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PhD THESIS

ABSTRACT

FACTORS WHICH EXPLAIN THE DEVIATION FROM THE INFORMATIONAL EFFICIENCY OF STOCK MARKETS

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SUMMARY OF THE THESIS

INTRODUCTION

In a modern society the capital market can be seen as a bridge between the fund suppliers and their users. For example, in the corporate sector, either through direct financing (emission of financial instruments for the public), or through indirect financing (loans), the collective funds are put at the disposal of the entrepreneurs and then channelled towards productive purposes. For this reason, the study of the stock market efficiency has always constituted a subject of debate firstly for investors, researchers and regulatory authorities, all this due to the fact that the efficiency of allocating the resources depends on the informational efficiency of the stock markets. When we talk about the informational efficiency, we refer to the capacity of the stock markets to process the new information that appeared on the market in a correct and systematic way.

Nobel laureate in 2013, Eugene Fama (1970), in the study entitled „*Efficient Capital Markets: a Review of Theory and Empirical Work*" defined an efficient market as being that market on which the stock prices reflect totally (unbiased, impartially) and permanently all the available information. On such a market the current stock price will be, at any time, the best estimator of its intrinsic value, and the expected gain will be proportional to the risk taken. The informational efficiency should be a natural consequence of the competition between the investors, of the low cost of information and of the relatively free access to the market.

The theory of efficient markets has not become famous because of its complexity, but because it constituted the organizing principle of the empirical enterprises from the economic and financial domain for decades. Moreover, although the basic idea is simple, its implications are, for many times, surprizing, subtle and remain controversial even nowadays.
Promoting the assumption of informational efficiency, in which the dissemination of relevant information is reflected automatically in the process of price forming, is one of the key objectives of the regulatory authorities. Actually, the discovery of the processes of formation and evolution of the stock prices is one of the main functions of the stock market. Also, on an efficient market the stock prices offer accurate signals for an optimal allocation of resources, fact that has a long term positive impact on the economic growth. Morck, Shleifer and Vishny (1990) underline the fact that the efficiency of the markets would not be important if the activity of the stock markets did not affect the economy of the countries. Empirically, a series of studies have highlighted the positive impact of the informational efficiency of the markets on the efficiency of allocating the capital (Wurgler, 2000), on productivity and economic growth (Durnev et *al*., 2004) or on the sensitivity of the corporate investments in the stock prices (Chen, Goldstein and Jiang, 2007).

In a restrictive approach, the informational efficiency of the stock market involves a random walk, the price variations being independent and identically distributed. In this context, the information from the past and present cannot be used in order to predict the future stock price, the investors finding themselves in the impossibility to „beat" the market, to make systematic profits.
Practically, there can exist predictability in the series of returns, that is consistent with the hypothesis of the efficient markets, but this refers to that component of the expected return required by the investors, following their assuming of the risk of the investment in the

respective. What the involved actors did not understand from the very beginning was the fact that it is necessary to define a framework that connects the behaviour that the stock prices must have and the perceptions of the actors on the market regarding this behaviour; in other words, a model of balance in terms of profitability and risk must be defined in order to test the efficiency of a market. On an informationally efficient market there can be market crashes as long as these ones cannot be foreseen. Phrases like „the market crashes prove that the markets are inefficient" or „the researchers did not foresee the market crash" reflect ignorance and confusion regarding efficiency. An efficient market does not have to be clairvoyant.

The vast majority of studies in the domain, that is the classic ones, have tried to find an answer to the question:" is the stock market efficient in its weak form in an absolute sense?", starting from the assumption that informational efficiency is a static characteristic that remains unchanged during the different development stages of the markets. The answer is no, and Fama himself (1965, 1970, 1991) emphasized in his articles that efficiency, like any other form of perfect competition from economy between demand and supply, is an ideal.

The empirical studies can only determine how close or far a stock market is from this ideal. The introduction of the concept of relative efficiency by Campbell et *al.* (1997) marks the beginning of a new series of studies that analyse the degree of efficiency of the markets and not the efficiency in the absolute sense, allowing at the same time the identification of some determinant factors of efficiency. Unfortunately, after thousands of articles published during five decades we still do not have sufficient information to offer a clear answer to the question: "When and why markets become more efficient?" The thesis, in its four chapters, is trying to answer this question analysing the weak form of the informational efficiency of the international stock markets, paying a special attention to the factors that explain the differences that appear between their degrees of efficiency.

The motivation of research lies in the necessity of identifying some factors specific to the markets and some global factors that explain the deviation from the hypothesis of informational efficiency of the stock markets. So far, the studies that exist on this subject are not very numerous, and their results are contradictory either because of the methodology used or because of the tests associated to the hypothesis of efficiency. *The purpose of the research* lies in the thorough study of the factors that determine variation in time of the degree of informational efficiency of the stock markets, a very useful study both for the foreign investors who diversify their portfolios internationally and for the regulatory authorities that will be able to orient their decisions to increasing the degree of efficiency of the markets.
The research methodology presents some original elements. Firstly, we used recent and performant predictability tests in order to measure the degree of informational efficiency (the Generalized Spectral test, the Generalized Hurst Exponent test, the Automatic Variance Ratio test). The choice of the tests has been a real challenge generated by the abstract nature of the definition of the concept „informationally efficient market". The tests have as null hypothesis the less restrictive version of the random walk model, the absence of linear correlations respectively, or the martingale hypothesis, the lack of linear and nonlinear correlations respectively. Thus, we focused on these two versions of the random walk model especially because the forecast of the first degree moment presents special interest to the investors and because it is considered that the validation of the martingale model is sufficient to accept the weak form efficient hypothesis. Secondly, we have taken into consideration the evolution of efficiency in time by applying the tests on rolling windows, fact that allowed the construction

of proxy measures of efficiency. Thirdly, the dynamic investigation of the relation between efficiency and its determinant factors was achieved with the help of the panel models that present a series of advantages compared to the cross-section analysis or the time series analysis of which, the most important, are the control of the unnoticed homogeneity and the elimination of the problem related to the omission of variables.

Chapter I is highly theoretical, being presented the main theories of the formation of stock prices. It begins with the introduction of the notion of stochastic discount factor and with the presentation of the economic forces that determines it, that is with the rational behaviour of the investors and the behaviour of the investors determined by psychologic factors. At the same time, in terms of the two theories/forces are presented a series of arguments that explain why the presence of short-term correlations, linear and nonlinear, and the long-term ones in the series of returns can be caused by a partial incorporation of the information into stock prices which determine, implicitly, a potential degree of predictability of the stock markets, thus inefficiency. The second part is dedicated to the presentation of one of the most important applications of the theory of rational expectations that still generates intense debates in the literature: the efficient markets hypothesis. We cover the most important moments from the history of this theory, its definitions and forms, as well as the associated econometric models, pointing out the nuances that distinguish one version from the other. The term efficiency is used to describe a market that treats correctly the relevant information concerning the stock prices. In such a situation, the market is informationally efficient, the stock price reflecting the totality of information that led to its formation. The chapter ends with the presentation of an alternative approach, the behavioral finances, that appeared, at least partly, as an answer to the difficulties with which the traditional paradigm is confronting and which sustains that investors do not always act rationally, but have behavioral deviations that lead to systematic errors in the way in which they process the information concerning an investment decision.

The second chapter contains a retrospective study of the tests, methodologies and possibilities of quantifying the relative efficiency of stock markets. Estimating the degree of informational efficiency depends firstly on the characteristics of the tests associated to the hypothesis of efficiency regarding the capacity of detecting both the linear dependencies and the nonlinear ones, of capturing the evolution in time of the detected dynamics and of evaluating the relative efficiency of stock markets. The main object of the first part of the chapter is the presentation of the predictability tests which are divided into two categories: tests for detecting the short-term memory and tests for detecting the long-term memory. Then are presented the main directions from the literature concerning the methodology of applying the predictability tests, which vary from the static approach of efficiency to the dynamic one, more practical, which involves the empirical implementation of the tests on rolling windows, thus succeeding in capturing the persistence in time of the deviations of the stock prices from the random walk model. The presentation of the statistical measures of the informational efficiency degree based on the predictability tests or starting from the synchronism of the stock prices and from the delay of incorporating the information in the stock prices ends this chapter.

The next two chapters contain our own contributions to the literature concerning the explanatory factors of the deviation from the hypothesis of informational efficiency of the

stock markets. We have divided these factors into two categories-specific and global- and we have tested, in several empirical studies, their explanatory power.

The **third chapter** identifies three specific factors of the stock markets that are associated with a higher level of informational efficiency namely the foreign portfolio investments, the investors' protection and the press freedom. The common denominator of the empirical approaches with a view to identifying each factor is represented by the methodology used.
In order to take into account the evolutive nature of efficiency, the efficiency tests were applied to either rolling windows of 300 observations each in subperiods of two years, or to the whole superiod, according to the specific of the test applied. The analysis of the relation between efficiency and each of the three mentioned factors is investigated using different panel regressions in which it is also included a set of control variables to capture the characteristics of the analysed markets.
At the end of each subchapter are presented a series of robustness tests that confirm the relation found between the weak form of informational efficiency and each investigated factor. The presence of the foreign investors, especially on the emergent markets should lead to a growth of their degree of informational efficiency, being given their superior capacity of achieving and incorporating information into stock prices. If the legal mechanism of the investors' protection offer them the certainty of a fair competitive environment, which does not promote the manipulation of the markets but a greater accuracy of financial reporting, the investors will be motivated to actively participate on the respective market, fact that will have a significant positive impact on the development and the performances of it. Moreover, under the terms of a free press that act as an external mechanism for monitoring and controlling corruption and fraud, capable to assure the transparency of the information, the stock prices will reflect more correctly their intrinsic value.

Chapter four is a natural continuation of the research from the previous chapter, making the transition from the investigation of the specific local factors to the investigation of the global factors of the deviation from efficiency. In the context of the financial liberalization of the stock markets, of reducing the governmental intervention, of the progress in the technology of information and of the standardization of the legislation among countries in the last decades, the capital markets have become more and more integrated fact which, undoubtedly, influences their informational efficiency. The empirical approach is the more interesting as it is the first to use a direct measure of integration in the analysis of its impact on the market efficiency and, in addition, is trying to find an answer to the question: „Are the more integrated markets the ones on which the short memory and the long memory manifest more powerfully in periods of crisis?". The first part of the chapter begins with a presentation of the most often met definitions and possibilities of quantifying the integration. Then there are described the sample data (18 developed markets and 20 emergent markets) and the used methodology (the measure R^2 proposed by Pukthuanthong and Roll, 2009). The chapter ends with the investigation of the relation short/long memory and integration, on the whole of the sample and on the subsamples of developed and emergent markets.

The thesis continues the research from the literature in the latest and less thorough direction regarding the hypothesis of informational efficiency, namely the one of the factors that explain the dynamics of predictability on stock markets. Knowing and understanding the way of forming and evolution of the stock prices are aspects that present interest for any investor and regulatory authority of the stock market.

THE SUMMARY OF CHAPTER I.

Theories of stock prices formation: efficient markets hypothesis vs. behavioral finances

The first chapter deals with the main formation theories of the stock prices. The private investors hope that the additional information concerning the behaviour of the stock prices could help them to detect the opportunities of investments and the optimization of diversifying the portfolios. The Central Banks, in their turn, want to form an image about the way in which the decisions concerning the monetary policy (the changes of the interest rate and the monetary offer) influence the stock prices which, in their turn, have an impact on the economic growth, employment and inflation.
In the context of a more pronounced globalization, forming an image of the behaviour of the stock prices has become an even bigger intellectual challenge: the volumes traded on the market are in a rapid growth; the financial products prove to be more and more complex and interdependent within the international market segments; the cross-border capital flows are increasing; the number of participants on the market from different currency areas is also increasing; also the regulatory environments are becoming more and more important for the private and institutional investors' decisions to buy and to sell.

In general terms, the ideal is a market on which the prices offer precise signals for an optimal allocation of resources. Applying the Arrow-Debreu general model of balance on financial markets, the price of each traded asset can be calculated as a balanced or up-to-date sum of the possible future gains generated by this one in different states of the system. And, because discounting and the risk cannot be ignored, the tests of the basic implications of the competitive economy must take into account the properties and the determiners of the discount factor. In literature there are two paradigms that explain the discount factor: one based on the rational behaviour of the investors and the other one based on the psychological models of the investors' behaviour – the behavioral finances.

John Muth was the first who, in 1961, stated explicitly the rational expectations hypothesis of investors: an expectation is rational if it incorporates optimally the totality of the available information. One of the oldest and remarkable applications of the theory of rational expectation is represented by the hypothesis of informational efficiency of the stock markets developed by Fama (1965, 1970). According to this hypothesis, on an informationally efficient market, the stock prices fully reflect the available information at all times. In this situation, the stock price is in equilibrium against this available information and will fluctuate only in response to the arrival on the market of new information which, by its nature is random, printing thus a random walk behavior to stock prices.

On such a market, it is impossible for an investor to predict the stock price and to obtain systematic profits because the best prediction based on historical prices is the present price, and price changes are independent and identically distributed (i.i.d.). This is the essence of the weak form of informational efficiency which implies in a restrictive approach a random walk model. The more a market has a higher degree of efficiency, the more random the sequence of price changes will be the highest degree of efficiency being recorded when the prices are completely random and unpredictable.

The imperfect gathering of information may lead to the decrease of the degree of informational efficiency, and, implicitly allocative of a competitive capital market. If more and more participants on the market did not invest in information, then less and less information would be incorporated in prices, these ones becoming noisy (Fama, 1970; Samuelson, 1965). However, on an open market, where there are numerous participants who are trying to maximize their profit, it is expected that the arbitrage will determine the increasing of the degree of market efficiency. The investors on the market will exploit even the smallest informational advantage they have, incorporating, thus, their information in prices and eliminating the profit opportunities.

Until three decades ago, many economists believed that the hypothesis of informational efficiency had to be true due to the arbitrage forces and that the investors had a rational behaviour or one impossible to formalize. But, once with the studies of the psychologists Kahneman and Tversky, the iterature grew rich with a long list of empirical findings of the ways in which the people form their expectations and make their choices. Starting with the 1980s, more and more theoretical models have been developed that are based on less rational agents, laying the foundation of a new theory as an answer to the difficulties with which the traditional paradigm is confronting: the behavioral finance. The new alternative theory is trying to explain the decision making process of the investors taking into consideration the psychological and emotional aspects of the decisions and focusing on the difference between price and value, postulated by the prospect theory (Kahneman and Tversky, 1979). The behavioral finance manages to find psychological explanations of the individuals' decisions, but fails to explain how the individuals' future decisions will look like. The decisions that the individuals sustain daily are constrained by psychological, emotional factors and are rarely based on a rational economic logic. Also, the theory states that the arbitrage experts (the rational experts) cannot correct the irrational investors' mistakes because the arbitrage is risky and implicitly limited, fact that leads to an incorrect evaluation of the stock prices.

Although there is still no consensus concerning the interpretation of some results of the informational efficiency studies or of the behavioral finance, the research initiated by Fama (1970), Shiller (1981, 2000) and Hansen (1982) offered numerous solid empirical findings that have important practical implications:

- on a short-term, the predictability degree is so small that the profit obtained is annulled by the transaction costs, the stock prices incorporating the new information rapidly;
- on a long-term, there is a significant degree of predictability indicating the variation of expected return which alternates with short periods of absence of linear and nonlinear correlations (of efficiency).

What can be said about the stock prices at present? Perhaps the most relevant answer is the one given by Fama in an interview offered to the daily „The New York Times", shortly after winning the distinction:

"If I were to characterize what differentiates me from Shiller or Thaler, it's basically we agree on the facts — there is variation in expected returns, which leads to some predictability in returns. Where we disagree is whether it's rational or irrational. And there's nothing in the available evidence that allows one to really settle that in a convincing way. The stuff that both Shiller and I have done has been very illuminating in terms of the behavior of returns. The interpretation of that is open for reasonable disagreement."

THE SUMMARY OF CHAPTER II.

The deviation from the informational efficiency: possibilities of quantification. The evolution of the degree of informational efficiency

Based on the argument that a stock market cannot be perfectly informationally efficient, Campbell et *al.* (1997) introduced the concept of *relative efficiency* which implies the comparative evaluation of the degree of informational efficiency of the stock markets. The common characteristic of the classical studies is represented by the absolute efficiency, where the conclusions are drawn following the tests applied during the whole studied period, without taking into account the possible alternation of the subperiods with different degrees of efficiency. Such a possibility, in which there is an informational efficiency dynamics, is sustained by the theory of adaptive markets developed by Lo (2004). This theory is trying to reconcile the hypothesis of efficient markets with the behavioral finance by applying the evolutionist principles. This new theory postulates that efficiency varies in time, the investors' opportunities to gain appearing sporadically.
The literature of the last decade has begun to evolve in this direction by delevoping some measures and methodologies that allow quantifying the deviation from informational efficiency of thestock markets. Two great categories of measures of efficiency deviation can be identified, the one(s) based on predictability tests and the other(s) that capture the synchronism of the stock prices, namely the delay in incorporating the information into prices.

The central objective of this thesis is to investigate and identify the factors that lead to the deviation from the informational efficiency of the stock markets. The first step in such an approach is to look over the main efficiency tests and to present the main statistical measures used in the literature to measure the relative efficiency or the deviation from efficiency. These measures will be used as an endogenous variable in the empirical investigations from the following chapters. The vast majority of the tests and statistical measures from the literature are built starting from the hypothesis of unpredictability that must characterize a market or a financial asset under the conditions of an informationally efficient market.

In this chapter we have made a presentation of the predictability tests used in the literature, and also of the methogologies and of statictical measures proposed to quantify the relative efficiency of the stock markets, being aware at the same time of the limits of our endeavour given the vast existing literature.

The predictability tests capture the investors' capacity to predict the future evolution of the stock prices based on the past evolution and/or on the accounting and financial data. In the empirical investigations from this thesis we limit to the direct tests of the short-term independence (tests from the family of variance ratio, portmanteau tests, spectral tests) and to those of autocorrelation on long term (based on the Hurst exponent or fractal analysis).

The inflexibility in the empirical implementing of conventional efficiency tests made difficult the comparison of efficiency of stock markets and, consequently, limited the conclusions of the studies to the verdict „the market is efficient" or „the market is not efficient". More exactly, taking into account the null hypothesis of these standard statistical tests, its rejection would indicate the presence of short-term linear correlations, fact that is in contradiction with

the hypothesis of efficient markets. For this reason, the concept of relative efficiency defined by Campbell et *al.* (1997) did not generate the expected attention from researchers. But, once with the availability of some advanced/performant statistical tests, the retrospective studies of Lim et *al.* (2006) and Lim and Brooks (2011) demonstrated that in the recent researches the emphasis moved from investigating the absolute efficiency hypothesis to a more practical form of efficiency that contests the classical hypothesis of the efficiency tests which sustain that the markets are in a equilibrium state. More exactly, this research group showed that it is not indicated to state the question of efficiency of emergent stock markets in an absolute sense, especially of the ones in transition, as if they were born "mature". The main reason is that, when a market opens, it is hard to believe that it is efficient, because it requires time for the process of price dicovering to become known. Nevertheless, as the markets function and their microstructure develop, in a certain period of time, they are likely to become more efficient. Consequently, the more relevant research question is if and how these markets are more efficient, and such a question cannot be answered with certainty with classical approaches that involve a fixed level of efficiency during the whole estimation period.

Jensen (1978) noted in Journal of Financial Economics: „I believe there is no other proposition in economics which has more solid empirical evidence supporting it than the efficient market hypothesis." (Jensen, 1978: 95). However the re-examining of the literature so far shows that, although the majority of the researches could not reject the informational efficiency hypothesis, the empirical results vary from acceptance to total rejection. Due to the fact that the non-validation of the efficiency hypothesis in the weak form implies the non-validation of the two other forms, most of the studies have limited to the investigation of this form which sustains that the stock price fully reflect all the information contained in its history.

Following Lim and Brooks (2011), we have divided the studies concerning the weak form of the informational efficiency into four groups:

- *studies in which the random walk tests have been applied over the full sample period* – in this category we find the most numerous studies that investigate the predictability of the stock prices and which try to find an answer to the question: „is the stock market analysed weak form efficient in an absolute sense?", starting from the assumption that the informational efficiency is a static characteristic that remains unchanged during the different stages of development of the markets.

- *studies in which the random walk tests have been applied on non-overlapping windows*, starting from the motivation that it is more important the understanding of the forces that determine a market to become efficient than investigating the idea of „all or nothing". Following Lim and Brooks (2011), we have divided the studies according to the event that has an impact on efficiency in seven subcategories. Thus, we have studies which analyse the impact on the efficiency of opening of domestic stock market to the foreign investors, of adopting an electronic trading system, of the implementation of a price limits system, of occurrence of a financial crisis (Asian and global especially), of changes in regulatory framework, of technological and informational changes and of social and political events. The results of these studies are, in general, inconclusive especially when the statistical tests used either reject or do not reject the random walk hypothesis in both subperiods – before and after the

event. Nevertheless, the research methodology reveals the dynamic character of market efficiency.

- *studies that are based on econometric models with time varying parameters estimated by Kalman filters* – in this category are included the studies that use models capable of capturing the dynamic of the efficiency by estimating the variable parameters of these ones. Zalewska-Mitura and Hall (1999) named these models „*tests for evolving efficiency*", considering that they offer a quantitative measure of the convergence time and speed towards efficiency. Besides, they allow the detecting of the inefficiency periods in an endogenous manner.

- *studies in which the random walk tests have been applied on rolling windows* – the methodology of rolling windows has the advantage of capturing the persistence of the deviations of the stock prices from the random walk model through time. According to Timmermann (2008) the episodic manifestation of dependence is caused by structural changes in the process of evolution of the stock price and by exogenous events; he also considers that the length of the window must be sufficiently small to allow the capturing of the predictability dynamic and big enough to assure a good performance of the test used.

Unlike the methodology of non-overlapping windows which does not allow the evaluation of the impact of some factors on the informational efficiency of the stock markets, the methodology of rolling windows comes to compensate this shortcoming laying stress not on absolute efficiency but on the relative one. This thing marked the beginning of a new series of studies that suggest different statistical measures to quantify the degree of informational efficiency of the markets. In a chronological approach, the measures based on predictability are the median value of the Hurst exponents, the percentage of windows in which the random walking hypothesis is rejected, absolute measures, measures specific to multifractality and the generalized measure of Kristoufek and Vosvrda (2013). To these ones, we add the ones based on the synchronism of the stock prices or on the speed of incorporating the information into prices. All these measures suggested so far in literature do not lead to a unique classification of the markets in terms of efficiency, but determine different results according to the period and the studied sample and/or the measure used.

THE SUMMARY OF CHAPTER III.

The influence of stock market specific factors on informational efficiency

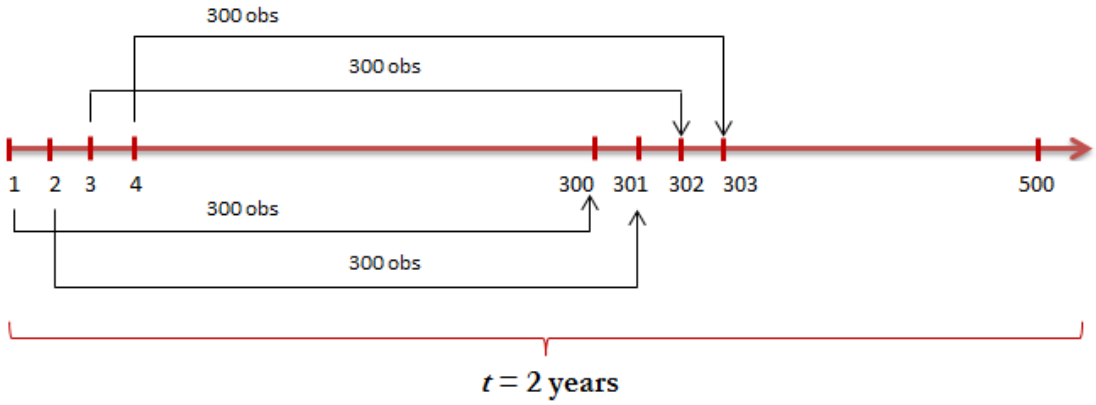
In the vast majority of weak-form efficient market hypothesis, there are few studies which identify the underlying factors associated with higher efficiency through a dynamic analysis using panel models. Those identified factors include the opening of domestic stock market to foreign investors, the changes in regulatory framework, the adoption of an electronic trading system, the implementation of a price limits system and the occurrence of a financial crisis. Unfortunately, these studies do not set light on the driving forces of the market efficiency mainly due to the research methodology which tests the random walk hypothesis in the subperiods of pre- and post-changes. Thus, the results may be inconclusive when the adopted tests either reject or do not reject the random walk hypothesis in both subperiods. In order to explore the factors associated with a higher degree of efficiency, a more appropriate approach is to examine the efficiency in the relative rather than absolute sense.

In this chapter we investigate the impact of stock market specific factors, namely the foreign portfolio investment, investor protection and press freedom, on informational efficiency. We chose these three factors because in the literature there are only a few studies investigating their impact on stock market efficiency. Our major contributions are:

- the usage of recent and robust efficient tests, challenge caused by the abstract nature of the definition of an informationally efficient market;
- the dynamic investigation of the relation between the variables using different panel regressions in which we include a set of control variables that captures the specific features of the investigated markets;
- the usage of several robustness tests in order to verify the validity of the results.

The efficiency tests employed have the best performances against their competitors as Charles et *al.* (2011) and Barunik and Kristoufek (2010) showed through Monte Carlo simulations. The linear dependencies are detected by the Automatic Variance Ratio (AVR) test of Kim (2009), the Generalized Spectral (GS) test of Escanciano and Velasco (2006) is employed especially for the nonlinear dependencies, while the long memory is investigated through the Generalized Hurst Exponent (GHE) test proposed by Barabasi and Vicsek (1991). All the three tests employed in this study perform well only in large samples, of at least 300 observations for the short-memory tests and 500 for the long-memory test. Because there is no consensus in the literature regarding the length of the window, we chose 300 observations. According to Timmermann (2008) the length of the window should be as small as possible in order to capture the dynamics of the predictability in time, yet large enough to have high performance of the test. Therefore, we divided the whole sample period in intervals (t) of 2 years length and quantified the efficiency differently. Given the high temporal variability of the p-values, we apply the short-memory tests in a rolling window of 300 observations, reducing at the same time the sensitivity to the choice of the first day of the sample. The p-value is computed in the first window, and then the sample is rolled one point forward eliminating the first observation and including the next one for the re-estimation of the p-value according to Figure 1.

Figure 1. The rolling window approach



Source: own processing.

For each index, we calculate in t, the percentage of time windows in which the *p-value* is less than 5%, denoted as $Percent$. Determining these percentages over the full sample period would not allow taking into consideration the time-variation of the degree of efficiency and would constrain the analysis to a cross-section one. In contrast, we estimate the generalized Hurst exponent on the whole interval t for each index due to the higher stability in time of Hurst exponents and because the rolling window approach requires in this case a window of at least 500 observations. Since deviation from 0.5 indicates the presence of long run dependence, the indicator measuring the efficiency will be $IE_{it} = |GHE - 0.5|$.

The first study of this chapter investigates the relation between the stock market efficiency and *foreign portfolio investment* using data for twelve Central and Eastern European stock markets over the period 1999–2010. Our panel regression results, supported by a series of robustness tests, show a direct and significant relation between foreign portfolio investment and efficiency, regardless of considering short or long run dependence. The quantification of foreign portfolio investment through *de facto* measures, namely net equity inflows, and cross-border portfolio investment holdings leads us to conclude that the involvement of foreign investors in these markets is a positive factor of the degree of efficiency. The fact that *de jure* stock market openness measures are not significant factors of efficiency shows that taking measures to open these markets to portfolio flows is not enough. In addition, as expected, market capitalization and turnover ratio are two other determinants of efficiency in these markets.

We can identify several interdependent channels through which the presence of foreign investors in Central and Eastern European stock markets should lead to an increase in their degree of informational efficiency. First, foreign portfolio investment raises the liquidity in these markets, which stimulates the arbitrage activity (Chordia et *al.*, 2008), and thus, there should be a faster capitalization of information into stock prices and smaller departures from a random walk benchmark. Second, according to Bae et *al.* (2006), foreign investors require transparency and stricter disclosure rules and these, in their turn, improve the information environment in emerging stock markets. Third, according to the theoretical model of Albuquerque et *al.* (2009), local investors underreact to global news because they do not have immediate access to them or do not have enough analysis capacity. In contrast, foreign investors obtain information faster and have superior capacity to incorporate global news in security prices (Bae et *al.*, 2012). Finally, foreign investors' need to manage risks will lead to

the development of derivative markets with stabilizing effect on spot markets. Lien and Zhang (2008) reviewed the literature on the price discovery function of derivative markets and show that a financial derivative market stimulates the capital inflows into emerging markets. At the same time, the use of financial derivatives leads to higher volatility and accelerated outflows.

The legal mechanism of *investor protection* is thought to play a key role in the well-functioning of equity markets. Pioneering studies of La Porta et *al.* (1997, 1998) have shown that the architecture of these mechanisms has a significant impact on the development and performance of stock markets. The hypothesis of a direct relation between the informational efficiency of stock markets and investor protection was first highlighted empirically by Mork et *al.* (2000) and attributed to the increased possibilities of investors to perform arbitrage in markets with high investor protection due to their transparency and better information. Arbitrage will lead to a better incorporation of firm specific information into prices, generating a reduction in their synchronism. Further empirical studies confirm (Daouk et *al.*, 2006; DeFond et *al.*, 2007) or reject (Griffin et *al.*, 2006) this hypothesis. The motivation of our work arises from the fact that there are only few studies investigating the relation between the predictability of stock prices, as a weak-form informational market hypothesis test, and the investor protection. Moreover, these empirical results surprisingly indicate that investors protection is generally insignificant. The common denominator of these studies is the cross-section analysis whose main drawback is that it does not take into consideration the time-varying characteristics of efficiency. The aim to investigate dynamically the relation investor protection – efficiency requires the use of various proxy variables for investor protection which must have time-variability, fact that limits significantly the area of choice. The most common measures of investor protection have no time dimension which limits the econometric approach to cross-section analysis. We refer here to the anti-director rights index of La Porta et *al.* (1999), the shareholder protection index of La Porta et *al.* (2006), the anti-self-dealing index of Djankov et *al.* (2008) or the revisited anti-director rights index of Spamann (2010). According to Bekaert et *al.* (2011) and Poshakwale and Thapa (2011), a first category of measures which take into consideration time-varying investor protection, can be represented by different sub-components of International Country Risk Guide's (ICRG) political risk ratings : investment profile, quality of institution and law and order. The second category of measures comes from the World Bank Doing Business database which evaluates three dimensions of investor protection: transparency of transactions measured by extent of disclosure index, liability of self-dealing measured by extent of director liability index and shareholders' ability to sue directors for misconduct measured by ease of shareholder suits index. The last proxy measure of investor protection is a dummy variable – country's legal origin – which is equal to 1 for common law countries and 0 for others. According to La Porta et *al.* (1998), the countries with English Common Law offer better investor protection than those with German, Scandinavian or French Civil Law.
Our panel regression results show a direct and significant relation between investor protection and efficiency on a sample of 49 stock markets indices over the period 1999-2010, results that are supported by a set of robustness tests. Thus, the improvements in legal and political institutions will lower the cost of liquidity in stock markets, fact that stimulates the arbitrage activity with positive effects on efficiency.

Freedom of the press reflects the degree of freedom of journalists and media organizations in each country and the efforts of the authorities to respect and ensure the respect for this freedom. In a free environment any news immediately becomes public through various

channels, print or electronic, while in a constrained or unfree environment, characterized by a low degree of disclosure, media becomes a target for those who want to control the news. The freedom of the press has experienced over time a positive evolution especially in democratic countries. However, the report of press freedom issued by Freedom House in 2014 denotes an overall pattern of decline, largely due to the situation in the Middle East and North Africa. Thus, despite the openings created by transnational media, the internet and privatizations of broadcasting, there still are various threats which restrict the ability of journalists to operate and the public access to information. In an economic environment in which the media have a high degree of freedom, agents are unable to hide negative information or disclose it gradually. In contrast, in restrictive environments, the stock markets will register a lower frequency of negative price changes, i.e. a reduction of negative asymmetry of returns, as economic agents tend not to disclose negative information to the market. In the literature there are many studies which sustain that the gradual diffusion of information among investors affects the stock prices, but very few are those that investigate the impact of press freedom on the informational efficiency of stock markets.

To the best of our knowledge this study is the second (after Kim et *al.*, 2014) to investigate the relationship between informational efficiency and press freedom on a sample of 41 stock markets over the period 1999 - 2012. Our major contribution is the use of an Efficiency Index proposed by Kristoufek and Vosvrda (2013) which combines partial measures of efficiency controlling for different types of correlations (short term - linear and nonlinear - and long term). In the simplest approach, an efficient market is a market in which there is no correlation structure of returns. Thus, we can determine the expected values of long memory and of percentage of windows in which linear or nonlinear dependencies occur for an efficient market to construct an efficient measure based on distance from the efficient market state. The empirical results indicate that nonlinear dependencies occur with greater intensity than the linear or the long term dependencies. But regardless of how we quantify the degree of informational efficiency, we find a direct relation between press freedom and efficiency which is confirmed by the robustness tests also. Market capitalization and volatility are two other determinants of efficiency whereas the degree of market openness has influence only on the long-run by generating long memory in series of returns.

THE SUMMARY OF CHAPTER IV.

The impact of market integration, as a global factor, on informational efficiency

The last decades have witnessed a growing progress in information technology, deregulation of domestic financial market, standardization of legislation across countries and the removal or relaxation of foreign ownership restrictions which all lead to increased trade and foreign investments. An important consequence of these reforms is reflected in a gradual increase of the degree of market integration. The financial crisis in October 1987 marked the beginning of a growing interest on investigating the connection between stock markets given the direct implications on the benefits obtain by investors after international diversification of portfolios. The interest on this subject has been amplified by the phenomenon of financial liberalization and the gradual relaxation of controls on capital mobility. Not only the OECD countries have reduced their capital control to the lowest point in the past fifty years, but also the emerging countries have increased their financial linkages with the worldwide economy. However, not all countries have benefited from financial liberalization. Its effects depended largely on certain thresholds, such as increased quality of institutions and developed national financial sectors (Masten et *al.*, 2008), that should have been overcome before the beginning of liberalization process (Chinn and Ito, 2006). Countries which have not been prepared have faced a slow economic growth, recession, and even financial crisis (Wei, 2006).

Emerging and frontier stock markets have experienced in the last decades different dynamics of integration as a result of gradual financial liberalization and partial opening of their economies. Bekaert and Harvey (2014) note that the integration process of developing markets is incomplete and has significant influence over the portfolio management. In the process of portfolio diversification of institutional investors, these markets may be seen as a distinct asset class and the choice of an active or passive investment strategy depends decisively on their degree of informational efficiency.

Without question the dynamics of integration should have an impact on the informational efficiency of stock prices, but the abstract nature of the two terms and also the questionable measures proposed in the literature raise serious difficulties in investigating this relation. The research approach in this chapter is a natural one that makes the transition from the investigation of specific factors in Chapter III to the investigation of global factors which explain the deviation from efficiency. Financial liberalization was treated in the previous chapter as a specific factor to each market, this being a necessary, but not a sufficient condition for a market to become integrated and thus to respond faster to global shocks. Various *de jure* and *de facto* indicators of financial liberalization empirically investigated in the previous chapter measure different facets of market openness and not the effective integration. The existence of indirect barriers such as availability of information, different accounting standards, investor protection and country risk discourages foreign direct investments and foreign portfolio investment. Also, under-development of the institutional environment (Stultz, 2005) and political crises (Frijns et *al.*, 2012) may lead to different levels of market integration in terms of a similar degree of market openness.

The two concepts, market integration and market efficiency, were generally treated separately in the literature. Thus, Rockinger and Urga (2001) and Schotman and Zalewska (2006) were among the first to investigate simultaneously the degree of integration and the degree of efficiency of stock markets over time, but without examining the empirical relation between

the two. Until now, to the best of our knowledge, the only ones who have investigated the relation integration – efficiency are Hooy and Lim (2013). On a sample of 50 developed and emerging stock markets, they find a direct significant link between the two variables only in the case of emerging stock markets. The debate on the benefits of a complete financial liberalization should weigh the costs of macroeconomic and financial stability with the economic growth and the efficiency gain. This is relevant given the potential effects of efficiency stock markets to the real sector, in particularly on the allocation of investment resources.

In this chapter we investigate the relation between the degree of predictability, measured through short and long memory tests, and integration in case of 18 developed markets and 20 emerging markets for the period 1999-2013. The interest to examine the relation short/long memory – integration is based on several considerations.
First, we can formulate two opposite hypotheses regarding the relation short/long memory – integration of stock markets. According to the first hypothesis, a high degree of integration should lead to a reduction of short/long memory of stock markets. An integrated market responds better to global factors due to the presence of foreign investors. They have a superior ability to incorporate global information into stock prices (Bae et *al.*, 2012), and their arbitrage operations will determine a decrease in long memory. The second hypothesis argues that integration induces long memory in stock prices because of the heterogeneity of investment horizons of foreign investors. The interaction between investors with different investment horizons (time scales) generates several effects such as volatility cluster and trend persistence. In support of the two hypotheses there are a series of studies showing that when markets are highly integrated, due to the phenomenon of contagion generated by financial crises, the short/long memory is even more pronounced in some markets (Lim et *al.*, 2008; Horta et *al.*, 2014; Hasan and Salim, 2014). In contrast, there are arguments and empirical studies that contradict this idea and reveal that in times of crisis the short/long memory is reduced (Todea and Lazăr, 2012; Lazăr et *al.*, 2012; Kristoufek, 2012; Tan et *al.*, 2014) .

Second, the relation integration – predictability of asset returns has not been studied using a direct measure of integration. Hooy and Lim (2013), as previously mentioned, are the only ones who found a positive impact of integration on the informational efficiency of emerging markets, but they used a price delay measure. In this chapter we investigate whether the same conclusions are obtained if we use for efficiency proxy measures based on predictability.

Third, it is known that especially the emerging stock markets more integrated experience larger price drops during global financial crisis (Bae and Zhang, 2014). It is interesting to see whether this phenomenon is accompanied by a negative impact on efficiency, manifested by an increase of stock prices predictability. More specifically, the question is whether the more integrated the markets the stronger is their short and long memory during a crisis. This possible result could generate an interesting debate for the regulatory authorities on the intention of full liberalization of capital flows.

To measure the market integration we use the R^2 proposed by Pukthuanthong and Roll (2009), which reflects the explanatory power of a number of global factors for the individual country's stock market returns. To estimate R^2 we have regressed the index returns on 10 global unobservable factors extracted with Principal Component Analysis. This method allows the condensation of variables that explain the variation of returns in each market into a small set of common risk sources. In the extreme case, when the 10 factors explain the entire

variation of index returns R^2 is equal to 1.00 and the market is fully integrated with the world market. When R^2 is equal to 0.00, the stock market is completely segmented.

The summary statistics on efficiency and integration are generally in line with expectations. The developed stock markets have a much higher degree of integration than emerging ones, the majority having the median of $R^2 > 0.8$. In case of emerging stock markets, excluding the more developed countries such as South Africa, Korea, Mexico and the countries in Central and Eastern Europe, R^2 is less than 0.4. At the extreme, the stock markets of China and Egypt are basically segmented. When comparing the results of the AVR and GS tests we observe that nonlinear dynamics are much more frequent than the linear ones. As regards long memory, the results reconfirm the conclusions of Di Matteo et *al.* (2004, 2005) according to which antipersistence ($H < 0.5$) is a characteristic of developed markets while persistence ($H > 0.5$) is specific to emerging markets. Although both phenomena are deviations from random walk, the vast majority of researchers consider only the persistence as a manifestation of long memory and implicitly of potential predictability. Therefore, we analyse the relation long memory – integration only on the subsample of emerging markets.

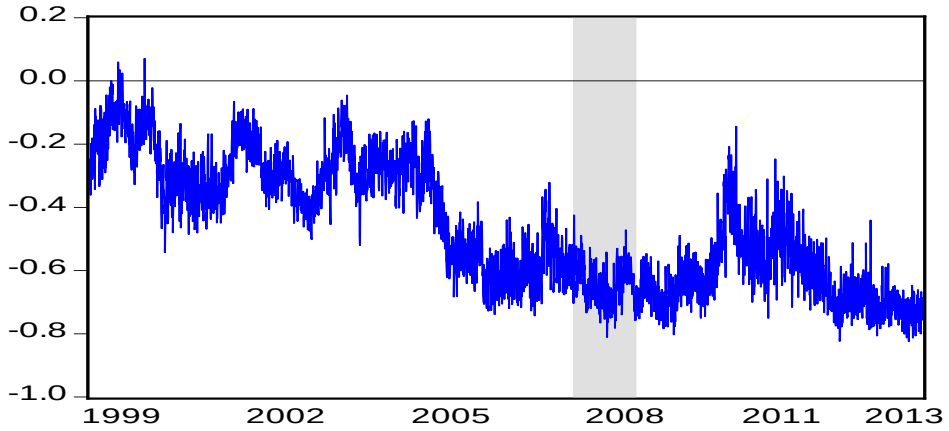
The presence of linear/nonlinear dependencies in the series of returns may be due to partial price adjustment and to other causes which are not related to the informational efficiency. Anderson et *al.* (2013), in the case of US securities, shows that this correlation may be generated also by the nonsynchronous trading effect, the bid–ask bounce and time-varying risk premia. However, the empirical results of this market microstructure study show that the linear and nonlinear correlations are mostly caused by partial price adjustment and hence by inefficiency. In this context we consider that the dependencies detected by the AVR and GS tests are mainly generated by inefficiency.

The results of the models estimated on the whole sample and separately on developed and emerging markets indicate a direct relation between integration and informational efficiency. Thus, it is observed the positive effect of integration on efficiency, evidenced by a decrease of serial correlation and an increase of integration at the same time. Also, the recent global crisis has not affected the intensity of linear dependencies. In addition, there is no marginal impact of integration on efficiency during the global crisis. If the measure of efficiency considers especially the nonlinear dependencies (GS test), there are some differences compared to the previous situation when the AVR test was able to capture only linear dependencies. First, in case of developed markets there is no significant positive impact of integration on the informational efficiency. One explanation could be that most developed markets have $R^2 > 0.8$ and there is no variability of integration in cross-section (the only exception is Portugal). Second, the global crisis has a positive impact on informational efficiency. Moreover, there is a positive marginal effect of integration during the global crisis on the whole sample and in case of emerging markets. In other words, the markets which are less integrated are the markets that are affected by the crisis in terms of informational efficiency.

As regards the relation efficiency – long memory, analysing all the 20 emerging stock markets, a first image can be obtained easily by determining Pearson's correlation coefficients in cross-section. For each window the coefficient values are plotted in Figure 2. The negative correlation between H and R^2, respectively the positive impact of integration on informational efficiency observed in each country in the previous paragraph, can be found on the entire sample. In the first subperiod (until 2005), due to a low degree of integration of

emerging markets, the intensity of the relation is weaker, the correlation coefficients ranging between 0 and -0.4. In the second subperiod, the degree of integration of emerging markets increased and the relation becomes stronger, the correlation coefficients ranging between -0.4 and -0.8 in general. Interesting are the values of correlation coefficients obtained during the global crisis, which oscillate around -0.6. They indicate that despite the increase in long memory in this period, the markets more integrated are the less affected by the crisis.

Figure 2. Cross-section correlations between H and R^2



Source: own processing

On a more rigorous analysis based on the estimation of econometric panel models, it can be observed the positive impact of integration on informational efficiency and the additional positive effect of integration on efficiency during the global crisis. Therefore, reducing or removing the controls on capital mobility results in increased market integration with positive impact on their informational efficiency even during the turbulent periods of financial crisis.

GENERAL CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

This paper represents a small step towards a better understanding of stock prices formation and evolution and of the role of stock markets in a country's economy. Financial theories can be subjective. In other words, there is no universally accepted law in Finance, but rather ideas/concepts that attempt to explain how markets work.

The efficient market hypothesis, for which Eugene Fama won the Nobel Prize in 2013, is one of the most controversial and extensively studied theories in Finance. Despite the progress in statistical analysis and the improvements of stock data and theoretical models in terms of quantity and quality, there is no general consensus among economists regarding the validity of this theory. One reason could be that for about two decades, the empirical approach was based on the idea of absolute efficiency. Even Fama (1965, 1970, 1991) admits that the extreme version of the market efficiency which asserts that stock prices reflect all available information is questionable, recognizing that the hypothesis itself is difficult to test because of the inevitable joint hypothesis problem (choosing the model of market equilibrium to characterize the behavior of investors).

Thus, in this paper we adopted a more appropriate research strategy and stopped treating market efficiency as a "yes" or "no" question. As described by Lee (2001), given that the stock markets are in a continuous state of adjustment, market efficiency should be viewed as a journey and not a destination. Therefore, our research has focused on the concept of relative efficiency that allows us not only to compare the informational efficiency of stock markets, but also to explore through panel regressions the factors associated with a higher level of efficiency. The recent studies employ the rolling windows methodology, the general consensus being that market efficiency is a feature that continuously varies in time, with alternating periods of efficiency and inefficiency. This methodology reveals how often the random walk hypothesis is rejected by the test statistic over the full sample period. Specifically, the relative efficiency is deducted from the percentage of windows with a significant test statistic: the higher the percentage is the more frequent the stock prices deviations are and hence the lower the degree of informational efficiency is. Our empirical approach, in which the measure of efficiency based on predictability tests applied on rolling windows is calculated on subperiods of two years and used as endogenous variable in panel regressions, it can be considered an element of originality. But our most important contribution to the literature is the identification and validation of four factors that influence the informational efficiency of the international stock markets.

Three of these factors – foreign portfolio investments, investor protection and press freedom – are considered to be specific for each stock market. First, foreign portfolio investment raise the liquidity in these markets, which stimulates the arbitrage activity (Chordia et *al.*, 2008) and leads to a better reflection of companies' fundamental values in stock prices, and can help promote the opinions of foreign shareholders concerning the corporate governance of local firms, resulting in a higher degree of public disclosure and alignment with international standards of financial reporting. In our study we identified on a sample of 12 Central and Eastern European stock markets for the period 1999-2010 a direct and significant relation between the *de facto* measures of foreign portfolio investment and efficiency, regardless of

the type of dependence – short or long run – taken into account when determining the measure of the degree of informational efficiency.
Second, stronger investor rights are associated with a lower market risk, lower cost of equity and increased arbitrage opportunities on those markets that offer high protection due to their transparency and better information. The increase of the degree of informational efficiency in those markets whose legal mechanism of investor protection is designed to enhance the confidence in investment opportunities in a market and to reduce information asymmetry it is confirmed by the empirical results obtained over the period 1999-2010 on a sample of 49 stock markets.
Third, a free press that can operate without fear of repercussions and over which there are no economic and political pressure made on its content and broadcasting of news, leads to greater transparency with positive impact on the degree of informational efficiency of stock markets. In this study we found that the correlation structure of 41 stock markets returns during 1999-2012 tends to diminish as the restrictions on the press / media are eliminated. In addition, the results indicate that nonlinear dependencies manifest themselves with greater intensity than the linear or long-term dependencies. But regardless of how we quantify the informational efficiency, the relation press freedom – efficiency is a direct one confirmed also by the robustness tests: an independent media that does not have to make compromises because of financial difficulties increases the ability of stock prices to incorporate the available information.

The fourth impact factor of efficiency, the market integration, drew our attention in the context of the recent gradual financial liberalization which has been reflected in powerful interconnections between markets. In addition, we observed that in the literature, except for two or three studies, the two concepts – integration and informational efficiency – are treated separately. Therefore, our research is relevant for the following reasons. First, it is the first to investigate the impact of integration on the efficiency of emerging and developed stock markets using a direct measure of integration and proxy measures based on predictability for efficiency. Second, it verifies which of the two hypotheses regarding the relation integration - efficiency is validated, ie a direct or an indirect relation. In the case of a direct relation, integration can be viewed as the result of opening markets to foreign investors; this facilitates a more rapid incorporation of global information into stock prices (Bae et *al.*, 2012). In case of an indirect relation, market integration can induce long memory in returns because market participants have heterogeneous investment horizons. Third, the study analyses the impact of the recent global crisis on the degree of informational efficiency and integration of emerging stock markets, based on the assumption that during a global financial crisis the market risk is higher in emerging markets. The empirical results indicate a significant direct relation between integration and informational efficiency on the whole sample, regardless of the type of memory in returns taken into account. But the impact of the global crisis on the informational efficiency is different: in case of short memory it is positive and negative in case of long memory. Moreover, the results of panel models show that the relation efficiency - integration depends on the level of market integration. The integrated markets are those that suffer less loss of informational efficiency in times of crisis. This supports the liberalization efforts of the last decades.

Our analysis may suffer from a number of limitations which have to be the subject of further research. First, the investigation of the degree of informational efficiency and of the underlying factors associated with higher efficiency should be extended at the level of individual stocks. Samuelson (1965) has offered the dictum that stock markets are in general

"micro efficient" but "macro inefficient", which might no longer be valid due to the high performance of the recent efficient tests. But such an approach will raise additional problems in measuring, for example, the investor protection at the firm level.

Second, according to Griffin et *al.* (2010) the predictability tests can yield misleading inferences because they do not account for the information environment. Thus, the limited information set available to investors, as well as the different speed in the incorporation of information into stock prices can lead to deviations from random walk which do not correspond to the same extent with the deviations from efficiency. Using other tests apart from predictability tests would bring new empirical evidence. Hillmer and Yu (1979: 321) highlight that: "*no matter how rapidly a market adjusts to new information, the adjustment process cannot be completed instantaneously*". Therefore, the efficiency measure should be based on the speed of information incorporation in stock prices. Though previous studies have analysed significant firm-level determinants of price delay, some of them still require further investigation. For example, Brennan *et al*. (1993) show that an increase in the number of analysts following a firm has a positive impact on the speed of adjustment. Is this result due do to analysts who facilitate the dissemination of public information to the investors? Chordia and Swaminathan (2000) find that the trading volume of stocks used as proxy for illiquidity and investor inattention influences the speed of information incorporation in stock prices: low trading volume stocks respond more slowly to market-wide information than high trading volume stocks. Can it be that investors are not paying attention to low trading volume stocks and that is why they take a longer time to reflect new information? Barberis et *al*. (1998) proposed a theoretical model in which under-reaction to information occurs because investors exhibit a conservatism bias, but this behavioral explanation is difficult to test empirically. Thus, a promising start would be to find some answers to the questions above, although it will be challenging to find suitable proxies for limited investor attention and slow dissemination of information.

Another direction for future research might be the impact of integration on sectors. Pukthuanthong and Roll proposed in 2014 a methodology to estimate R^2 for securities and would be interesting to study the relationship integration – return-risk ratio to identify the opportunities for portfolio diversification in different fields. In addition, following the study conducted in Chapter IV we found a decrease in the degree of integration of emerging markets since 2012. In a detailed future analysis we try to find explanations for this phenomenon, which in many markets is associated with a decrease of the degree of informational efficiency.

Although we intuit several interdependent channels through which a high investor protection is associated with a higher degree of efficiency, in future research we will try to see if they are valid. Investor protection laws encourage more accurate financial reporting (Leuz et *al.*, 2003) which leads to a higher informational content of the annual earnings announcements (DeFond et *al.*, 2007), having the effect of a better reflection of the fundamental values of the stock prices. Eleswarapu and Venkataraman (2006) show that improvements in legal and political institutions will lower the cost of liquidity in stock markets, fact that stimulates the arbitrage activity (Chordia et *al*., 2008, Chung and Hrazdil, 2010) with positive effects on efficiency. Giannetti and Koskinen (2010) demonstrated that a higher investor protection determines a decrease in ownership concentration, the market becoming thus harder to manipulate and implicitly more efficient. The presence of foreign investors can increase efficiency, presence which is stimulated by strong investor protection (Poshakwale and

Thapa, 2011). Finally, McLean et *al.* (2012) show that investor protection is related to better capital allocation and investment efficiency.

We conclude by pointing out that understanding of the determinants of informational efficiency is likely to provide useful policy guides to stock exchange regulatory authorities for the optimal design of trading protocols and policies to protect investors. Theoretical and empirical findings show that there is a strong link between informational efficiency and the allocation of investment resources in the real sector. This should motivate policy makers to avoid misallocation of resources that could have long-term negative impact on economic growth.

Although we do not have yet complete and widely accepted explanations concerning the functioning of stock markets, Eugene Fama advises us to „*look at the facts. Collect the data. Test the theory. Like astronomy, every time we look, the world surprises us totally. And it will again*."

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