Mesopotamia, when the crises were generated by farmers' debt. Taking as a benchmark, the most representative crises in history, the Great Depression from 1929-1933 and the global financial crisis from 2007-2009, we find that evolution of economies is marked by the occurrence of crises. Using a chronological approach, we can identify the occurrence of seven major[1] crises util the Great Depression from 1929-1933, followed by another six significant crises[2] until the global financial crisis from 2007-2009. The next two parts of this chapter examine the propagation mechanisms of the global financial crisis from 2007-2009 and its impact on the dynamics of Central and Eastern European stock markets.

In the second chapter we analyzed the interconnections between the global financial crisis - corporate performance – investors' sentiment. The first part of this chapter is dedicated to the investigation of corporate performance dimension, performance-financing decision relationship and theories regarding the capital structure. In the second part, we intend to identify the determinants of the performance of companies listed on Central and Eastern European stock markets during the period 2006-2013 and to examine the impact of the global financial crisis on performance – leverage relationship. In the analysis, we estimated a panel model EGLS on a sample consisting of 336 companies listed on capital markets in Central and Eastern Europe. Given that the prices' movement on stock markets is influenced by macroeconomic events, specific characteristics of companies and investors' confidence in the economic environment, the last part of this chapter focuses on analyzing the determinants of stock performance, namely: global financial crisis, economic growth, return on assets and investors' sentiment, measured by ESI indicator.

Chapter three brings to foreground investors' behavioral deviations, considered as a determinant factor of anomalies in the stock markets.

[1] We make reference to tulip Mania from Holland (1636-1637), the crisis generated by Mississippi and South Sea bubbles (1719-1720), the crisis from 1873, Barings crisis (1890), the crisis from 1893, which affected the United States, the panic from 1907, the crisis from 1914 generated by the occurrence of the First World War.

[2] We mention the OPEC crisis (1973-1974), the stock market crash from October 1987, the financial crisis from Asia (1997), the Russian crisis (1998), the financial crisis from Mexico (1994-1995), *dot com* crisis (2000).

Among these, a special attention is given to investors' herding behavior, a concept that was introduced in the literature by the parents of crowd psychology, namely: Gustave Le Bon (1895), Edward Lee Thorndike (1898) and Ivan Petrovich Pavlov (1906). The first part of this chapter is based on identify the key behavioral deviations, define the concept of herding behavior and presentation of empirical models used in quantification of investors' mimicry. The main objective of this chapter is to identify the presence and conditions causing herding behavior on Central and Eastern European stock markets. In the analysis realized at overall market and at sector level, we estimate CSAD model proposed by Chang *et al.* (2000) and improved by Yao *et al.* (2014).

Chapter four broaden the scope of research from previous chapter regarding investors' herding behavior and analyze its explanatory factors. In this regard, we estimated the state space model developed by Hwang and Salmon (2009) for a sample consisting of 384 companies listed on ten stock markets in Central and Eastern Europe (Romania, Bulgaria, Hungary, Czech Republic, Poland, Estonia Latvia, Lithuania, Croatia and Slovenia), during the period 2003-2013. The central role in this model is attributed to investors' sentiments, which are reflected in their behavior profile definition. The subject is debated in literature, since so far the results of studies have not reached a consensus in the identification of optimal methods used for quantify investors' sentiment. In the study conducted in this chapter we used three methods to quantify investors' sentiment: ARMS index and technical analysis indicators, namely Fear & Greed and RSI. Similar to other studies in the literature (Hwang and Salmon, 2009; Corredor *et al.*, 2013), the results vary depending on the method used to measure investors' sentiment. The scientific approach ends by formulating own conclusions regarding the impact of global crisis on companies' performance and investors' behavior and marking the architecture of future research, taking into consideration the implications of psychological factors on the stock market dynamics.

This thesis contributes to existing research in the literature related to stock markets in Central and Eastern Europe, taking into consideration current trends on the concept of investors' herding behavior and proposes the improvement of the models by including sentiment indicators: ESI indicator, ARMS index and technical analysis indicators. Identifying conditions and understanding the explanatory factors of herding behavior is essential, because firstly, it must be an integrant part of the decision making process of portfolio managers and of research conducted

by financial analysts and secondly, it has to be included by statisticians in financial assets pricing models.

Financial crises may be regarded as a complex manifestation, resulting from the joint influence of several factors, having a major impact on the financial sector and real economy, which is reflected in a decline of economic growth, reduced productivity, higher unemployment rate, deterioration of investor perception on the economic environment, asset price reduction, collapse of capital markets and bankruptcies. Looking back to past events, we find that the frequency, extent and consequences generated by financial crises have different spatial and temporal coordinates, our attention focusing both on local crises and on global crises, that arise due to existing connections within the financial system. Among these, a special place is given to the global financial crisis (2007-2009), whose negative effects spread rapidly, due to the high degree of financial integration, which favored the contagion. Studies in specialized literature Claessens (2010), De Haas and Van Hören (2011), Colander (2013) identified the main channels of transmission of the global financial crisis: collapse of international trade, reallocation of global capital, international activity of banks, lack of liquidity on the inter-banking market, refocusing investor strategies towards low risk asset categories. Since the shock wave generated by the global financial crisis reverberated throughout Central and Eastern Europe, as of 2008, having both microeconomic and macroeconomic implications, conducting a research which quantifies its impact becomes imperative.

There is a rich history of financial crises, which affected over time, both developed markets and emerging markets, whose extent had devastating effects on the economy, reflected in profound recessions, post-crisis revival taking place rather slowly, being conditioned by high costs. Every crisis provides its lessons, thus the Great Depression of 1929 shows us that monetary policy deficiencies and overinvesting may constitute the prerequisites for the emergence of a financial crisis that requires intervention by the authorities in order to restore people's confidence and stimulate consumption. We continue with the Asian crisis of 1997, which teaches that crises can be sudden, capital inflows, which translate into investments with short-term maturities may cause instability, especially in an economy with a fixed quotation, and the loss of investor confidence correlated with inadequate measures to counter the crisis will generate a high capital mobility, vulnerability and increased instability. We conclude by referring to the global financial crisis

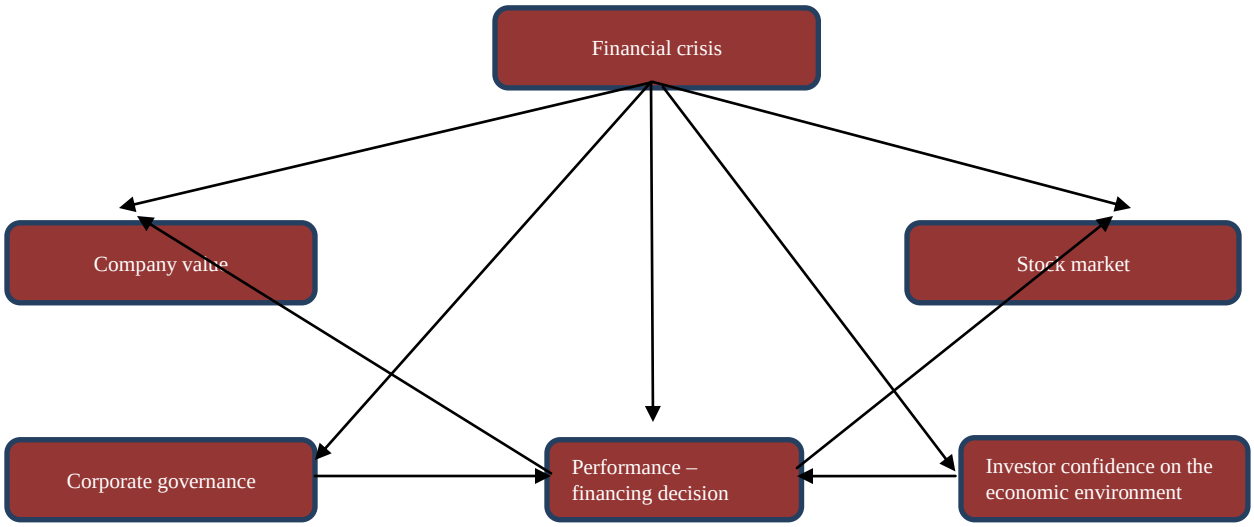
(2007-2009), from which we learn that breaking speculative bubbles, lack of transparency in the banking sector, running excessive risks represent the root causes in the emergence of financial crises. The intervention of government authorities and international cooperation led to a reduced timeframe of such. However, the question still remains: *Were the lessons from past crises learned and will they be used as advice in order to limit the impact of future crises on the economy?*

SUMMARY OF CHAPTER 2. Impact of the global financial crisis on performance of companies listed on Central and Eastern European stock markets

The shock caused by the global financial crisis has influenced the performance of companies listed on Central and Eastern European capital markets, constraining managers to find viable survival solutions, under the restrictive conditions provided by an adverse economic climate. The deterioration of financial results will send negative signals to the market, thus increasing investor fears regarding the future evolution of companies, that will begin to sell their shares, thus putting pressure on price reduction, which reflects in a decreasing stock performance. Complementary, capital markets dynamics incorporates investors' confidence in the economic environment, which, under the conditions of global financial crisis, have become skeptical with regard to the growth perspectives of Central and Eastern European economies.

In light of investors' perception, financial performance may equally be considered a reference point in assessing the value of a company and projecting such image on the capital markets. The vision on this concept is represented in a simplified form in the figure below.

Figure no. 1 **Interconnection between financial crisis-investors' confidence-capital market-financial performance-corporate governance- company value**



Source: Specialized literature processed by the author

Identifying determinants of corporate performance is the primary task of managers, who seek to fulfill the fundamental objective of maximizing company value and shareholders' benefits. Thus, agreeing with the studies from specialized literature (Titman and Wessels, 1988; Mateev *et al*., 2013; Joeveer, 2013; Claessens and Yortoglu, 2013), the main factors affecting corporate performance are: the financing structure, size and age of the company, liquidity, affiliation to a sector of activity, corporate governance, growth opportunities, research and development activity, economic growth, industrial production index, inflation, value of market capitalization, investor confidence in the economic environment, measured by sentiment indices and financial crises.

For a better understanding of the major implications corporate performance generates over the investment process, in this chapter I referred to the multidimensional approach of the concept, respectively to the financial dimension, which encompasses financial and stock performance and to the non-financial dimension, which includes the social and environmental component (Yermack, 1996; Demsetz and Villalonga, 2001; Steurer *et a*l., 2005; Cheng, 2008). Additionally, for a meaningful analysis of the performance-leverage relationship, we considered necessary an insight into the theories related to capital structure, namely: the theory of

Modigliani-Miller – 1958, 1963, trade-off theory - 1973, pecking order theory - 1984, agency theory – 1976 and market timing theory – 2002.

Specialized literature, although rich in empirical evidence, has never reached a consensus on the links between key financial variables such as: profitability, company size, financial leverage and indebtedness, the role of corporate governance, corporate governance quantification. In this chapter, we intend to identify the determinants of financial performance and of stock exchange performance of companies listed on capital markets in Central and Eastern Europe, in the period 2006-2013 and to investigate the impact of global financial crisis on performance in general and the performance-leverage relationship in particular. The remarkable item that substantiates the analysis is the extent of company samples used for estimating the pattern. Thus, the sample consists of 336 companies listed on the capital markets of Central and Eastern Europe, the highest share being held by Poland (42%), which is followed by Romania (24.7%), Bulgaria (14, 3%), Hungary (13.7%) and Czech Republic (5.4%). Given the assumption according to which, in addition to the information relating to macroeconomic events, price movements on the capital market also incorporates investors' optimism or fears about the perspectives of the economic environment, for a sound analysis, we considered it beneficial to include in the pattern a variable, which quantifies the sentiments of market participants and to further explain the interrelationship between financial performance, stock exchange performance, investor sentiments. To this end, we used the ESI index which is a sentiment indicator calculated by the European Commission in order to point out the confidence of investors in the economic environment.

Given the characteristics of the data, the study was conducted by estimating a panel-type pattern based on EGLS methodology (Estimated Generalized Least Squares). The consideration for choosing such method is attributed to the advantages offered by the estimation of such a model. Gujarati (2004) refers to the reduction of multicollinearity, taking into account the heterogeneity of data and superior ability to detect variable characteristics, as compared to the cross-section or the time series analysis. In order to identify determinants of corporate performance in each state considered in the study, we estimated regression models on panel type data as: $\boldsymbol{Perf_{it} = \beta_0 + \beta_1 \cdot F_{it}}$, where $Perf_{it}$ represents the financial performance measured by ROE and ROA variables, and F_{it} represents company-specific exogenous variables: leverage effect,

indebtedness, size, liquidity, age, stock performance, corporate governance. We consider the analysis of global financial crisis impact on the financial performance and on the performance - leverage relationship related to non - financial companies essential, in order to highlight how adverse effects were experienced on financial results and on managers' approach regarding the adjustment of funding structure in order to ensure the survival of companies in an unstable economic environment. In this regard, we introduced the dummy variable *CRISIS*, which is rated 1 during 2007 - 2009 and 0, otherwise.

The results entitle us to respond firstly, to the question *What are the determinants of financial performance on capital markets of Central and Eastern Europe*?, therefore the major impact on corporate profitability, measured by ROE indicator, is financial leverage, size, age and liquidity of companies. Secondly, we focus our attention on the questions: *How was the global financial crisis experienced by the companies listed on capital markets of Central and Eastern Europe*? and *What was the impact of global financial crisis on the performance- leverage relationship?* and we point out that the adverse effects of the financial crisis caused drastic reduction of financial performance rates and led to a resizing of the financial leverage concept.

Based on the hypothesis according to which financial results send signals to the capital market on the situation of companies, empirical evidence obtained allows us to provide an answer to the following question: "*How was the financial crisis reflected in the variations of stock exchange performance indicators?"*, so that it triggered fears among investors, with negative consequences on the evolution of stock performance of companies. Complementary to the impact generated by the financial crisis, we would like to point out other determinants of stock market performance of companies: profit rate, indebtedness, economic profitability, market returns and economic growth rate.

In addition to the information on company specific characteristics and macroeconomic events, price movements on the capital market include investors' view subject to a certain amount of subjectivity about the perspectives of the economic environment. In order to highlight the complex relationship between financial performance - stock performance - investor sentiment, we endeavored to provide an answer to the question "*What is the impact of investor confidence in the economic environment on stock performance of companies?".* Investor confidence in the

economic environment, quantified by the ESI sentiment index is directly linked to the stock performance of companies and of the market as a whole, so that investor optimism about the opportunities provided by the business environment will engage their interest to perform capital investments in Central and Eastern European countries. Similar results were obtained by Subeniotis *et al.* (2011), who argue that the evolution of return is influenced by investor sentiment, stock exchange capitalization, inflation and industrial production index. Based on these results, according to which investor confidence in the economic environment, quantified by a sentiment index, has implications for the performance of companies and of the market, it is necessary to extend the research area to develop new hypotheses on the implications of the interdependence between investor sentiment, their behavior and financial performance on the dynamics of capital markets in Central and Eastern Europe, which will be the subject of an extensive research undertaken over the following chapters.

SUMMARY OF CHAPTER 3. Investors' behavior in the context of global financial crisis: behavioral deviations and market consensus acceptance. Empirical evidence on herding behavior in Central and Eastern European stock markets

Investor behavioral deviations influence capital markets evolution, and within such, herding behavior has a leading role, being placed by studies in the specialized literature on the border between two sciences: psychology and finance. Christie and Huang (1995) mention that herding behavior is triggered when "*individuals ignore their own beliefs and take investment decisions only depending on collective actions on the market, even when they disapprove of market forecasts*." In the same direction, Shiller (2000) attributes such behavioral deviation to "*investors" failure to propagate and evaluate the information regarding the true fundamental value*", having impact on the emergence of speculative bubbles.

Followers of behavioral finance theory advocate the inclusion of psychological factors in the analysis of capital markets, since "*to do otherwise would be irrational*" (Thaler, 1999). On the other hand, followers of the efficient markets theory, respectively Fama (1998) argue that the studies rarely test an alternative hypothesis to the existence of efficient markets, and the results

vary depending on the statistical method used, the only anomalies, which raise the interest being *earnings momentum* and *price momentum.*

In this chapter we presented the typology of models used in specialized literature studies to identify the presence of herding behavior. Thus, we have identified models that highlight investors' tendency to imitate the behavior of other market participants - LSV model proposed by Lakonishok, Shleifer and Vishny (1992), PCM model proposed by Wermers (1995) and models that highlight the collective attitude of investors towards market consensus - CSSD model developed by Christie and Huang (1995), CSAD model developed by Chang *et al.* (2000) and *state space model* developed by Hwang and Salmon (2001, 2004, 2008, 2009).

The main objective of this chapter was to identify the presence of herding behavior of investors and the conditions, which support its occurrence on the capital markets of Central and Eastern Europe. To this end, we used the CSAD method developed by Chang *et al*. (2000) and improved by Yao *et al*. (2014), in order to reduce multicollinearity and increase model predictive capacity. The arguments that led to the selection of this methodology refer to the perspective on herding behavior, whose presence is identified by measuring the dispersion of financial assets returns from market return. Complementary, in extreme conditions existent on the market, the link between the dispersion of financial assets return and market return is expected to be nonlinear, the CSAD method having the ability to identify the presence of a collective market behavior. In order to substantiate the analysis, we estimated *quantile* based regressions, due to the advantages it brings compared to OLS regression, respectively: incorporates in the estimation of information model regarding distribution tails and achieving higher performance in time series analysis, which do not have a normal distribution.

The data used are represented by stock quotations for a number of 384 companies listed on ten capital markets in Central and Eastern Europe - Romania, Bulgaria, Hungary, Czech Republic, Poland, Lithuania, Latvia, Estonia, Slovenia and Croatia and stock exchange indices: BET, SOFIX, BUX, PX, WIG, OMXV, RIGSE, TALSE, SBITOP and CROBEX, between January 2003 and December 2013.

The results allow us to provide answers to a series of questions. Thus, if we consider the question "*Is there a herding behavior of investors on the capital markets of Central and Eastern*

Europe?", the answer is that on global market level, it is manifested only in Estonia and Latvia. Additionally, quantile based regression enables us to formulate relevant opinions on investors' behavior, so that empirical evidence support the existence of such imitation on the following capital markets: Estonia, Latvia, Lithuania, Slovenia, Croatia, Bulgaria and the Czech Republic. Herding behavior is present both for inferior quantiles level and on superior quantiles level.

By analyzing the existence of investors' herding behavior within a certain field of activity enables us to answer the following question: *Which are the sectors in which herding behavior is particularly present?*. The answer is that investors' imitation was identified mainly in the oil industry, chemical industry, constructions and agriculture. A lower frequency was found in the financial sector, health and services. A summary of the results may be seen in the table below:

***Table no.* 1 Empirical evidence on sectors of activity regarding the existence of herding behavior on Central and Eastern European stock markets**

Country/field of activity	Bulgaria	Croatia	Czech Republic	Estonia	Hungary	Latvia	Lithuania	Poland	Romania	Slovenia
Agriculture	■	*		■	*				*	■+*
Chemical	+		■+		■+*					
Constructions	■			■+			■+		+	
Electronics		■+*			■+					
Financial		■*								*
Tourism	■									
Technology		*	■+*	■			*			
Oil&Gas	■+	*				■+	*			■
Health		*								
Services		*					■+			
Others	*			■+		■+*				

Source: Author's adaptations; "■" indicates the presence of herd behavior within a field of activity, "+" indicates the presence of herd behavior within a field of activity under excessive volatility conditions, "*" indicates the impact of the global financial crisis on investor herd behavior within a field of activity.

In what concerns our answer given to the question "*Which are the conditions that favor the triggering of herd behavior*?", we point out that the main circumstances on which the emergence of herdig behavior are: *volatility* (for Latvia, both under conditions of high volatility and under conditions of low volatility), *liquidity* (in the case of Latvia and Estonia given high trading volumes and in the case of Latvia and the Czech Republic in the presence of reduced trading volumes), *size of the companies quantified by stock exchange capitalization* (Bulgaria - in all companies except those with an average size; Hungary - small sized and medium to large companies, Croatia - small sized companies, Estonia - medium size and medium to large companies, Latvia - medium to large and large sized companies, Slovenia – large sized companies).

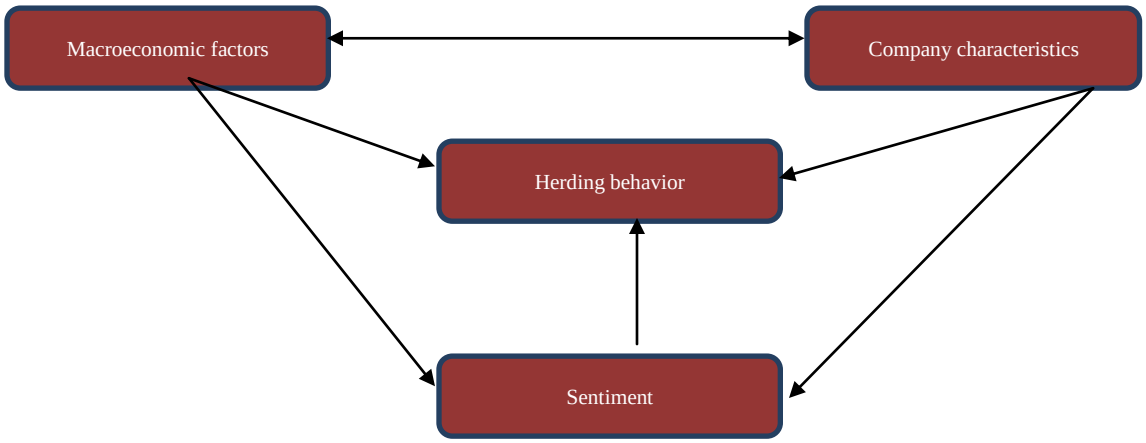
One of the main objectives of our doctoral research is to analyze the impact of the global crisis on the behavior of investors in Central and Eastern Europe. According to the results obtained, we conclude that the global financial crisis had a significant impact on the participants in the capital markets of Croatia, Hungary, Latvia, Lithuania and Slovenia, thus, in extreme conditions, a reduction of dispersion of financial profitability occurs in relation to market profitability, the investors tending to accept market consensus.

In order to provide an overview of the herding behavior, we improved the CSAD method by including a variable, which quantifies investor sentiments, which is an element of originality. The results obtained showed that the presence of imitation is influenced by investor sentiments on the capital markets of Latvia, Estonia and Croatia.

SUMMARY OF CHAPTER 4. Determinants of investors' herding behavior. Empirical evidence for stock markets in Central and Eastern Europe

The prevailing attitude leaves its mark on the behavioral profile of investors, that make investments on the capital markets of Central and Eastern Europe. Hwang and Salmon (2009) meaningfully define the sentiment as "*a state of the market that evolves over time, and the herding behavior has an impact on the evolution of individual titles on the market*." Excessive optimism, panic, euphoria, imitation, greed are just some of the behavioral deviations, which are frequently associated with the development of capital markets, the argument being that the personality type of investors, their way of thinking, financial culture and subjective perception of the profitability-risk relationship are directly guiding the decision-making process and reflect their influence on price formation modality of financial assets on the capital markets. In this context, we consider relevant the opinion of the authors Durad *et al*. (2014) according to which "*prices are moved by inexperienced analysts, ignorant in this matter who are working on Wall Street*". Considering the extent and dynamics of investors' herd mentality phenomenon, which are reflected in capital market development, the aim of this chapter is to identify the explanatory factors of market participants' behavior. Figure no. 2 schematically renders the explanatory factors of the herding behavior of investors.

***Figure no.* 2 Interconnections between investors' herding behavior –sentiment– macroeconomic factors – company characteristics**



Source: Author's adaptations from specialized literature

The analysis of behavioral patterns accompanied by the need to identify an appropriate measure for quantifying the investors' sentiment represents a goal of the researchers that support the omnipresence of sentiments in defining capital markets trajectory. Throughout this chapter we have presented direct and indirect methods used to quantify the sentiments:

- *Direct methods* – enquiry-based, by direct involvement of investors and by analyzing their perception on economic environment perspective and on future development of capital markets: Michigan Consumer Sentiment Index (MCSI), Investor Intelligence (II), Economic Sentiment Indicator.
- *Indirect methods* – which use financial variables to reflect behavioral deviations of investors, among which we mention: the number of initial public tenders, average profitability on the day following the initial public tender, liquidity, discount granted when closing the fund, ARMS index.

In order to achieve the aim of this chapter to identify the explanatory factors of investors herding behavior on the markets of Central and Eastern Europe, we used portfolio analyses, constructed based on the value of stock exchange capitalization and on trading volume, and we estimated the state space model, developed by Hwang and Salmon (2009). The choice of this model is based on the consideration according to which herding behavior measurement should be done in terms of macroeconomic factors and company-specific characteristics. In our opinion, the originality

consisted in introducing technical analysis indicators, respectively RSI and *Fear & Greed* and the ARMS index, as explanatory variables in the model. In estimating the model we used daily quotations of the main stock exchange indices3 and shares of a number of 384 listed companies on ten stock markets in Central and Eastern Europe.

Considering the results obtained, we provide more details on the explicative factors of herding behavior of investors and we provide answers to the following questions: "*How do behavior deviations of investors reflect in the market?*", "*Do investor sentiments trigger herding behavior*?". Thus, there is a direct link between market profitability and herding behavior of investors in Hungary, Poland, Bulgaria and an indirect link in the Czech Republic, Latvia, Estonia, Lithuania, Slovenia and Croatia. Additionally, other factors affecting the herding behavior of investors are market risk of the company, market capitalization and trading volume.

Choosing an appropriate method for quantifying sentiments remains an open debate, as up to the present moment, no studies in the specialized literature have identified a valid universal method. Results vary depending on the choice of method for quantifying sentiments (Hwang and Salmon, 2009; Corredor *et al*. 2013). In this scientific approach, we used three methods to quantify sentiments: ARMS index, RSI index and Fear & Greed indicator. Our results certify a negative link between sentiment and herding behavior of investors. Estonia and Latvia report an adverse correlation between herding behavior and prevailing attitude of investors, measured by ARMS index. For Bulgaria, the Czech Republic and Slovenia we found that technical analysis indicators may be used to explain the tendency of investors to follow market consensus.

Conclusions and future research directions

What impact did the global financial crisis generate on company performance and on behavior of investors in the capital markets of Central and Eastern Europe? - A question that is in the minds of many people and to which investors, bankers, portfolio managers, financial analysts and statisticians had to think equally. We reflected on this question too, and the complex answers provided set the analysis frame of this scientific approach.

[3] In order to reflect the overall evolution of Central and Eastern European capital markets we used the following stock exchange indices: BET (Romania), SOFIX (Bulgaria), BUX (Hungary), PX (Czech Republic), WIG 20 (Poland), SBITOP (Slovenia), CROBEX (Croatia), TALSE (Estonia), RIGSE (Latvia), OMXV (Lithuania).

The main objective of this scientific approach was to investigate the negative effects of the global financial crisis on company performance and investor behavior, which on one hand, outlined the shape of a new image of the performance-financing decision relationship and on the other hand, reconfigured the behavioral profile of capital markets participants in Central and Eastern Europe.

The topicality of the research lies in the deep implications of investors' ability to reason on the evolution of capital markets, which is a perpetual concern among researchers in psychology and finance. A closer examination of price movements on the capital markets, distinguishes the inclusion of an affective component in their formation - the sentiment – omnipresent information within the investment process, *"and believing otherwise would be irrational"* (Thaler, 1999). In the same direction, sentiment analysis and identification of a method to quantify such, universally valid, is the focus point of debates and brings a series of controversies in specialized literature (Hwang and Salmon, 2009; Baker and Wurgler, 2006, 2007, 2009, Corredor et al. 2013), as the results obtained so far vary depending on the research methodology used.

Analyzing the circumstances of the global financial crisis, there were different mechanisms of propagation, some markets were affected by contagion, others by trade flows, amid the contraction of international trade, of existing interconnection on the interbank market or of herding behavior, triggered amid the installation of investors' lack of trust in economies into recession. The capital markets of Central and Eastern Europe have experienced the international financial turmoil since 2008, when volatility increased and market capitalization decreased, letting the investors know that they received the signals about the deterioration of the macroeconomic environment. We find that there is a delay between the reaction of the capital market and the real economy, which has experienced adverse effects from 2009, when there was a strong contraction of the economies of Central and Eastern Europe, Poland being the only country which recorded a positive economic annual growth rate, although the tendency is towards pronounced decline.

One of the main objectives of this scientific approach was to examine the impact of global financial crisis on the performance of companies listed on the capital markets of Central and Eastern Europe and to identify its main determinants. The shock caused by the global financial

crisis left its mark on company performance, constraining managers to adjust their business model, with direct repercussions on the financing structure. In order to express our point of view on the negative effects of the global financial crisis on the performance and its determinants, we have empirically validated the following hypotheses: selection of the financing structure has a significant impact on the financial performance and the global financial crisis determined a resizing of the financial leverage concept. The consistency of this analysis is provided by the extent of the sample consisting of 336 companies listed on capital markets in Central and Eastern Europe, for the period 2006-2013. Our results obtained from estimating EGLS panel models (Estimated Generalized Least Squares) highlight that the determinants of financial performance are the financing structure, company size and age, level of liquidity and stock returns. The main factor influencing the financial performance of companies is the financing structure, the indirect link existent between performance and leverage, being consistent with the pecking order theory.

The pillar that contributes to maximizing company value and shareholder benefits is the optimization of capital structure. The negative effects of the financial crisis were felt in corporate investment strategies and have led to redefining the performance - leverage relationship, which acquires new meanings. Thus, we conclude that the impact of the global financial crisis determined a leverage resizing, both in non-financial companies and in financial companies.

Further on, the complexity of corporate performance has conditioned us to address its financial dimension, in terms of stock exchange performance. The argument that was in favor of this decision is that in addition to macroeconomic events and companies' specific information, more attention should be paid to investor confidence in the economic perspectives provided by Central and Eastern European countries, as their optimistic expectations or fears will mirror in the stock exchange performance. Therefore, we believe that in the setting of the global financial crisis, such an analysis raises interest, because most of the times, investors facing a hostile reality will review their investment strategies and will choose to follow the market, with direct impact on their risk profile, ranging from risk seeker to risk averse. To this end, the following two hypotheses, namely *the global financial crisis determined a change in view of investors, which is reflected in the evolution of companies on the capital market and the stock market performance is influenced by the specific characteristics of companies and confidence in the economic environment* have been empirically tested and validated by results obtained as a result of

estimating an EGLS panel model. The conclusion we reached is that the determinants of stock market performance of companies listed on the capital markets of Central and Eastern Europe are: profit rate, indebtedness, economic profitability, market return, economic growth rate, global financial crisis, investor confidence in the economic environment, quantified by ESI sentiment index.

Complementary to the analysis of the vital role of the global financial crisis in outlining the performance-financing decision relationship and the interdependence between stock market performance - macroeconomic climate - investor confidence, in this scientific approach, great attention was paid to herding behavior of investors, a borderline concept between classical finance and behavioral finance. Fama (1998) argues that deviations from the efficient market theory, namely stock market anomalies are sensitive to changes made to the method by which they are quantified, the only ones that raise the interest are *price momentum* and *earnings momentum*, and most of the times, testing an alternative hypothesis, according to which the market is inefficient is vague. On the other hand, Shiller (2003) is a supporter of behavioral finance and claims that there is a correlation between the development of capital markets and psychological factors.

Considering that most studies in specialized literature are oriented towards developed markets, a priority objective of this scientific approach was to analyze herding behavior of investors on ten capital markets of Central and Eastern Europe, namely Romania, Hungary, Bulgaria, Poland, Estonia, Latvia, Lithuania, Croatia, Slovenia, during the period 2003-2013, in order to cover the gap in the specialized literature, by conducting an empirical investigation, with the purpose to identify its presence and the conditions that favor mimetic behavior of market participants. The analysis focused on the following hypotheses: *capital markets of Central and Eastern Europe are characterized by the presence herding behavior of investors, the existence of herding behavior varies depending on affiliation to a certain sector of activity, there is an asymmetry in the herding behavior of investors, depending on existing conditions on the capital market, during the global financial crisis the investors on Central and Eastern European capital markets had a herding behavior, sentiments influence the triggering of investors' herding behavior*. In order to validate these hypotheses, we used an improved version of CSAD method developed by Yao *et al.* (2014), in order to reduce the effect of multicollinearity and to increase the predictive power

of the model. Our own contribution is the inclusion of a variable which quantifies investor sentiments (i.e. a dummy variable built depending on the evolution of ARMS index) in CSAD model equation.

The results identified the presence of herding behavior of investors, both globally on market level and on industry level, providing explanations on this concept, which continues to bring challenges for researchers in the field of behavioral finance. Thus, we apprehend that on global market level, investor behavior manifests only in the case of Estonia and Latvia. In what concerns the analysis on field level, we notice its presence across multiple capital markets, except for Romania and Poland. Another observation is that investors tendency to imitate the actions of other market participants manifests particularly in oil, chemical industry, constructions and agriculture. Poor empirical evidence on herding behavior of investors have been identified in the financial field, health services.

For a clearer view of herding behavior, we estimated quantile based regressions and conducted portfolio analyses, as we believe this method provides reliable results, as imitation is triggered especially at group level and under extreme market conditions, being the first research that uses these statistical methods, for a sample of Central and Eastern European capital markets. The results confirm the presence of herding behavior in capital markets of Estonia and Latvia, which was identified by OLS regression, but it additionally detects its existence also on capital markets in Bulgaria, Czech Republic, Lithuania, Slovenia and Croatia. Another remark is that the presence of herding behavior was highlighted both on inferior quantile level, and on superior quantile level. Considering all these aspects, we conclude that quantile based regression achieves superior results, as compared with OLS regression in the analysis of herding behavior, as it takes into consideration also distribution tails.

Based on the results, we formulate our opinion on the favorable conditions that trigger herding behavior on capital markets of Central and Eastern Europe, thus we affirm that the size of companies, measured by stock market capitalization, volatility and market liquidity affects the tendency of investors to perform transactions similar to such of other market participants. The conclusion that may be drawn is that there is an asymmetry depending on market conditions, therefore herding behavior occurs under the following conditions: Bulgaria (in all companies

except for average size companies), Hungary (small sized companies, medium to large companies), Croatia (small sized companies), Estonia (medium and medium to large companies, high liquidity), Latvia (medium to large and large companies, high volatility, low volatility, high liquidity, low liquidity), Slovenia (large sized companies), Czech Republic (low liquidity). We point out that we presented the results at market level.

Within this scientific approach, we focused on the analysis of the impact of global financial crisis on the behavior of investors on the capital markets of Central and Eastern Europe. The global financial crisis has created an environment adequate for examining the extent to which the herding behavior of investors was influenced by extreme market conditions. We estimated the improved version of CSAD model, which was developed by Yao *et al*. (2014) and in order to highlight the effects of global financial crisis, we included in the model a dummy variable rated 1 for the period September 2007 - December 2009 and 0 otherwise. Our opinion is that the effects of the global financial crisis were experienced by investors on capital markets of Croatia, Hungary, Latvia, Lithuania and Slovenia. The empirical results support the influence of the global financial crisis on herding behavior, so the coefficients of the dummy variable related to the crisis are significant for most Central and Eastern European capital markets under analysis, especially in fields of activity such as agriculture (Croatia, Hungary, Romania, Slovenia), electronics (Croatia), financial (Croatia, Slovenia), technological (Croatia, Czech Republic, Lithuania), oil (Croatia, Lithuania), health (Croatia), services (Croatia) (Croatia, Czech Republic, Lithuania), chemical (Hungary), other (Bulgaria, Latvia). The conclusion is that in times of extreme market conditions, a reduction of the dispersion of financial asset profitability as compared to the market profitability occurs, explained by the intention of investors to limit their losses and their focus towards the evolution of market index.

The inclusion in CSAD model of a variable which highlights the impact of investor sentiments on triggering herding behavior constitutes an element of originality. In order to quantify investor sentiments, we used the ARMS index. We have included in the model a dummy variable, rated 1 if the investors are optimistic and 0, otherwise. By analyzing the results obtained from CSAD model estimation, we concluded that the presence of herding behavior is influenced by investor optimism on capital markets in Estonia and Latvia. On the other hand, in the case of Croatia, investor fears trigger imitation on the capital market.

Identifying the presence of and the conditions that favor mimetic behavior were the only prologue, which enabled us to shape an image on herding behavior of investors, but in order to "*fill*" this outline already created, we need to include a new element: sentiment - ciphered information which provoked the masses of investors. Analysis of the sentiments continues to draw the attention of researchers in psychology and finance, which on one hand examine the influence of emotions on human behavior, in general and on the other hand, focuse on a topic worthy of interest, namely how the sentiments of participants market manifest their influence, participants that act on instinct and intuition, the investment process and how they are reflected in the price movement on the capital market. Deciphering the behavioral profile of the investor that makes investments on the capital markets of Central and Eastern Europe is a sinuous process, which primarily takes into consideration the sentiments and way of relating to other market participants, and secondly, it includes future expectations of investors on capital market development, being influenced to a greater or lesser extent by subjectivity. Thus, we conclude that the choice of investment strategy is influenced by the "way of being" of investors.

In order to substantiate our own opinion on the explanatory factors of herding behavior of investors on the capital markets of Central and Eastern Europe, we estimated the *state space model* developed by Hwang and Salmon (2009) and tested the following hypotheses: *sentiments influence herding behavior of investors, market risk is an explanatory factor of herding behavior of investors, intensity of herding behavior varies depending on specific characteristics of companies*. In estimating the model we used daily quotations of market indices and of a number of 384 companies listed on the capital markets of Central and Eastern Europe. For a complex examination of herding behavior, complementary to the methods developed by Hwang and Salmon (2009), within this scientific approach we conducted analyses on the basis of quantile based portfolios, built according to market capitalization and trading volume. Estimates obtained by the *state space model* reveal that mimetic behavior of investors is influenced on one hand, by the specific characteristics of companies, namely: market risk, market capitalization and trading volume and on the other hand, the existing conditions on the market, respectively market return. The main predictor of herding behavior is market risk. There is a indirect link, therefore the more reduced the market risk, the more investors will intensify their mimetic behavior towards the market index.

In order to refine the topic and bring further clarifications on the impact of sentiments on herding behavior of investors, we included in the model sentiment indicators. The prevailing attitude of investors was quantified by an indirect method, namely: ARMS index, to which we added two technical analysis indicators: RSI and *Fear & Greed*. We believe that the most important contribution to the specialized literature is certifying the influence of the prevailing attitude on the behavior of investors on the capital markets of Central and Eastern Europe, as the research conducted within this scientific approach includes in the model technical analysis indicators, in order to quantify investor sentiments. The empirical results obtained confirm a negative connection between sentiment and herding behavior of investors. In the case of Estonia and Latvia there is a negative correlation between herding behavior and investors' sentiment, measured by ARMS index. On the other hand, the results for Bulgaria, the Czech Republic and Slovenia certify the role of technical analysis indicators in explaining the tendency of investors to follow market consensus. Our results will vary depending on the method used to quantify sentiments. These are similar to those in the specialized literature (Hwang and Salmon, 2009; Corredor *et al*. 2013) and stresses the need to continue the research in this area, in order to validate the most appropriate methods used for quantifying sentiments.

Thus, the general conclusions about the herding behavior of investors on the capital markets of Central and Eastern Europe are that the circumstances upon which its emergence depend, vary from one capital market to another and from one field of activity to another. In what concerns the impact of global financial crisis on investor behavior, it appears that negative effects were experienced differently, both on market level and on field of activity level. The manifestation of collective market behavior is at the confluence of specific company characteristics, the overall evolution of the market and investor sentiments.

Although the results obtained in the analyzes carried out during this scientific approach are relevant and provide the necessary information for a better understanding of the concepts of financial crisis, company performance, investor sentiment and the interconnection between such, it is necessary to specify the limits of the research and to outline the directions for future research. In what concerns the limits of the research, on one hand, the analysis of herding behavior will have to be developed by using additional research methodologies and by extending the capital market sample. We believe that conducting a study across several developed,

emerging, frontier markets, according to that conducted by Chen (2013) and the use of additional models will bring significant results on the investors' behavior on international level. On the other hand, the results of the impact of investor sentiments on herding behavior varies depending on the sentiment indicator used in the model, similar results being obtained by (Hwang and Salmon, 2009; Corredor *et al.* 2013). Therefore, we deem believe that this topic is a challenge and remains open for debate in future research.

Future research directions aim at identifying a link between herding behavior of investors and long memory. An initial study was conducted by Cajueiro and Tabak (2009) for the capital market in Japan, which used the CSAD method to identify herding behavior and MF-DFA method (Multifractals Detrended Fluctuation Analysis) to highlight long memory. The authors concluded that the presence of long memory on the capital markets may be a consequence of herding behavior of investors. Considering the study conducted by Demirer *et al*. (2015), another course of research will focus on analyzing the link between herding behavior at field of activity level and investor strategies determined on different time frames.

This scientific approach addressed the global financial crisis topic and resulting implications on company performance and on the behavior of investors on capital markets of Central and Eastern Europe. Faced with a hostile reality caused by the global financial crisis, investors, bankers, managers of portfolios, financial analysts and statisticians were confronted with the situation to answer at least one of the following questions: *Which strategy to follow in order to my limit losses?, What are the sectors of activity that I have to restrict my exposure to?, Which will be the extent of the effects of the financial crisis on company performance?, How should models be adjusted in order to capture the change in investors' behavio*r? and they had to find solutions to limit losses and to ensure the viability of companies. Given these considerations, we conclude this scientific approach by mentioning the usefulness of the results obtained, which find application in the activity of portfolio managers, financial analysts and statisticians. Portfolio managers will use information about the tendency of investors to follow a collective market behavior in the activity of international portfolio diversification, given that it manifests differently from one capital market to another, depending on economic conditions and investor sentiments. Financial analysts will seek to identify actual presence of herd mentality of investors or the existence of informational cascades, given the high availability of information on the

specific characteristics of companies and on macroeconomic events. To this end, analyses will be conducted, both on market level, and on industry and company level, whose objectives are to develop appropriate studies concerning market tendencies and adequate recommendations to purchase/sell/maintain a particular financial asset in the portfolio. Development of advanced assessment models of financial asset prices is the task of statisticians. Omission from the model of explanatory variables relevant with regard to investors' behavioral deviations will affect model performance, having a negative impact on the forecasts carried out.

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