THE RELATIONSHIP BETWEEN FINANCIAL LIBERALIZATION AND STOCK MARKET EFFICIENCY: A STUDY OF EMERGING MARKETS

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ABSTRACT

The process of neoliberal globalization has been associated with successive financial crises during the 1990s. Mexican and Turkish crises of 1994 have culminated with the widespread Asian crisis of 1997; the Russian crisis of 1998, and the possibility of an impending crisis in Brazil during the early months of 1999 have raised serious doubts about the success of uncontrolled movements of capital. Moreover, global financial meltdown in 2008, which can be interpreted as the main challenge of neoliberal globalization, emerged as the most debatable issue of the century. Some economists and policymakers have opined that current financial crisis heralds the failure not only of an economic system, but also of the ideology of free market and neoliberalism.

On the other side, in contrast to classical pessimistic view of freedom, modern psychologists assume that freedom has a positive influence on subjective wellbeing. Residents of countries with open economies are experiencing the positive consequences of more economic and financial freedom.

In consideration of the aforementioned concerns, it is investigated whether the global financial and economic crisis is a crisis of neoliberalism. Moreover, the diverging results of empirical literature about the liberalization effects is justified based on the pre-requisite economic conditions. Specifically, panel unit root test, panel cointegration, panel Granger causality, General Methods of Moment (GMM) modeling, as well as threshold panel regressions, are the main econometric techniques applied to explore the aforementioned issues.

Principally, these analyses can be categorized into three major parts. First, this research examines the causal direction between financial liberalization and emerging stock market efficiency in short- and long-term. Second, the effect of financial openness on stock market efficiency has been examined with respect to trade openness and quality of institution as pre-requisite conditions for benefiting from financial liberalization. Once the presence of quality of institutions and trade openness are confirmed as essential and imperative factors, the third analytical section focuses on measuring the critical level of institutions above which an economy can enjoy the beneficial effects of financial liberalization. Similarly, it is posited that, below the threshold level, the country may be in danger of experiencing crisis.

Several key findings are worth mentioning here. The empirical evidence on the effects of financial market openness implies the likelihood of a deteriorating impact on stock market efficiency in the short term, as the risk and cost aspect of liberalization initially impede stock market efficiency. However, in the long term, as the stock market participants had time to adjust to the external shocks, they would move to produce more disclosures. Moreover, the study findings lend empirical support to the existence of a significant link between financial openness and stock market efficiency in countries with high institutional quality. It is shown that the success and failure of financial liberalization are assumed to be dependent on country characteristics. This premise implies non-linear relationship (U-shaped) between financial liberalization and stock market efficiency. This U-shaped relationship reveals that, below a certain level of institutions, financial liberalization may lead the market to experience more stock autocorrelation and consequently start moving towards crisis. On the other hand, once the threshold level is reached, financial liberalization has the ability to boost up stock market efficiency.

ABSTRAK

Proses globalisasi neoliberal telah dikaitkan dengan beberapa krisis kewangan yang telah berlaku sejak tahun 1990an. Contohnya, krisis di Mexico dan Turkey pada tahun 1994 yang disusuli dengan krisis di Asia pada 1997; krisis di Rusia pada 1998 dan krisis di Brazil pada awal tahun 1999 telah menimbulkan persoalan tentang keupayaan pergerakan modal yang tidak terkawal. Tambahan pula, krisis kewangan global pada 2008 telah ditafsirkan sebagai cabaran utama dalam globalisasi neoliberal yang sering diperdebatkan dalam kurun ini. Sesetengah ahli-ahli ekonomi dan pengubal-pengubal dasar berpendapat bahawa krisis kewangan bukan sahaja menunjukkan kegagalan dalam sistem ekonomi tetapi juga menonjolkan kegagalan ideologi pasaran bebas dan neoliberalisme.

Sebalik daripada pandangan klasikal yang pesimistik itu, ahli-ahli psikologi moden mengandaikan bahawa kebebasan mempunyai kesan positif ke atas kesejahteraan subjektif (*subjective wellbeing*). Tambahan pula, penduduk di negara-negara yang mengamalkan sistem ekonomi terbuka mempunyai pengalaman yang baik dalam aspek kebebasan ekonomi dan juga kewangan.

Ekoran daripada percangahaan pendapat tersebut, tesis ini ingin mengkaji sama ada krisis ekonomi dan kewangan global merupakan krisis neoliberalisme. Seperkara lagi, tesis ini juga ingin menerangkan penemuan kajian empirikal lepas yang bercanggah terhadap kesan liberalisasi itu adalah akibat daripada prasyarat keadaan ekonomi. Lebih khusus lagi, ujian panel punca unit, ujian panel kointegrasi, ujian panel sebab-penyebab Granger, kaedah *generalised method of moment* (GMM) dan regresi-regresi panel paras ambang (*threshold panel regressions*) adalah teknik utama ekonometrik yang digunakan untuk menerokai isu-isu yang dinyatakan di atas.

Secara umumnya, analisis ini boleh dikategorikan kepada tiga bahagian utama. Bahagian pertama akan mengkaji hubungan sebab-penyebab jangka pendek dan panjang antara liberalisasi kewangan dan kecekapan pasaran saham baru. Bahagian kedua akan mengkaji kesan keterbukaan pasaran kewangan kepada kecekapan pasaran saham dengan mengambilkira keterbukaan perdagangan dan kualiti institusi sebagai prasyarat yang diperlukan untuk memperoleh manfaat daripada liberalisasi kewangan. Setelah mengenalpasti kepentingan kualiti institusi dan keterbukaan perdagangan dalam liberalisasi kewangan, bahagian ketiga tesis ini akan memberi tumpuan kepada pengukuran tahap kritikal institusi-institusi tersebut yang membolehkan sesebuah negara itu menikmati kesan-kesan positif daripada liberalisasi kewangan. Begitu juga, jika sesebuah negara berada dibawah paras ambang (*threshold level*), krisis yang dialami berkemungkinan memudaratkan negara-negara tersebut.

Beberapa hasil kajian yang penting akan dinyatakan di sini. Kajian ini mendapati bahawa kesan-kesan keterbukaan pasaran kewangan besar kemungkinan menjejaskan kecekapan pasaran saham terutamanya dalam jangka pendek kerana aspek risiko dan kos liberalisasi seringkali menghalang kecekapan pasaran saham. Akan tetapi, dalam jangka panjang pelabur-pelabur di pasaran saham mempunyai masa yang mencukupi untuk membuat pelarasan terhadap kejutan-kejutan luaran dan selanjutnya mampu menghasilkan lebih banyak peluang. Di samping itu, hasil kajian ini juga membuktikan bahawa terdapat hubungan yang signifikan antara keterbukaan kewangan dan kecekapan pasaran saham di negara-negara yang mempunyai institusi-institusi berkualiti tinggi. Tambahan pula, kajian ini juga menemui bahawa kejayaan dan kegagalan liberalisasi kewangan adalah bergantung kepada ciri-ciri sesebuah negara. Idea ini menunjukkan bahawa hubungan antara liberalisasi kewangan dan kecekapan pasaran saham adalah tidak linear (bentuk

U). Hubungan yang berbentuk U ini menunjukkan bahawa pada paras ke bawah institusi-institusi yang tertentu, liberalisasi kewangan akan menyebabkan pasaran saham menjadi lebih bersifat autokorelasi dan seterusnya menuju ke arah krisis. Sebaliknya, apabila paras ambang dicapai, liberalisasi kewangan akan mempunyai keupayaan untuk meningkatkan kecekapan pasaran saham.

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CHAPTER 1:

INTRODUCTION

1.1 Introduction

The term "financial liberalization" originated three decades ago, when several OECD countries and some developing nations started moving from financial repression towards financial liberalization by relaxing controls on their national capital accounts. Financial repression is characterized by a fixed exchange rate regime, high reserve requirements, interest rate ceilings, and control on capital flows—all of which are introduced in an effort to maintain financial stability (Abbott, Andersen and Tarp, 2010).

A financially repressed system is also described as one in which the government determines who gets and gives credit and at what price. Such economies do not allow for efficient capital allocation, in which higher capital flows are directed towards countries with higher interest rate regimes. Industrialized nations relied on capital account controls for significant periods of their economic development, and relaxations of capital account restrictions are perceived as an integral aspect of economic development. As a result, many of these countries experienced low growth, macroeconomic instability, and high costs to maintain regulation.

Prior to the 1980s, governments in developing countries faced increasing difficulty in raising capital for development projects due to insufficient savings and a population expansion. Moreover, due to the persistent debt crises in these countries and the recent global financial crisis, which was most severely felt in industrialized countries, the flow of public and private capital to developing countries had declined (Kanu, 2011).

Therefore, economists advocated for the removal of capital controls, as a stabilizing factor of the development process, aimed at improving efficiency and expected to return these economies from distorted factor prices to production frontiers. According to Bagehot (1999) possession of large quantities of borrowable funds is at the root of a country's economic progress. As this condition was not met during the 1980s, the world economy was undergoing startling change, whereby almost every country started moving toward freer markets and extensions of the private enterprise capitalist system. Most of the developed nations have since privatized state-owned industries as de-regulated private industry, and have freed the international trade and capital movement, and seem intent on further liberalization. Developing countries also initiated reforms to liberalize their financial markets in the late 1980s, to access the abundant resources available in international financial markets.

According to the definition adopted in the pertinent literature, liberalization can be characterized as the process of allowing the market to determine credit allocation. Financial liberalization, first mentioned by McKinnon (1973) and Shaw (1973) advocates reduced direct intervention of the state. In other words, it is achieved through a market-oriented economy, whereby price mechanisms are used to allocate resources. The reasoning behind financial liberalization is driven by the need to reduce costs relating to maintaining fixed exchange rate and promoting proper allocation of savings to productive investments, thus decreasing the effect of externalities caused by the repression regime. As raising financial resources and accumulating capital are driving the economic growth, these were the foremost goals of the countries aiming to achieve financial liberalization. To summarize, developing an efficient financial system is the essence of financial liberalization.

The available empirical evidence on the effects of capital liberalization policy is mixed. While some sources suggest that the inflow of international capital stimulates investment and leads to economic growth, some authors posit that capital flight and cash outflow may cause instability and in some cases even financial crisis (Huang and Huang, 2008). Financial liberalizations have become associated with capital flow reversals, where initial capital inflows at the onset are subsequently offset by capital outflows resulting in higher levels of accumulated indebtedness. This suggests that financial control removal might have a fragile influence on stock market. While it can bring low cost capital for financing new investment opportunities, it may put the economy at risk of sinking in financial crisis.

A growing body of literature defines efficiency gains from capital account liberalization in developed countries in terms of economic growth, financial development, portfolio diversification, and reduction of the cost of capital. The benefits of capital mobility are clear, as it results in a more efficient allocation of resources, including an additional source of funding for domestic investment projects in poorer countries with low savings, possibilities for risk diversification, and the promotion of financial development.

However, there is empirical support for a converse effect, whereby emerging market economies experienced increased macroeconomic volatility and unbalanced current account due to increased capital mobility. According to the opposing view of globalization, the opening of domestic capital markets of emerging economies to foreign investors inflicts considerable cost and generates very limited benefits to these nations. According to this view, since emerging markets lack modern financial institutions, they are particularly vulnerable to the volatility of global financial markets. This vulnerability will be higher in countries with more open financial markets. Similarly, many global-skeptics have argued that there is no evidence supporting the view that a higher degree of

capital mobility has a positive impact on growth in the emerging economies (Edwards, 2001). Therefore, some emerging countries reverse the trend toward the liberalization and impose controls on capital accounts.

In this vein, it is also claimed that economic theory in many cases differs from economic truth, especially in developing countries. In this regard, Corley et al. (1996) elaborated that, after the fall of the Soviet Union in 1989, Russia pushed towards a free market approach to expedite economic growth. Surprisingly, while many economists expected the Russian economy to make a significant progress, it declined over only seven years. According to Corley et al. (1996), the missing factor in the Russian endeavor was the absence of the rule of law, which leads to effective functioning of economic institutions. The rule of law, as reflected by the legal system, holds all the institutions and residents of a particular country accountable under the law, the governments of the developing countries being no exception (Corley et al., 1996). The quality of country governance is known to affect the operation of financial and capital markets through its influences on the availability of external financing, cost of funding, market valuations, and quality of investments (Low, Kew and Tee, 2011).

For these reasons, the research in this field has moved toward conditioning the effect of liberalization on the quality of institutions (Honig, 2008). A number of interaction variables have been used to measure the optimal circumstances for achieving improved efficiency through financial liberalization. Although capital market development has been adopted by many developing countries as a strategy for achieving economic growth, the establishment of adequate institutional factors, such as legal system, rule of law, property rights, administrative policy, and investors' protection, might be even more critical to making these markets more efficient. In the discussion on why some nations are

prosperous while others are poor, Reed et al. (2006) identified the absence of adequate institutional factors as the main impediment to viable capital markets and economic growth.

A number of studies have been conducted, whereby the authors examined the effects of stock market liberalization on economic factors, especially in emerging economies. Most of these researchers focused on changes in return behavior, volatility, and increase in economic growth, while very few attempted to analyze the influence of liberalization on stock market efficiency. Recognition that an efficient stock market can provide useful input to market regulators has prompted numerous authors to take their investigation a step further by considering the impact of some postulated factors on the degree of market efficiency.

While most of the empirical studies were carried out under the rubric of the Efficient Market Hypothesis (EMH), there is evident paucity of theoretical works on the effect of financial liberalization on stock market efficiency. Market efficiency has been emphasized because it can lead to the improvement of economic performance, and thus economic growth. The efficient market hypothesis in finance suggests that equity prices are reflected faster in new information. In addition, stocks and equities will be more efficiently priced when the equity market is liberalized and more open to domestic and foreigner investors (Kawakatsu and Morey, 1999).

In the current research, the relationship between financial liberalization and stock market efficiency has been investigated with regard to the threshold effects of institutions and the necessity of trade liberalization as a precondition for financial liberalization.

1.2 Statement of the problem

Within the context of the recent financial crisis, it is increasingly questioned whether stock market efficiency is improved through liberalization. Although numerous researchers have studied the empirical effects of financial liberalization on stock market efficiency, a consistent conclusion remains elusive.

On one hand, the process of neoliberal globalization has been associated with successive financial crises during the 1990s—Mexican and Turkish crises of 1994 culminating with the widespread Asian crisis of 1997, the Russian crisis of 1998, and the possibility of an impending crisis in Brazil during the early months of 1999—raising serious doubts about success of uncontrolled movements of capital in short term. On the other hand, residents of countries with open economies are experiencing the positive consequences of more economic and financial freedom.

Apart from the possible positive effect of liberalization on economic growth, which has been extensively discussed in the pertinent literature, in contrast to classical pessimistic view of freedom, modern psychologists assume that freedom has a positive influence on subjective wellbeing (Gehring, 2013). In free countries, people not only experience private property rights, but also enjoy wider civil and political liberties (Kasper, 2004).

It is also evident that free countries facilitate more competition. Kasper and Analysis (2004) suggested that competitive capitalism cultivates a can-do optimism among people. As competition produces more winners than losers, losses can be overcome by a renewed effort that emerges from competition. Moreover, widespread corruption is more prevalent in countries with poor economic freedom than in open economies. Empirical evidence indicates that, when the economy fosters international competition, the cost of corruption

increases, making it less likely to take place. Consequently, corruption declines, as countries open up economically.

Despite the increased interest and participation of emerging markets in the liberalization phenomenon, thus far, only limited work examining their efficiency has been conducted. In addition, skepticism regarding their ability to value investment opportunities accurately is evident. Hence, extant literature reveals conflicting views of this relationship, even after conditioning for the liberalization. Liberalization literature has evolved significantly since the term was first introduced; however, the empirical literature on the effect of liberalization is still mixed.

In addition to the aforementioned contradictions, global financial meltdown in 2008, which can be interpreted as the main challenge of neoliberal globalization, emerged as the most debated issue of the century. In the wake of the fall of Lehman Brothers on September 15th, 2008 and the subsequent near-total collapse of the global financial system, many predicted the end of the world of liberal capitalism, or at least announced the death of neoliberal ideology. *The Economist* (2008) did warn at the time that economic liberty was under attack and capitalism was at bay. Around the world, economists and policymakers have opined that excessive reliance on unfettered markets was the root cause of the current worldwide financial crisis. Free financial markets have collapsed across the world, with far-reaching consequences for the world economy as a whole. Since the late 2008, emerging markets had been mostly hit by the fallout of the financial meltdown and experienced common symptoms, such as partly dramatic stock market volatility, currency depreciation, capital flight, and sharp declines in foreign direct investment.

Now, the main problem of the era is to investigate whether the global financial and economic crisis is a crisis of neoliberalism. The current financial crisis heralds the failure not only of an economic system, but also of an ideology—that of free market and neoliberalism. However, it would be premature to declare the ideology of neoliberalism dead and underestimate its remnant power (Aalbers, 2013).

Thus, this study firstly seeks to justify the diverging results of empirical test about the effects of liberalization and investigate which strand of literature represents the pattern that can be observed in the real world. Investigating the veracity of each strand also enables meeting the study objectives. Secondly, the study will aim to establish whether the spreading of the global financial turbulence to the developing world is a symptom of the neoliberalism ideology failure, or is related to neoliberalism in practice.

1.2.1 Paradigms in respond to series of recent crises

In response to the series of crises noted above, two groups of paradigms have emerged:

1. Scholars who are suspicious about the relevance of neoliberalism ideology.

They believe that current crisis may undermine the free market ideology and can even be a symptom for demise of neoliberal ideology. Advocates of this view claim that the recent crisis not only spelled out the end of neoliberalism, but also offered prospects for a more equitable world (Overbeek and van Apeldoorn, 2012). They further posit that new-Keynesianism or post neoliberalism is the solution. This is to be expected, given that the current worldwide crisis has prompted resurgence in Keynesian thoughts.

The standard reading is that Keynesian economics advocates government intervention and demand-side management of the economy to get as close to full employment as possible.

In Keynesian thinking, government deficit spending and fiscal stimulus are needed at the time of a downturn, as free markets do not automatically lead to optimal outcomes, but may rather result in a spiral of downward developments. Consequently, free financial markets have collapsed across the world.

2. Scholars in this mindset believe that current crisis refers to neoliberal practices, rather than neoliberal ideology.

Under this paradigm, the response to the crisis is possible through greater or intensified neoliberalism. Thus, the challenge to neoliberal ideology was quickly turned into neoliberal solutions, as the scholars in this group pointed to the distinction between neoliberal ideology and neoliberal practice. Thus, they claimed that, while neoliberal practice can be declared dead, neoliberal ideology was very much alive. Thus, even if macroeconomic Keynesianism is assumed to be back for good (it has never been entirely absent), this does not imply that the neoliberal era is over.

The authors subscribing to this school of thought discussed broadly that neoliberalism not only remains dominant, but also seems to continuously come up with new ideas on how to save and revamp the system. As pointed out, they claim that the neoliberal spirit is very much alive; it has different forms and is more flexible than most of us would like to think. It is sometimes argued that discussions of perceived neoliberalism are false, since there are no completely neoliberal systems. Neoliberalism was never about total withdrawal of the state, but rather about its qualitative restructuring. In fact, “corporate welfare” is a

central tenet of actual neoliberalism. According to Aalbers (2012). neoliberalism practice hides what real neoliberalism wants and does.

According to the prevailing interpretation that has been expressed, for instance, in the G20 meetings, the crisis was caused by a lack of adequate governance and regulation of finance, not because of any inherent tendencies of financial markets, or capitalism more generally. From this point of view, once the regulatory lacks and biases have been corrected, and the economic situation otherwise normalized, the world is expected to return the neoliberal business as usual. Thus, new-Keynesianism or post-neoliberalism is not a solution, but rather intensified neoliberalism.

1.3 Objective of the study

- The first objective of the study is to investigate the directional relationship between the efficiency of emerging stock market and financial liberalization in the short and long term. In another words, the aim is to investigate whether liberalization-led-to-efficiency hypothesis can be proven in short and long term, based on empirical data.

- The second objective is to investigate whether a legal framework and sufficient institutions, as well as trade openness, is crucial for a country to reap the benefits of financial liberalization in emerging markets.

The third objective is derived from above, and is:

- To acquire the optimum level of institutional development, which is crucial to benefitted from financial liberalization, as it could help financing policy makers in taking preventive action to avoid financial crisis due to financial liberalization.

1.4 Research questions

- What is the causality relationship between financial liberalization and stock market efficiency? In other words, does financial liberalization cause stock market efficiency to adhere more strongly to international norms of corporate governance, or is an efficient stock market more willing to receive abundant money at low price and push the economy to open up?

- Does financial liberalization itself lead to the stock market efficiency, or does it need trade openness and institutional development as auxiliary preconditions to be effective in the economy?

- What is the optimal level of institutional development for emerging markets to benefit from financial liberalization?

1.5 Significance of the study

In investigating the effect of financial liberalization on stock market efficiency, one important question that needs to be addressed is why informational efficiency is important when a country proceeds to open up.

The importance of transparency of economic activity has been increasingly recognized in economic research since the onset of the recent financial crisis. The effect of transparency is considered at both the micro level firms' behavior and at the macro level, i.e., on the agents' response to unobserved monetary or fiscal policies (Mehrez and Kaufmann, 2000). At the macro level, which is the focus of this research, recent attention has been given to the relationship between the behavior of international common lenders and poor

transparency. Lack of information and uncertainty are inherent features of finance (Vishwanath and Kaufmann, 2001).

Poor transparency may lead to "informational overshooting" in the stock market. Moreover, when combined with financial liberalization, poor transparency increases the probability of a crisis. However, this does not imply that countries should not liberalize their financial system, or that financial liberalization always results in a crisis. It only implies that countries that liberalize their financial sector should make every effort to provide a precondition to increase transparency (Mehrez and Kaufmann, 2000). Although in his empirical work Caprio (1999) does not propose that the lack of transparency causes a financial crisis, he does suggest that a it may exacerbate a crisis (Caprio, 1998).

Furthermore, many experts on development economies and finance, including Levine (1997), Baumol (1965) and Rousseau and Sylla (2003) demonstrate strong evidence of a positive relationship between stock markets and economic growth. The reason behind the drive to establish and augment the stock market in developing countries is the need to speed up the economic growth by providing a stimulus to domestic saving and facilitate quality and quantity of investment. Stock markets can accelerate economic growth by making it possible for growing companies to raise capital at low cost. Thus, the developing countries that have embarked upon the development of stock markets hope that these markets would play an important role in supporting social change through economic growth, as they could facilitate the exchange of goods and services, mobilize domestic and international resources, diversify risk, and improve efficiency in the allocation of factors of production, thereby raising the standard of living (Kanu, 2011).

1.6 Scope of the study

The designation “emerging market” is associated with the nomenclature adopted by World Bank, whereby a country is deemed “emerging” if its per capita GDP falls below a certain level, which changes over time. Emerging Global Advisors uses criteria established by the International Monetary Fund (IMF) which states that an emerging market is defined by a GDP-per-capita ratio that ranges between $2,000 and $12,000. Of course, the basic idea behind the term is that these countries “emerge” from less developed status and join the group of developed countries. Emerging markets are thus used to describe the nations with social or business activities in the process of rapid growth and industrialization. However, ranking the world’s economies by per capita gross domestic product would suggest that the United Arab Emirates, for example, is among the world’s most developed economies, but it is an emerging market nonetheless because of its market structure. Intuitively, managers know that operating a business in an emerging market is different from doing so in a developed economy. It is tempting to chalk up these differences simply to country context. Indeed, market structures are the products of idiosyncratic historical, political, legal, economic and cultural forces within any country.

The economies of China and India are currently considered the largest. Similarly, emerging markets are those developing countries that show signs of advancement in their financial structures—banks, stock markets, and regulatory bodies—and have reached a certain level of maturity in terms of depth, breadth, and liquidity in the financial structure and economy as a whole.

The best and most definitive lists of emerging markets are compiled by investment banks, and include MSCI and FTSE index, or the list by IFC (International Finance Corporation,

part of the World Bank Group). However, in this context, the term "developing countries" refers to entirely different groups of countries[1]. Developing countries are struggling in comparison and still need help from trade partners around the world. The fundamental difference between the emerging and developing nations is that the former are growing rapidly and becoming more important on the world economic stage.

The literature review suggests that most of the pertinent studies have been conducted using data on developing countries, and include those by Velenchik (2001); White (2001); Kose et al. (2009); Orok-Duke, Akpan Ekott and Edu Enya (2009); Kose, Prasad and Taylor (2011); to name a few. Kim et al. (2012) recently attempted to change this trend by considering the effects of trade and financial openness on informational efficiency in emerging markets. In line with this initiative, the present study provides a relatively detailed investigation of the liberalization-efficiency relationship in emerging markets.

Moreover, there are some unique specification for emerging markets which differentiate it from developing markets and makes it interesting to study. Emerging markets carry a much higher risk because their stocks can be quite volatile. Anything from inflationary pressures to rising interest rates to signs of a global economic cool-down could send them tumbling. Emerging markets investing carries other unique risks, such as political upheaval, regulatory changes, and currency fluctuations.

While emerging markets (and thus emerging markets funds) carry higher risk than the average investment, the potential for rapid economic growth in emerging countries means a higher return potential. Mature economies like England and the Unites States are often expected to grow around 3% annually, while emerging economies with ample room to

[1] www.emergingeconomyreport.com [accessed on 30th December 2011]

grow have the potential to expand much faster. Going forward, this growth should translate into superior corporate profitability and impressive gains for investors.[2]

The present work adopts the FTSE categorization of emerging markets, according to the three levels—Advanced Emerging, Second Emerging, and Frontier Emerging markets—which include 10, 12, and 26 countries, respectively. As the stock market in most of these countries is newly established, the stock price data is only available for recent years, which reduces the scope of the current investigation to a sample comprising 27 emerging markets. Furthermore, in a panel data set, which has the time series component in itself, a longer dataset generates more accurate results. Nevertheless, one of the principal variables of the current research, namely the World Governance Indicator by Kaufmann and Kraay (2008), has been produced since 1996. This is considered as one of the limitations of the study, as it restricts the initial time dimension.

The data used in this study includes actual values of daily indices of the aforementioned 27 emerging stock markets. The closing prices for the major stock index in each market were collected from Datastream. Due to the availability of all sample countries, the sample period spans from January 1st, 1996 to December 30th, 2011. The countries included in the analysis are Czech Republic, Hungary, Malaysia, Mexico, South Africa, Thailand, Turkey, Chile, China, Colombia, Egypt, India, Indonesia, Pakistan, Peru, Philippines, Russia, Argentina, Bangladesh, Croatia, Estonia, Kenya, Mauritius, Oman, Romania, Sri Lanka, and Tunisia. These countries were chosen based on the latest version (September 2011) of the FTSE group for emerging stock markets.

[2] http://www.forbes.com, [accessed on 4th August 2014]

1.7 Organization of the study

Chapter 1 provides a general introduction to the study, by briefly outlining the importance of the financial market and its relation to liberalization. This is followed by the statement of the problem the study aims to investigate, the study objectives, the research questions that the study aims to answer, as well as significance and scope of the study.

Chapter 2 reviews the definitions of stock market efficiency provided by different schools of thoughts, and presents most relevant theoretical literature on neoliberalism and its antagonist and propagandists. These reviews provide the basis for the conflicts regarding the advantages and disadvantages of financial liberalization. In the next section of this chapter, the evolution on the nexus between financial liberalization and stock market efficiency is discussed.

Chapter 3 contains the methodological framework for measuring the efficiency through variance ratio test, as well as Hurst Exponent method, different panel unit root test types, cointegration test, and panel causality test. It also includes a comprehensive explanation of the system GMM estimator, which provides long-term coefficients related to the variables. The chapter ends with an econometric description of the threshold panel and provides some recommendations on how to rectify its drawbacks.

Chapter 4 presents model specification and estimation results of the first objective on Granger causality. The results of the panel unit root test, cointegration test, and short- and long-term causality. It also identifies the conditions under which financial liberalization would enhance stock market efficiency in emerging markets. The model specification and empirical results of the long-term relationship between financial liberalization and stock market efficiency, obtained by applying system GMM, are presented in Chapter 5.

Estimation of the threshold panel model, aimed at obtaining the critical level of the threshold variable, which justifies the conflicts in the literature, is presented in Chapter 6. Finally, Chapter 7 summarizes the results of all the models developed in this study, as well as highlights the key policy implications and recommendations for authorities, in hope to enable them to benefit from financial liberalization.

CHAPTER 2:

LITERATURE REVIEW

2.1 Introduction

The inter-relationship of share returns and the macroeconomic variables has been a subject of considerable interest, judging from the abundant literature on the topic. Since the late 1980s, many developing countries have actively pursued financial liberalization policies, with the anticipation that the opening of capital account will deliver higher rates of economic growth. Their broad liberalization packages also included the removal of statutory restrictions on foreign ownership of domestic equity securities for stock market openings (see Bekaert and Harvey (2000) and Henry (2000)). As a result, most emerging market economies experienced surges in the volume of international capital flows over the next two decades. However, a series of financial crises in the 1990s and the recent global financial turmoil have triggered an intense debate in both the academic and policy circles on the desirability of full liberalization of capital flows.

2.2 Definition of stock market efficiency

The behavior of stock prices in developed, as well as in less developed markets, is a key topic in the finance literature. Stock markets are supposed to have the ability to attract portfolio investments, enhance domestic savings, and improve the pricing and availability of capital for domestic investment. However, the achievement of these requirements depends upon the efficiency of stock markets. Whenever stock markets facilitate the operation of the capital market, they play a decisive role in the pricing of risk, as well as the pricing and allocation of assets.

The term “market efficiency” was first formalized in the seminal review of Fama (1970) and has since been generally referred to as the informational efficiency of financial markets that emphasizes the role of information in setting prices (Lim and Brooks, 2011). According to Fama's Efficient Market Hypothesis (EMH), at any given time, the market prices already reflect all known information, and change fast in response to any new information that becomes available. According to this premise, no market participant can outperform the market by using the information already available to all investors, except by sheer chance (Fama, 1998):

Fama (1970) distinguished between three forms of market efficiency, with regard to the relevant information subset:

1. A market is weakly efficient if prices fully reflect all information contained in the historical price series. Therefore, if stocks follow a random walk, it is impossible to predict future returns by using information in the pattern of stock prices based on technical analysis.

2. The semi-strong-form of EMH expands the relevant information set to all publicly available information that might influence the value of a given company. Such efficiency implies that a fundamental analysis of a firm and the economy in general will not enable investors to earn excess returns.

3. A market in which any investor has monopolistic access to all information relevant for price formation, including private (insider) knowledge, is called strongly efficient. Thus, there is no possibility for market participants to make excess returns.

Since verifying the efficiency of a stock exchange in a strong-form is dependent on the stock exchange having already been efficient in semi-strong-form, and verifying the efficiency in a semi-strong-form is dependent on the stock exchange having already been efficient in weak-form, it is necessary that the efficiency of a stock exchange in a weak-form be studied and verified first. Thus, the existence of significant stock return autocorrelations would imply investors' "mis-reaction" to information. This interpretation has strong theoretical grounds and is widely adopted in the existing empirical literature, which offers strong support for the view that short-horizon stock returns are predictable.

We can broadly divide the prevailing views on the meaning of these correlations into three schools of thoughts. The first school, the *loyalist*, posits that markets rationally process information. They argue that large autocorrelation at short horizons is due to market frictions.

Similar to the loyalists, the second school of thought, the *revisionist*, believes that markets are efficient. However, even in frictionless market, short-horizon stock returns can be auto-correlated.

The third school of thought, the *heretic*, takes a different approach, suggesting that markets are not rational, and that profitable trading strategies do exist. Heretics argue that time series patterns in returns occur because investors either overreact or only partially adjust to information arriving to the market. Thus, astute investors can achieve excess profits, even if financial markets are functioning well. Based on the statistical analysis conducted by Boudoukh, Richardson and Whitelaw (1994) the markets react quickly to information, such as announcements of earnings, dividends, and takeovers. This places

some doubt on the *heretics'* view due to delayed reaction and death of market efficiency. The present study is based on Boudoukh, Richardson and Whitelaw (1994) work that supports the *loyalist* and *revisionist*[3] point of view, and seeks to measure stock return autocorrelation, using it as an indicator of stock market efficiency.

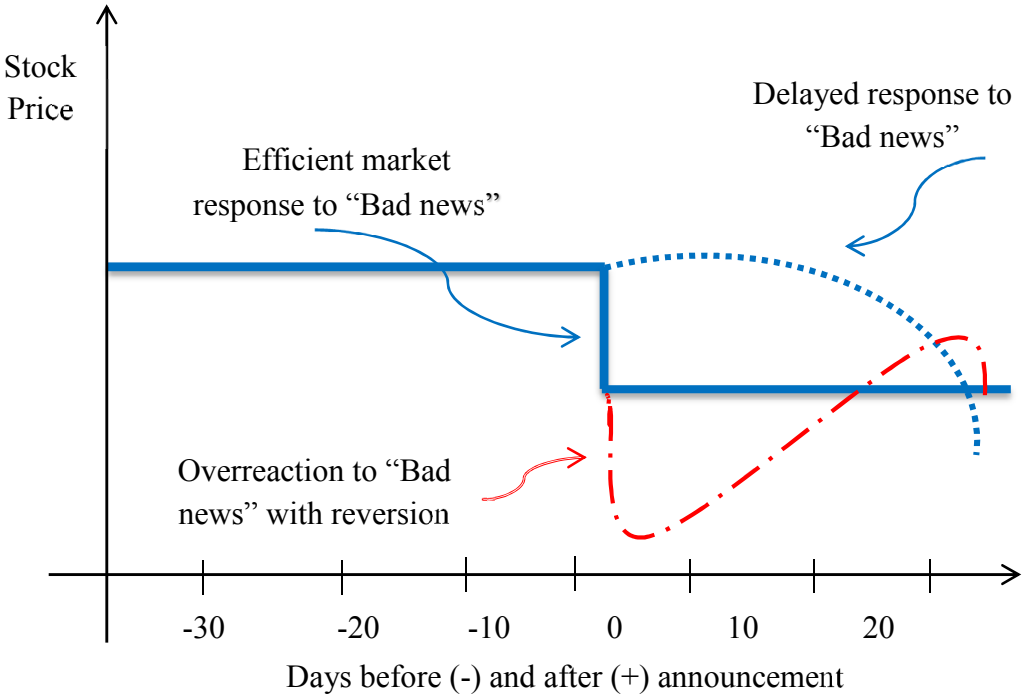


Figure 2.1: Reaction of stock price to new information in efficient and inefficient markets

Source: http://www.rhsmith.umd.edu/faculty/gphillips/courses/Bmgt640/Effic.pdf (accessed on 2 Jan 2014)

2.2.1 Serial correlation and market inefficiency

In this section, two issues related to market efficiency are discussed, the first of which is:

1. Does the presence of significant serial correlations in stock returns indicate market inefficiency?

[3] Loyalist definition of market efficiency implies market rationality and Revisionist definition of market efficiency is based on lack of profitability (see Rubinstein (2001) and Jensen (1978))

Market efficiency has been defined in many different ways (for references, see Lim and Brooks (2011)), and an agreed-upon standard definition is still lacking. Hence, it is important for researchers to clarify how they define and measure such informational efficiency. In this study, the price reflectivity-based definition given by Malkiel and Fama (1970), is adopted, whereby a stock market is efficient if new information is fully reflected in its current stock price and the resulting price changes are completely unpredictable. Thus, the existence of significant stock return autocorrelations would imply investors' "*mis-reaction*" to information.

This interpretation has strong theoretical grounds and is widely adopted in the existing empirical literature (Froot and Perold, 1995). Many researchers have attempted to explain how asset prices adjust to the release of new information. According to the market efficiency theory developed by Malkiel and Fama (1970) and Fama (1998) the semi-strong efficient market is the one in which prices quickly, and in an unbiased way, reflect the public information (Acharya, 2010).

Different frameworks have since been developed to analyze the behavior of asset prices in response to the arrival of new information. Brown and Jennings (1989) and Grundy and McNichols (1989) have developed models to explain the price adjustment process based on the rational expectations framework. According to this view, when traders are heterogeneously informed, spot prices and volume contain private information, and traders have rational expectations about the relationship between prices and signals. Debondt and Thaler (1985 and 1987) advanced the overreactions hypothesis based on empirical findings, which showed a weak form of inefficiency. In their study sample, past losers outperformed past winners within 36 months after portfolio formation, and the

losing stocks earned about 25% more than the winning stocks. The authors interpreted this finding as confirming the behavioral hypothesis of investor overreaction.

The empirical findings supporting the underreaction hypothesis were documented by Bernard and Thomas (1990), and Michaely, Thaler and Womack (1995). These studies suggested that market behaved differently to different news, underreacting to earnings announcements, and overreacting to dividend omissions. Jegadeesh and Titman (1993), (2001) reported some anomalies in stock market price behavior, as their findings indicated that buying past winners and selling past losers generated significant positive returns over 3-12 month holding periods. These types of contradictory findings have led to the development of alternative theoretical frameworks that aimed to explain the price adjustment process.

To summarize, when data on past returns is available, the cross-section of stock returns is predictable due to two key explanations. The first type of arguments based on Debondt and Thaler (1985 and 1987) contrarian strategy, suggests that long-term historical losers outperform long-term winners over the subsequent three to five years, implying negative autocorrelation in the holding. Secondly, alternative competing hypotheses tend to focus on the predictability of a contrarian strategy based on the premise that markets respond to new information gradually. The empirical evidence suggests that a stock with low past returns would, on average, experience low subsequent returns, thus indicating positive autocorrelation.

From an efficient market perspective, the speed of adjustment can be assessed by checking for the evidence of under- or over-reaction in security prices, while adjusting to their intrinsic values when new information is released. The intrinsic value series that

emerges is assumed to follow random walk (Acharya, 2010), whereby individual intrinsic values are serially uncorrelated in efficient markets with adjustment coefficient = 1, whereas coefficient > 1 indicates over-reaction, and coefficient < 1 corresponds to under-reaction (Theobald and Yallup, 2004)

2.2.2 Evolution of EMH

The chronological review of empirical evidence on the perceived validity of EMH clearly demonstrates that it no longer enjoys the same level of strong support it received during the 1960s.

By the start of the 21st century, the intellectual dominance of the efficient market hypothesis had become far less universal. Many financial economists and statisticians began to believe that stock prices are at least partially predictable. A new breed of economists, such as Lo (2004), Malkiel, Mullainathan and Stangle (2005) and Ito and Sugiyama (2009) emphasized psychological and behavioral elements of stock-price determination. These practitioners and scholars came to believe that future stock prices are somewhat predictable—the argument based on the past stock price patterns, as well as certain "fundamental" valuation metrics. Moreover, many of these economists were even making the far more controversial claim that these predictable patterns enable investors to earn excess risk-adjusted rates of return (Acharya, 2010).

As a result, Lo (2004) proposed the new paradigm—based on which the former EMH can be reconciled with the empirical evidence—known as Adaptive Market Efficiency (AMH). According to AMH, market efficiency is not an all-or-nothing condition, but rather a characteristic that varies over time and across markets. In support of the paradigm,Lo (2005) argued that convergence to equilibrium, which is central to the EMH,

is neither guaranteed nor likely to occur at any point in time. Consequently, it cannot be assumed that the market would converge toward some ideal equilibrium state, or achieve conditions for perfect efficiency. Instead, the AMH implies more complex market dynamics that incorporate cycles, trends, bubbles, crashes, manias, and other phenomena that occur in the financial markets.

This is in line with the view shared by Campbell and Thompson (2008), Lo and MacKinlay (2001) and Lo (2008), all of whom have repeatedly argued that perfect efficiency is an idealization (Lim and Brooks, 2011). Given this paradigm shift, many practitioners studying this phenomenon have started testing the absolute version of market efficiency. Hence, it is not surprising to learn that most of the published studies failed to discern the effect of their postulated factors on stock market efficiency. In this regard, if the research framework departs from the traditional focus of *absolute* market efficiency, and instead employs the concept of relative efficiency, it is possible to examine the impact of the postulated factors on the degree of market efficiency.

In present study, market efficiency is considered from both *absolute* and *relative* perspective, facilitating comparison of the results of both aspects. An investigation of whether traditional and recent perception of efficiency would produce the same result on the relation between financial liberalization and stock market efficiency is also performed. Therefore, stock market efficiency has been measured based on both EMH and AMH approaches through all objectives, in order to ascertain whether applying different methods can influence the results.

2.2.3 Adaptive market hypothesis

In the early 1900s, Bachelier indicated similarities between stock price changes and the Brownian motion, or stochastic process. Such results directed Fama (1965) to formulate the EMH, which states that, as stock prices incorporate all information that could affect them, the best estimate of the stock prices has to be equal to the current price. The validity of the efficient market hypothesis has, however, recently been under serious debate.

According to the EMH, at least in its weak-form version, all information provided by the past prices is already embodied in the present prices. Presently, most finance academics believe that market is weak-form efficient (see Doran, Peterson and Wright (2010)).

However, numerous researchers have found some evidence in support of the view that sometimes the stock prices present a deviation from the idealized EMH. For example, critics from the field of behavioral finance have documented irrational but predictable investor behavior, such as overreaction and over confidence (see Debondt and Thaler (1985 and 1987)). Lo and MacKinlay (1988) asserted that random walk would be a wrong model for asset prices. Similarly, Singal (2003) reviewed all the possible anomalies causing bias with respect to the efficiency. Market can be inefficient for different reasons, due to mispricing or anomalies originated in the cost of information, the cost of trading, or the limits of arbitrages. In this case, the actual price may not reflect the news, permitting formation of patterns. Given the flawed assumption of the EMH that market efficiency is constant over time, the focus has shifted towards the new understanding of the market efficiency.

The new approach, which considers the possibility that market efficiency does evolve over time, is best described by Self and Mathur (2006). The authors discussed that the "true underlying market structure of asset prices is still unknown. However, we do know that, for a period of time, it behaves according to the classical definition of an efficient market, then, for a period, it behaves in such a way that researchers are able to systematically find anomalies to the behavior expected of an efficient market".

In this regard, the characteristics of the market microstructure, limits to arbitrage, psychological biases, noise trading, and the existence of market imperfection are among the potential factors that can give rise to periods of departure from market efficiency (Lim and Brooks, 2011). Nonetheless, it is not unreasonable to expect market efficiency to evolve over time due to changes in macro institutions, market regulation, and information technologies.

Based on evolutionary principles, Lo (2004) proposed a new version of the EMH in which the rationality in human behavior is considered AMH that, as an evolutionary alternative to market efficiency, combines EMH and behavioral finance in an intellectually consistent manner.

Viewing financial markets from a biological perspective was first proposed by Farmer and Lo (1999). Works by Lo (1999, 2002) and Farmer (2002), soon followed, before the concept was formalized by Lo (2004) as Adaptive Market Hypothesis. It is interesting to note that the inspiring ideas underlying the AMH stem from several bodies of literature—bounded rationality in economics, complex system, evolutionary biology, evolutionary psychology, and behavioral ecology. AMH can be considered as a major breakthrough that offers not only reconciliation to the controversy in finance pointed earlier (regarding

the deviation of stock price behavior from random walk), but also concrete implication to the practice of investment management.

The AMH provides a number of practical implications within finance. Firstly, it proposed that the risk premium varies over time according to the stock market environment and the demographics of investors in that environment. Secondly, arbitrage opportunities do exist from time to time in the market. Thus from an evolutionary viewpoint, active liquid financial markets imply that profit opportunities must exist. However, as they are exploited, they disappear. While previous opportunities cease, new ones are continually being created, as certain species/ traders die out.

In addition, rather than moving towards a higher degree of efficiency, the AMH implies that complex market dynamics—such as trends, panics, bubbles, and crashes—are continually witnessed in natural market ecologies. The third implication of AMH is that investment strategies are successful or unsuccessful, depending on the particular market environment. Contrary to the EMH, the AMH implies that, while investment strategies may decline for a time, profitability is restored once environmental conditions become more conducive to such strategies.

A consequence of this implication is that market efficiency is not an all-or-nothing condition, but is a characteristic that varies continuously over time and across markets. This is consistent with the conjecture of Grossman and Stiglitz (1982) that sufficient profit opportunities must exist to compensate investors for the cost of trading and information gathering. In fact, Daniel and Titman (1999) have earlier discussed the possible co-existence of EMH and behavioral finance by introducing the term “adaptive efficiency”. While these authors recognized the behavioral biases of most market participants, they

assumed presence of other investors capable of detecting and profiting from biases by examining historical price trends. More specifically, in an adaptively efficient market, profit opportunities do arise in historical data; however, if investors learn from the price history, these profit opportunities will gradually erode through time.

A corollary of this implication is that, as previously noted, market efficiency is not an all-or-none condition, but rather a characteristic that varies continuously over time and across markets. Lo (2005) argued that, unlike EMH, which assumes that market should move towards the ideal point of equilibrium, AMH implies that market is more complex and is subject to trends, bubbles, crashes, and other phenomena.

2.2.4 Application of adaptive market hypothesis

The AMH has gained increasing attention in the recent academic literature. Departing from the traditional definition of market efficiency, in recent work in this field, rolling sample approach of different methods has been applied. As the rolling sample approach is consistent with AMH, it indicates that market efficiency varies during the time. Lim and Brooks (2006) examined the evolving efficiency of developed and developing stock markets through the portmanteau bicorrelation test statistic. Using a rolling sample approach, the authors found that the degree of market efficiency varied through time in a cyclical fashion.

Kim, Shamsuddin and Lim (2011) provided strong evidence of time-varying return predictability (consistent with AMH) of Dow Jones Industrial Average (DJIA) index based on the data covering 1990-2009 period. Their findings indicate that return predictability fluctuates over time and is governed largely by changing market conditions. In addition, the authors reported that the US market had become more efficient after 1980.

They also showed that, due to extreme degree of uncertainty during market crashes, no return predictability is evident.

Ito and Sugiyama (2009) measured the time-varying structure of market efficiency in the US. They found that the US stock market, which was the most inefficient during the late 1980, became the most efficient in the last half of the 20th century. In a comparative study conducted by Smith (2011), time varying return predictability of fifteen European emerging stock markets, as well as three developed stock markets, was investigated. According to the author, each of these eighteen markets provides evidence of time varying nature of market efficiency, which is consistent with adaptive market hypothesis.

In a comprehensive work of Lim, Luo and Kim (2011) return predictability for three major US stock indices has been examined over the full sample period 1970-2008. Applying rolling window autocorrelation (AR) and Wild-Bootstrapped Automatic VR (WBAVR) test provided evidence for the time-varying properties of those indices. The authors also found that most periods with significant return autocorrelations could be associated with major exogenous events. This is in line with the premise driving the present study, which seeks to investigate the effects of financial liberalization on return autocorrelation.

2.3 Definition of liberalism

The word “liberal” took on a particularly political meaning with the establishment of liberal parliamentary caucuses in Sweden and Spain, and later on throughout Europe, in the first decade of the nineteenth century (Gray, 1995). However, because of its relatively long history, the term “liberalism” has become a rather nebulous concept and its usage has varied considerably over time, and in accordance with varying regional experience.

Ryan (1993) has started chapter 14 of Goodin and Pettit (1995) book with the embarrassing question that asks "…*are we dealing with liberalism or liberalisms? It is easy to list famous liberals; it is harder to say what they have in common . . . they do not agree about the boundaries of toleration, the legitimacy of the welfare state, and the virtues of democracy*."

According to Goodin and Pettit (1995) liberalism is a set of political theories that emphasize that "*individuals ought to be free to choose between different meaningful options in life-defining decisions. Secondly, liberalism includes the view that society ought to be subjected to the rule of law and to democratic governance*.".

Finally, Ryan (1993) linked liberalism with the idea that state power ought to be exercised with caution and within constitutional limits, for instance within a system based on the separation of powers, as suggested by earlier liberals, such as Locke and Wootton (1993) and Montesquieu, Nugent and Alembert (1900).

One frequently encountered distinction separates "classical" and "modern" types of liberalism. *Classical* liberalism is associated with earlier liberals, such as Lock, Smith, Tocqueville, and von Hayek, who believed that the state ought to be *minimal,* which practically means that every aspect of life in a state, except armed forces, law enforcement, and other "non-excludable goods" ought to be left to the citizens to manage and perform. This kind of state is sometimes described as a "night-watchmen state", as the sole purpose of the minimal state is to uphold the most fundamental aspects of public order. Classical liberalism has tendency to favor *laissez-faire* economic policies.

Classical liberalism has thus much common ground with what is typically described as "economic liberalism". Economic liberalism is, in essence, the belief that states ought to abstain from intervening in the economy, and instead leave as much as possible to individuals participating in free and self-regulating markets.

Modern liberalism is, on the other hand, characterized by a greater willingness to let the state become an active participant in the economy and consequently has tendency to regulate the marketplace. Therefore, for all intents and purposes, modern liberalism is a profound revision of liberalism, which claims that laissez-faire economic policies are inadequate and misleading, and the state must play significant role in the economy. While such "modern" views could be associated with nineteenth century theorists, such as Constant (1988) (Constant (1988)). More recently, Dewey, Bveridge and Rawls (1916) have articulated similar ideas. Modern liberalism could generally be thought of as being situated politically to the left of classical liberalism, because of its willingness to employ the state as an instrument for wealth and power redistribution in order to create a society deemed to be more decent or equitable. Neoliberalism is another term frequently used to describe this type of liberalism.

2.4 Definition of neoliberalism

According to Saad-Filho and Johnston (2005), though we live in the age of neoliberalism, it is impossible to define purely theoretically. While it is not possible to precisely date the emergence of neoliberalism, its foundations can be traced back to the classical liberalism advocated by Adam Smith. The possibility of a "self-regulating market" is a core assumption of classical liberalism, which is adopted by many neoliberals as well. To a certain extent, the philosophical differences between liberalism and neoliberalism are slight; it is certainly the case that all the elements of neoliberalism are contained within

liberalism—responsibility, self-government, private rather than public ownership, an essentialization of the market, and attention to practices of freedom of an individual.

However, while in neoliberalism, there is an element of reducing the state involvement, it postulates that a more authoritative state must now concentrate on providing the conditions under which individual entrepreneurship, self-government, freedom, and responsibility can be possible. According to Kendall (2003), under the neoliberal paradigm, government is viewed as the active constitution of the conditions under which civil society might flourish. These conditions include both the introduction of market forces and the attachment of performance targets in social areas, such health and education, and the associated requirements that individuals take responsibility for their own lives (rather than becoming dependent on state distribution). As Aalbers (2013) has explained, neoliberalism is not about total withdrawal of the state, but rather demands its qualitative restructuring.

Elaborating neoliberalism, Aalbers identified definition similar to that proposed by Kendall (2003). In his point of view, neoliberalism is more than traditional liberalism, and it is not capitalism by another name. It is a specific movement within capitalism that relies on some but not all of the old principles of economic liberalism. The forced introduction of market models and regulation is the central point of neoliberalism. In this process, the state is not a silent actor, but a rather active one (Aalbers, 2013).

2.4.1 Neoliberalism and crises

Neoliberal globalization constitutes the dominant trend in the world economy at the present juncture. It is driven by a widespread push towards trade and capital account liberalization, increasing internationalization of corporate production, distribution

strategies, and intensification of technological change. Most commentators would accept that the process of globalization offers enormous benefits in the form of more rapid economic growth on a worldwide scale, owing to the accelerated pace of technical change and the associated increases in production, international trade, and investment. However, it is also recognized that the globalization process poses a novel set of challenges.

In contrast, those supporting the anti-globalization perspective have focused primarily on a series of successive currency crises during the 1990s, culminating with the widespread Asian crisis of 1997, the Russian crisis of 1998, and the possibility of an impending crisis in Brazil during the early months of 1999. Significant flows of short-term speculative capital have emerged as the principal element of systemic fragility, posing a major threat to the sustainability of liberalization success. Less than a decade ago, market-liberalizing ideas and policies reigned supreme. Today, however, the popularity of unfettered markets has declined dramatically. Consequently, many economists and policymakers have opined that excessive reliance on unfettered markets was the root cause of the current worldwide financial crisis.

Whilst the magnitude of the capital flows and the dimensions of the subsequent crises are strikingly different, there are nonetheless important elements common to all types of crises. This common element is sever dependence on the short-term financial flows, in a setting characterized by premature capital account liberalization in the absence of adequate regulation.

It is striking that, contrary to the conventional IMF wisdom, financial crises have occurred in spite of "sound fundamentals", namely fiscal equilibrium and low inflation. The recent financial crises highlight a paradoxical situation characterized by the need for effective

regulation at a time when the capacity of the nation state to undertake the type of regulation required is severely circumscribed. Hence, the establishment of an effective regulatory framework at the global level emerges as a major requirement if successive financial crises, with significant economic and social cost, are to be avoided in the future.

The greatest crisis of our time occurred on September 15th, 2008 in the wake of the fall of Lehman Brothers and the subsequent near-total collapse of the global financial system. Since then, most emerging markets were significantly affected by the fallout of the financial meltdown and experienced partly dramatic stock market volatility, currency depreciation, capital flight, and sharp declines in direct foreign investment. At the time, *The Economist* (2008) did warn that economic liberty was under attack and capitalism was at bay. Many predicted the end of the world of liberal capitalism, or at least announced the death of neoliberal ideology. There were, however, arguments from the other side of the political spectrum that the crisis not only spelled out the end of neoliberalism, but also offered prospects for a more equitable and sustainable world (Overbeek and van Apeldoorn, 2012).

The need for effective intervention or regulation at the national and the supranational levels emerges as a key precondition for overcoming a major market failure in the system**.** A paradox of neoliberal globalization is that the powers of the nation-state vis-a-vis corporate actors are reduced considerably through a process of intense financial and capital account liberalization at a time when the need for effective regulation emerges as a major requirement for the proper functioning of the system.

Therefore, there is a need to investigate if these crises can be considered as a symptom of crisis of neoliberalism, as some extant literature suggests. However, it would be

premature to declare the ideology of neoliberalism dead and underestimate its remnant power (Aalbers, 2013).

2.4.2 Two school of thought on global crisis

The neoliberal era is seen as beset by contradictions. On one hand, it can be claimed that the onset of the global financial crisis in 2008 has caused resurgence in Keynesian thought. On the other hand, some scholars argue that neoliberalism not only remains dominant, but also seems to continuously produce new ideas on how to "save and revamp the system" (Aalbers, 2013).

Based on the first school of taught, the 2008–2009 global financial crisis, and the public responses to it, have prompted commentators to speculate whether we are, after a long break, once again "all Keynesians" (Patomäki, 2009). The prevalent view is that Keynesian economics advocates government intervention and demand-side management of the economy to get as close to full employment as possible. In Keynesian thinking, government deficit spending and fiscal stimulus are needed at the time of a downturn, as free markets do not automatically lead to optimal outcomes, but may rather result in a spiral of downward developments. Proponents of this view believe that free financial markets have collapsed across the world, with far-reaching consequences to the world economy as a whole. Governmental responses seem in accordance with the basic tenets of Keynesian economic theory, which constitute a move towards a post-neoliberal era, i.e., a resurgence of Keynesianism.

According to the prevailing interpretation that has been expressed by the second school of thought, the crisis was caused by a lack of adequate governance and regulation of finance, not because of any inherent tendencies of financial markets, or capitalism more

generally. From this point of view, once the regulatory lacks and biases have been corrected, and the economic situation otherwise normalized, the world is expected to go back to the neoliberal business as usual. The "return" to Keynesianism may thus be temporary and limited to the operation of rescuing banks, corporations and, more generally, private capital.

The political consequences of the financial crisis are indirectly contingent on its socio-economic effects. If these effects remain limited, the overall direction of developments will probably stay unaltered. As states had become increasingly indebted by 2011, the aftermath of the crisis is expected to be characterized by painful decisions to cut state expenditure or raise taxes. This may mean further downsizing of the welfare state and neoliberalization. Even assuming that macroeconomic Keynesianism is back for good (and many argue that it has never been entirely absent), it does not mean that the neoliberal era is over.

Given the above arguments, applying econometric methods, the present study aims to analyze whether the financial crises throughout the world may in fact be drawing the neoliberal era to a close.

2.5 Basic theoretical framework

The first view for theoretical support draws on the neoclassical growth model, proposed by Solow (1956). In this model, releasing the restrictions on the movement of capital facilitates international allocation of capital. Consequently, capital moves from capital abundant developed countries to capital scarce developing countries, as the return on capital investment in developed countries is lower than can be achieved in developing

countries. The influx of capital towards developing countries reduces the cost of capital and causes a temporary increase in investment and growth (Henry, 2007).

In Viner's words, the basic reason for international investment of capital is that, under normal conditions, capital moves from countries with low marginal value productivity to those with high marginal value productivity. This shift makes marginal value productivity of capital equal throughout the world and consequently tends toward a maximum contribution of the world's capital resources to world production and income (Viner, 1947) .

The new version of Viner's justification goes a step further, as it highlights the importance of financial institutions in the aforementioned process. The Asian financial crisis of 1997 is a particularly significant example of indiscreet opening of capital account. When economic conditions are distorted, and suffer from lack of adequate regulation and supervision, capital outflow may lead to crisis. Conversely, when capital account opens, inflow looks for both best economic opportunity and government guarantees. According to the above argument, the best way to prepare the economy for liberalization is through accelerating the pace of creating suitable economic conditions and slowing down the velocity of the capital account opening (Arestis and Paula,2008).

One of the famous theories supporting the current study stems from the traditional valuation model of stock prices developed by Modigliani and Miller (1958) and the "wealth effect". The traditional valuation model of stock prices suggests that their levels reflect the expectations about the future state of the economy, and can therefore predict the economy. The "wealth effect", on the other hand, contends that stock prices lead economic activity by actually causing the economic changes.

According to the theory of asset portfolio, when the correlation of all types of assets available to an investor decreases, the investor can use this condition to establish an asset portfolio of lowest risk at given returns, or of highest returns at given risk. Thus, the liberalization of capital market enables the investors to invest beyond a country's national boundaries, which can decrease the risks of the portfolios by reducing the correlation of the basic securities.

In welfare economics, the theory of the second best emerges when one or more optimal conditions cannot occur simultaneously. In other words, actions taken in an attempt to rectify a market failure in one sector of an economy, aiming to improve the efficiency and rectify the failure may indeed decrease it. In theory, at least, it may be better to leave the market imperfections to resolve without any manipulation or attempts to fix them, as these efforts would be welfare reducing. According to the theory of the second best, removing one distortion while keeping other distortions may not increase the welfare. For example, if the capital account liberalized while importing industries are still protected, cash inflow would shift to sectors with less comparative advantage, leading to welfare reduction (Eichengreen, Arteta and Wyplosz, 2003).

Reconciling this theory with the intents of the present study, it is worth noting that stock market opening by itself may not be welfare increasing while the trade market is still closed. This theory supports Basu and Morey (2005) theoretical conclusion that financial liberalization *per se* does not contribute to improving the stock market efficiency.

According to economic theory, countries characterized by fewer distortions will tend to perform better than those where regulations and distortions impede the functioning of the markets. For some time now, most (but not all) economists have agreed that freer trade in

goods and services indeed results in faster growth (Edwards, 2001). In standard models, this "free trade" principle extends to the case of trade in securities and countries that have fewer restrictions on capital mobility, whereby, with remaining conditions being equal, such countries will tend to outperform those that isolate themselves from global financial markets. This view is clearly exposed by Rogoff (1999).

In theory, significant long-term efficiency gains can be reaped by allowing global investment to follow towards countries with low capital-labor ratios. Researchers have now come to believe that the marginal gains of international trade in equities can be significant. Regression results indicate that, as noted above, while controlling for other variables, countries that are more integrated into global financial markets have historically performed better than those that have isolated themselves.

One of the earlier theories that link integration and stock prices refers to the theory of market segmentation and market integration (Kearney and Lucey, 2004). Considerable body of research has focused on the evolution of a country from being segmented to being integrated into the world markets. At least two levels to this evolution are currently recognized. Economic integration refers to decreased barriers to trading in goods and services, while financial integration pertains to free access of foreigners to local capital markets (and local investors to foreign capital markets).

2.6 Evolution on the nexus between financial liberalization and efficiency

In the first wave of studies conducted by Kawakatsu and Morey (1999), Nikiforos (2004), Cajueiro, Gogas and Tabak (2009), and Jui-Cheng (2009), the authors followed stock price behavior before and after the announcement of openness by the local government. As a result of the growing interest in this field, several broad-spectrum statistical methods

evolved during this time, which have been applied to investigate stock return autocorrelation. These statistical methods range from simple Filter Rule method to a very complex time-varying global Hurst Exponent method.

However, despite numerous studies on the subject, no consensus on whether financial system liberalization is necessary for a country to experience an increased efficiency in stock market has been reached thus far. The main issue that arises here stems from the difficulty to ascertain the veracity of the liberalization date. According to some critics, liberalization is a gradual process that evolves over time rather, than occurring at a specific point in time. However, in the analyses performed in most studies in this category, a specific date is used as the market opening date, and liberalization is treated as a one-time event that constitutes an instantaneous and complete removal of barriers.

The next generation of studies of this phenomenon comprise the works by Fuchs-Schundeln and Funke (2003), Galindo, Schiantarelli and Weiss (2007), Chinn and Ito (2006), Huang and Huang (2008), Kaminsky and Schmukler (2008), Chen (2009), Bekaert, Harvey and Lundblad (2011) and Kose, Prasad and Taylor (2011). These authors posit that positive effects of liberalization are visible only within a developed financial system. In his book on trade openness, Rodrik (1999) argued that openness may not be suitable for all countries. This is in keeping with the view offered by (Bekaert, Harvey and Lundblad, 2005), who claimed that financial liberalization perhaps does not bring the anticipated benefits, as the strength of the domestic institutions and other factors also play a role. This strand of studies exemplifies South East Asian crisis, exploring the preventive solution for probable future crisis. Rapid and comprehensive liberalization of the financial system was a precondition for financial crisis in South East Asia.

The economies of Thailand, Indonesia, and Korea—the countries most acutely affected by the crisis—all implemented financial deregulatory measures that permitted significant inflows of short-term foreign capital, allowing the growth of foreign debt and eventually destabilizing the economy. According to Kil (2004), institutional shortcomings in the government's regulatory structure for domestic financial institutions in these countries were crucial determinants in rapid rise of short-term debt. In these countries, financial liberalization measures were not supported by adequate oversight or prudential regulation. Moreover, absence of institutional capacity and lack of autonomy of central banks to act effectively and independently prolonged and intensified the financial crisis (Kil, 2004). In Korean financial institutions, for example, capital market opening led to a sudden and significant increase in foreign capital inflow.

Consequently, Korean economy became highly vulnerable to exogenous shocks that led to a region-wide financial crisis. Similarly, in Taiwan, relative absence of institutional need for foreign funding and external pressure to open its financial markets led to a more tentative financial liberalization program that retained existing stringent restrictions against foreign capital inflows. As a result, the country managed to avoid the Asian crisis (Kil, 2004).

However, the degree to which East Asian economies experienced the financial crisis is not merely due to the highly mobile international capital, as it also depends on the country's institutional factors. Bekaert, Harvey and Lundblad (2005) analyzed that heterogeneity of the effect of financial liberalization, noting that countries that benefitted the most were those with higher than average financial development, good institutions, and an investment profile favorable for foreign investors. Gay (2008) studied the effect of the institutions in transition economies, noting that they significantly and positively

influenced the economic performance. These findings confirm the importance of the time-horizon in which institutions act, suggesting that institutions appear to work over time-horizons.

This finding points towards inconsistency between policy makers' short-term priorities and sound policies with intermediate or long-term goals. Thus, is the present study aims to examine the long- and short-term relationship between financial liberalization and stock market informational efficiency, considering the mediating role of institutions.

Finally, the last wave of studies represented the link between financial and trade openness and stock market efficiency through technology transfer. The basic idea behind such a link is that real and financial sectors of an economy are interrelated, as economic theory would suggest. Thus, the time series behavior of real stock returns is likely to be governed by the production technology of the economy. The authors of studies in this stream have concluded that financial liberalization by itself may not lead to more efficient stock market. Only three studies explicitly examined the association between trade liberalization and stock market informational efficiency in developing countries (see Eichengreen, Arteta and Wyplosz (2003), Basu and Morey (2005) and Lim and Kim (2011)).

Despite the growing amount of empirical work on the effects of trade and financial reforms, before a new framework was proposed by Basu and Morey (2005), limited theoretical analysis has been conducted to understand the effect of liberalization on stock return autocorrelation properties. This is an important point, because when real and financial sectors are interrelated, increased productive efficiency in the real sector due to economic liberalization is bound to affect the extent of financial market efficiency

measured in terms of autocorrelation in real stock returns. Indeed, standard finance textbooks offer descriptions of various forms of market efficiency; however, there is evident paucity of work on relating it to the technological efficiency due to various liberalization programs.

Lim and Kim (2011) applied this newly developed theoretical model onto empirical data and concluded that trade openness is positively related to informational efficiency, because efficiency signals higher future firm profitability. When there is less uncertainty about a firm's future earnings or cash flow, investors tend to react faster to public information. However, association between financial liberalization and stock market efficiency has not been significant. Basu and Morey (2005) also concluded that financial opening without trade reform does not lead to weak-form efficient market.

2.6.1 New proposed theoretical model

The main theoretical background of the current research lies in the new model developed by Basu and Morey (2005), which explores the effects of trade opening on emerging market stock returns. The authors modeled trade opening as an elimination of a non-tariff restriction on the import of foreign intermediate inputs. In an autarkic environment, where the domestic production is starved due to lack of availability of complementary foreign intermediate inputs, technological economies of scale are not reached, leading to diminishing returns to capital. This technological inefficiency transmits to the financial sector, as the stock market starts to deviate from efficiency by displaying mean reverting behavior. On the other hand, as soon as the non-tariff barrier to the free flow of foreign intermediate inputs is removed, the resulting technological efficiency manifests in terms of a random walk behavior of the stock market prices. The authors also establish that financial opening alone will not promote stock market efficiency. Trade reform in the

form of removal of non-tariff barriers to imports intermediate inputs is just as crucial, as it translates technological efficiency to financial market efficiency.

This theoretical analysis offers a testable hypothesis regarding the link between the productive efficiency and financial market efficiency. The model predicts that stock returns will show non-zero serial correlation in a closed economy. However, once the country opens on the trade front, the stock returns will show zero serial correlation. The difference emerges as, once the country opens itself to trade, it can use imported intermediate inputs optimally, which was not possible in a closed economy. In this model, intermediate inputs are non-rival in nature and may be viewed as blueprints of new technology, which directly affects the home country's total factor productivity.

The government in a closed economy optimally plans the production of these inputs and makes it available to the private sector using a marginal cost pricing rule. In addition, the private sector in a closed economy faces a rigid quantity constraint on these intermediate inputs, which gives rise to diminishing returns to physical capital. In an open economy, on the other hand, all these inputs are imported from abroad and are financed by short-term loans from international credit agencies.

Trade openness is thus viewed as removal of a non-tariff barrier, or alternatively, as a relaxation of a quantity constraint. After trade opening, home country can make efficient use of intermediate inputs, which complement physical capital. The resulting gain in productive efficiency makes the growth process self-sustained. The self-sustained growth process thus translates into random walk behavior in the stock prices, as the stock prices reflect the value of capital.

2.7 Institutions

The review of the extant literature revealed an argument that lack of adequate institutions is the main cause of financial crises. It has been emphasized in the second wave of studies on the nexus between financial liberalization and efficiency that the institutions play an important role in enabling a country to reap the benefits of financial liberalization. This, in turn, points to the need to identify the definition of governance and the manner in which it would fundamentally affect the country economic backgrounds to improve the financial system efficiency.

Early references to the importance of institutions date back to Adam Smith. In their *Wealth of Nations,* Smith and Skinner (1986) postulated that "Commerce and manufactures can seldom flourish in any state . . . in which there is not a certain degree of confidence in the justice of government." In another section of the book, they more explicitly relate differences in investment rates (hence, differences in growth rates) to the extent to which the rule of law and property rights exist:

In all countries where there is tolerable security, every man of common understanding will endeavor to employ whatever stock he can command in procuring either present enjoyment or future profit. In those unfortunate countries . . . where men are continually afraid of the violence of their superiors, they frequently bury and conceal a great part of their stock." (Smith and Skinner, 1986).

Yet, for a long time, neo-classical economics have ignored these early insights. The problem with this institution-free view of the world has always been that it cannot explain why different non-market institutions coexist with and within markets, how market and non-market institutions interact, and whether different rates of growth performance may

be related to differences in the institutional characteristics of national economies. As the transition experience of the ex-soviet countries has demonstrated, the creation of markets and private property rights was not sufficient for the emergence of efficient entrepreneurs. As Coase (1992) indicated, the countries of the ex-Soviet space "may be advised to move to a market economy . . . but without institutions no market economy is possible"

The appropriate institutions in this context refer to more than "the rule of law" and "property rights institutions" that Djankov et al. (2003) consider as the remedy to the problems in transition countries. The authors further note that regulatory institutions, institutions of social insurance, quality of networking institutions, institutions of conflict resolution, and institutions supportive of production of "public goods" in the general sense, including an efficient public policy, are also necessary.

According to North (1994), institutions can be defined as "rules of the game" between economic actors, which consist of either "formal constraints" (e.g., rules, laws, and constitutions), or "informal constraints" (such as norms of behavior, conventions, and voluntary codes of conduct) and their enforcement characteristics. Institutions can also refer to routines and ways of behaving that are based on formal rules, past decisions, tacit knowledge, and norms and are only modified if the environment changes (Nelson and Winter, 1982). In this definition, institutions are viewed as a "set of behavioral rules that shape and govern interaction between human beings, partly by helping them to form expectations . . .".

The second definition of institutions is typically associated with (Williamson (1983), 1985)), even though it actually dates back to Coase (1937). In this definition, institutions are considered as "governance structures", rather than "rules of the game". The emphasis

here is on ownership structures, hierarchies, corporate culture, or information asymmetries that lead to principal-agent problems. According to Coase (1937), institutions can help to resolve such problems through, for example, the guarantee they provide for well-defined property rights. In addition, statutory or voluntary governance standards could be introduced, as this could alleviate agency problems that emerge when agents (public or private actors) act against the interests of the principals (e.g., citizens, consumers, and stakeholders) who appoint them to carry out a function on their behalf. While the difference between institutions as "governance structures" and as "rules of the game" may not be easy to pin down, it can be clarified by understanding that the former refer to a system of rules that enables economic actors to avoid sub-optimal collective action outcomes that might emerge when the latter are either inadequate or absent.

The third approach to institutions is associated with Axelrod (1984), who analyzed cooperation in order to explore how cooperation can emerge in a world of self-interested actors (superpowers, businesses, or individuals) when there is no central authority to police their actions. In this setting, governance institutions can be conceptualized as "private ordering" outcomes that can resolve information and sanctioning problems in a decentralized manner.

Here, it is essential to clarify that institutions differ from organizations, even though the latter may also be referred to as "institutions" in the language of public debate. Two main reasons behind this ambiguity are delineated below.

First, organizations such as firms, central banks, or regulatory agencies are essentially goal-oriented economic actors and may be guided or constrained by institutional norms, or they may be the enforcers of those norms. However, organizations differ from

institutions because the latter are not specific to a particular organization and should not be confused with the rules/ by-laws that govern the operation of the organizations. Rather, institutions (either as "rules of the game" or as "governance structures") operate at a deeper level as endogenous solutions to the collective action problems that organizations may be established to address. Secondly, by making the distinction between institutions and organizations, focus can be restricted to "governance quality", rather having to address organizational structure *per se*. In this context, governance quality refers to the extent to which public or private sector organizations are subject to the right mix of incentives and constraints that induce them to deliver optimal outcomes. Therefore, institutions as governance quality are more pervasive in the literature.

It can be derived from literature that governance institutions are products of collective action and public choices. In that sense, they can be conceived of as constituent parts of the social contract between members of a community that consist of individual, corporate, and political economic actors—with different levels of power endowment at the beginning and during the historical period within which the contract takes shape.

However, the determinants of institutions optimality have been discussed not only by Marx (1987), but also by a wide-range of non-Marxist social scientists, including Von (1998), Hayek (1978), Olson (1982), Olson (2009), Buchanan and Tullock (1999), Stigler (1971) and North (1990).

The incumbents with economic, political, and social power can influence the choice of institutions that serve their interests. More recently, Acemoglu (2003) demonstrated new theoretical grounds supporting the view that inefficient institutions may be both prevalent and persistent. The author argued that this is the case mainly because they are chosen to

"serve the interests of politicians or social groups that hold political power at the expense of the rest".

In the extant literature, two types of governance institutions are typically recognized—*Type One institutions* that include institutions as rules of the game (Axelrod, 1984; North, 1990) and *Type Two institutions* that include institutions as governance structures (Coase, 1937; Williamson, 1983, 1985). Type One institutions tend to have *a market-creating effect* by encouraging or supporting the emergence of new markets, where economic actors can engage in mutually beneficial economic exchange. The higher the quality of the Type One institutions, the lower the transactions costs, the higher transaction volumes and the higher the probability that economic actors will extend their activities into new areas. The quality of these institutions can be measured by the quality of the following indicators: rule of law, contract enforceability, risk of expropriation, power and accountability, judicial competence, and impartiality and trust.

Type Two institutions, on the other hand, tend to have *market deepening effect,* which refers to increased efficiency of the existing market. This effect is felt as a result of improved quality of public and private governance structure, which enables economic actors to secure higher overall returns on a given volume of contracting. In other words, when *Type Tw*o institutions are of higher quality, this leads to reduced risks of coordination failures and agency problems, lower incidence of externalities and market failures, improved policy credibility, and reduced macroeconomic volatility. Moreover, as the quality of T*ype Two* institutions increases, economies will be less likely to suffer welfare losses that arise from resource misallocation and distortions. The following indicators serve as the measure of the quality of *Type Two* institutions: bureaucratic or

government efficiency, policy predictability, company law and corporate governance regimes, and transparency or accountability.

2.7.1 Governance indicators

In the significant majority of empirical literature, these three main resources of governance quality data are used:

(1) The International Country Risk Guide of the Political Risk Service (ICRG);

(2) The World-wide Governance Indicator (WGI) of the World Bank;

(3) Corruption Perception Index of Transparency International

In this study, the latest update of Governance Indicator designed by Kaufmann, Kraay and Mastruzzi (2005) was used. The governance indicators measure the following six dimensions of governance: (i) voice and accountability; (ii) political Instability and violence; (iii) government effectiveness; (iv) regulatory quality; (v) rule of law, and, (vi) control of corruption.

These dimensions are based on several hundred individual variables measuring perceptions of governance, drawn from 37 separate data sources constructed by 31 organizations. Six aggregate governance indicators are motivated by a broad definition of governance, as the traditions and institutions by which authority in a country is exercised. This includes (1) the process by which governments are selected, monitored and replaced, (2) the capacity of the government to effectively formulate and implement sound policies, and (3) the respect of citizens and the state for the institutions that govern economic and social interactions among them.

The first two governance clusters are intended to capture the first part of the definition of governance—the process by which those in authority are selected and replaced. A number of indicators measuring various aspects of the political process, civil liberties, and political rights refer to "Voice and Accountability". These indicators measure the extent of citizen participation in the selection of governance, media independence, and the extent of authority accountability for their actions. The second governance cluster is labeled "Political Stability and Absence of Violence" and its combined indicators measure perceptions of the likelihood that the government in power will be destabilized or overthrown by domestic violence and terrorism.

The next two clusters summarize various indicators of the ability of the government to formulate and implement sound policies. The main focus of "Government Effectiveness" index is on "inputs" required for the government to be able to produce and implement good policies and deliver public goods. On the other hand, "Regulatory Quality" is more focused on the policies themselves and includes measures of the incidence of market-unfriendly policies, such as price controls or inadequate bank supervision, as well as perceptions of the burdens imposed by excessive regulation in areas such as foreign trade and business development.

The last two clusters summarize in broad terms the respect of citizens and the state for the institutions governing their interactions. "Rule of Law" measures the success of a society in developing an environment in which fair and predictable rules form the basis for economic and social interactions, and importantly, the extent to which property rights are protected. The final cluster, referred to as "Control of Corruption", not only measures conventional definition of corruption, defined as exercise of public power for private gain,

but also frequency of "additional payments to get things done," and "grand corruption" in the political arena or in the tendency of elite forms to engage in "state capture".

2.8 Data description

A number of interaction variables have been used to describe and measure the optimal circumstances in which financial liberalization can lead to improve efficiency. Several authors that analyzed institutional effect employed variables that measure general institutional quality, such as indicators of corruption, law and order, and bureaucracy quality extracted from International Country Risk Guide. However, following the comprehensive work by Kaufmann, Kraay and Mastruzzi (2005), which aimed to establish new generation institutional variables named "Governance Indicator", the research interest in this field has shifted to recruiting them.

2.9 Identification of research gap

The rationale for financial liberalization has historically been based on two potential benefits—a quantity effect, manifested in higher levels of savings and investment in an economy, and a quality effect, reflected in a more efficient allocation of capital (Abiad, Oomes and Ueda, 2008).

While the extant literature on *quantity* effect is voluminous, most of these studies investigated the relationship between economic growth and financial liberalization (Bekaert, Harvey and Lundblad, 2001; Edison et al., 2002; Lütkepohl and Krätzig, 2004; Bekaert, Harvey and Lundblad, 2005; Klein, 2005; Ben Naceur, Ghazouani and Omran, 2008; Eichengreen, Gullapalli and Panizza, 2011; Combes et al., 2014), whereas less work has been done on analyzing the robust influence of liberalization on stock markets.

Additionally, although the success of liberalization cannot be evaluated by assessing whether it has positive or negative effect on growth, this was the focus of most of the literature sources focusing on *quantity effect*. Merits of liberalization also need to be investigated by evaluating the *quality effect*, whereby it must be ascertained whether liberalization improves the transparency and allocation of capital across firms (Abiad, Oomes and Ueda, 2008). Country liberalization forces the entire economy to embrace higher legal, regulatory, and disclosure standards foreign investors from more developed environments advocate for (Bae, Bailey and Mao, 2006). However, due to the recent financial crisis, the latest studies in this field have shifted to focus on the importance of transparency exposed in informational efficiency.

It is agreed that financial liberalization combined with poor transparency increases the probability of a crisis (Vishwanath and Kaufmann, 2001). Although theoretically sound, this does not imply that financial liberalization always results in a crisis. Rather, it suggests that countries that liberalize their financial sector should make every effort to provide necessary precondition to increase transparency (Vishwanath and Kaufmann, 2001; Edison et al., 2002; Klein, 2005; Chinn and Ito, 2006)

The present study focuses on the *quality* effect, and examines the link between financial openness and stock market informational efficiency in the context of trade openness and quality of governance framework, as this is an insufficiently researched topic.

However, there is a growing body of empirical literature that has examined the role of liberalization and its influence on emerging stock markets. According to the EMH, when borders are omitted, and equity markets are liberalized and become more open to cash flow, equity prices reveal more information.

The extant studies on the effect of financial liberalization on stock market generally follow two *methodological* formats, which are briefly described below.

In *Classic* format, the official announcement date by local government, which corresponds to the *de jure* measure of financial openness, is considered as a *milestone* point, after which stock price autocorrelation—which was either negative or positive before the government announcement—is expected to converge towards zero. Numerous literature sources report on measuring the weak form of efficiency by employing a wide array of statistical tests, such as linear serial correlations, unit root, low-dimensional chaos, variance ratio test, and Chow and Denning (1993) multiple variance ratio test, to detect different types of deviations from a random walk in financial time series.

However, there are some notable weaknesses of this approach, the first of which refers to the recognition of the liberalization date. Liberalization is a gradual process and does not constitute an instantaneous and complete removal of barriers, as in practice, administrative constraints and capital control might still be binding even after the official announcement. Thus, owing to this complexity, financial liberalization indices in the form of a dichotomous zero-one variable have departed from the recent literature. According to the rational expectation hypothesis, investors have an effect on liberalization dates. In addition, as the announcement of opening dates precedes the actual opening dates, this must be recognized in the models attempting to describe this process.

In practice, impacts of market liberalization are likely to emerge just after the announcement dates, rather than on the actual opening dates. Furthermore, it might also be possible for a foreign investor to access the market through a country fund well before foreigners are allowed to directly transact in the local equity market. For example, the

official liberalization date of Thailand's stock market was announced in September 1987, when foreigners were allowed to enter Thai stock market and purchase shares. However, in July 1985, the Bangkok Fund was already exhibited on the London Stock Exchange, suggesting that, in practice, the actual opening date typically differs from the announced liberalization date (Bekaert, Harvey and Lundblad, 2005).

The other disadvantage of this stream of literature stems from the consideration of the *absolute* format of efficiency, which is no longer reliable. With the introduction of the new paradigm of adaptive market efficiency (AMH), which allows efficiency to vary over time and across markets Lo (2004), the efficient market hypothesis (EMH) clearly demonstrates that it no longer enjoys the same level of strong support it received during the 1960s. In this paradigm, equilibrium, which is central to the EMH, is neither guaranteed nor likely to occur at any point in time. Using the new paradigm in which efficiency is not assumed a binary zero-one variable is not applicable in this category of studies.

In more recent works, a new generation of liberalization indices is applied in regression analysis to investigate the quantity effect of liberalization. These analyses are based on the Basu and Morey (2005) theoretical model that links the liberalization concept to stock market efficiency. According to this paradigm, the opening of both trade and financial markets is vital for improving the stock market efficiency through gains acquired from technological transfer after removing tariffs. In this group of studies, both absolute and relative form of efficiency has been applied in regression analyses.

Basu and Morey (2005) proposed a theoretical model in order to expand the theoretical body of knowledge concerning the effects of liberalization on the stock return

autocorrelation properties. Their model indicates that removing non-tariff barriers on the import of foreign intermediate will manifest in stock price behavior, resulting in moving stock price from a mean-reverting process to random walk. According to the authors, during this process, technological gain from trade openness is transmitted to the stock price autocorrelation. Their model also implies that financial opening alone will not promote stock market efficiency, as it requires trade opening to import intermediate inputs (Basu and Morey, 2005; Lim and Kim, 2011).

The validity of this model, however, is still insufficiently tested using market data and practical conditions. Only two studies (Basu & Morey, 2005; Lim & Kim, 2011) explicitly examined the association between financial openness and informational efficiency of stock market in emerging economies.

Kim and Lim (2011) analyzed the empirical relationship between financial openness and degree of informational efficiency, applying *de facto* and *de jure* measures of financial liberalization, as well as the index proposed by Chinn & Ito (2002). However, their findings suggest that none of the indicators for financial openness is significant and that the regression results do not empirically support the existence of the association between financial openness and stock market efficiency. Kim and Lim (2011) thus state that it is rather premature to jump to the conclusion on the lack of association between financial openness and informational efficiency.

Accordingly, a non-significant relation can be avoided if countries take advantage of high level of quality of institutions. Although the authors attempt to rectify the drawbacks by applying the institutional proxy used in the earlier work of Li et al. (2004) they could not establish a significant correlation. They justified their results by suggesting that the time-

invariant version of institutional development is weak and thus cannot be used to evaluate the quality of institutions in each country. The second caveat in their article—which the current research aims to address—concerns the assumption that liberalization of goods market is a precondition for the same effect on financial markets (Aizenman, 2008;Basu and Morey (2005); Chinn & Ito, 2006 (Lim and Kim, 2011). This points to the existence of an interaction between effect of financial liberalization and trade openness.

CHAPTER 3:

METHODOLOGY

3.1 Introduction

The methodological aspects of current study are threefold:

The definition of efficiency and its linkage to random walk has to be elaborated in order to be able to extract the suitable measurement. Therefore, the first step is how to measure efficiency. It is discussed broadly from two different schools of thoughts and their pertinent measurement tools and justification about why to choose a specific method of measurement. Secondly, the theoretical background of the study which links the variables needs to be clarified in details. Last but not least, estimation techniques of each chapter as well as their advantages over other methods have been described.

3.2 Efficiency and random walk

Establishing whether individual securities or market indices follow a random walk is widely used as a test of market efficiency. If stock prices or market indices exhibit a random walk behavior, investors are unable to earn consistently excessive returns, because shares are priced at their equilibrium values. In contrast, if stocks do not follow a random process, the pricing of capital and risk will be disturbed, which will in turn affect the optimal allocation of capital within an economy. In this case price changes would be predictable and investors could achieve excess returns (Füss, 2005). Weak-form market efficiency theory states predicting prices based on the analysis of past prices is futile as stock prices move in a random walk.

In this study, it is assumed that stock market return behavior over subsample periods can be categorized into five types, depending on the independence of the returns over time,

namely efficient, moving towards efficiency, switching to efficiency/inefficiency, adaptive, or inefficient. A market is efficient if returns are independent with no dependence throughout the sample. On the other hand, it is moving towards efficiency if returns historically exhibited dependence, which tended to diminish over time. A market is said to have switched to efficiency/inefficiency if returns were independent (dependent) but become dependent (independent), although this could be evidence of an early stage adaptive market. A market is deemed adaptive if returns have gone through at least three different stages of dependence (e.g., dependent, independent, dependent).

Finally, a market is inefficient if it has no independence in returns throughout the sample. Thus, this classification incorporates all possible types of returns behavior.

3.3 Measurement

3.3.1 General concept of measuring stock market efficiency

In the market efficiency literature, measuring the efficiency of the stock market is an important topic. The predictability of stock returns based on past price changes has been extensively investigated given its direct implication on weak-form market efficiency. The vast majority of the literature implicitly assumes that the level of market efficiency remains unchanged throughout the estimation period. However, the possibility of temporal instability in the underlying economic relations has received increasing attention from economists (see, for example, Stock and Watson (2003)). There is an expanding literature (such as works on the evolution of EMH) that challenges the assumed static characteristic of market efficiency by means of non-overlapping sub-period analysis, time-varying parameter model, and rolling estimation window. In this context, it is encouraging to note that the documented empirical evidence of evolving stock return

predictability can be rationalized within the framework of the AMH proposed by Lo (2004, 2005).

On the methodological front, a broad spectrum of tests—ranging from simple to complex—have been applied in the extant studies in this field, focusing on whether the null hypothesis of non-predictability holds throughout the sample period. Thus, aiming to cover both *Static* and *Dynamic* tests of stock return predictability, in this study, two types of tests in all analytical parts are applied, as the aim is to establish whether the outputs are consistent or not. The first test—Automatic Variance Ratio (AVR)—relates to static point of view and is extracted from Efficient Market Hypothesis introduced by Fama. Applying AVR, it is assumed the efficiency of stock market is constant over time. The second test is Hurst exponent, which measures the changing degree of market efficiency. Unlike AVR, this method considers efficiency as a dynamic factor that varies during the period of time.

3.3.2 Efficient market hypothesis (EMH)

The weak form of EMH proposes that share price changes are unpredictable. In the simplest version of the random walk model, the actual price equals the previous price plus the realization of a random variable:

$$p_t = p_{t-1} + \varepsilon_t \tag{3.1}$$

where p_t is the natural logarithm of a stock price and ε_t is a random disturbance term. The ε_t satisfy $\mathrm{E}[\varepsilon_t] = 0$ and $\mathrm{E}[\varepsilon_t \quad \varepsilon_{t-h}] = 0$, $h \neq 0$ for all t. If the expected price change $\mathrm{E}[\Delta \mathrm{p}_t] = \mathrm{E}[\varepsilon_t] = 0$, then the best linear estimator for price p_t is the previous price p_{t-1}.

Under the assumption that expected price changes μ are constant over t, the random walk model expands to a random walk with drift (μ = drift parameter):

$$p_t = \mu + p_{t-1} + \varepsilon_t \tag{3.2}$$

ε_t i.i.d. $(0, \sigma^2)$ or

$$\Delta p_t = \mu + \varepsilon_t \tag{3.3}$$

The random walk implies uncorrelated residuals and hence uncorrelated returns, $\Delta p_t . \varepsilon_t$ Here, i.i.d. $(0, \sigma^2)$ denotes that the increments are independently and identically distributed (i.i.d.) with $\mathrm{E}[\varepsilon_t] = 0$ and $\mathrm{E}[\varepsilon_{2t}] = \sigma_\varepsilon^2$. If the ε_t s are i.i.d. normally distributed random variables and therefore price changes are characterized through a white noise process, then equation (3.3) is equivalent to an arithmetic Brownian motion and the increments ε_t follow a normal distribution with $\varepsilon_t \sim N(0, \sigma^2)$.

In general, there is no identity between the weak form of market efficiency, and the random walk hypothesis. However, if stock prices are found to follow a random walk process, equity markets are weak-form efficient (Malkiel and Fama, 1970). Consequently, the random walk properties of stock returns are considered an outcome of the efficient market hypothesis.

3.3.2.1 Variance ratio test of random walk

The traditional tests of random walks (serial correlation and unit-root tests) are susceptible to errors because of the spurious autocorrelation induced by non-synchronous trading, which is characteristic of stock markets in developing countries, and stems from

the lack of power. To resolve this shortcoming, Lo and MacKinlay (1988) developed tests for random walk based on variance ratio estimators. These tests are particularly useful for investigations in which stock returns are frequently not normally distributed. Autocorrelation-based tests, in particular the Variance Ratio tests, remain favorite among investigators for determining the predictability of stock return series (see the survey by Lim and Brooks (2011)).

Their popularity is partly due to the behavioral implication of significant return autocorrelations, which is widely interpreted as investors' mis-reaction (under or over reaction) to the arrival of new information (Barberis, Shleifer and Vishny (1998),Daniel, Hirshleifer and Subrahmanyam (1998),Harrison and Stein (1999)). Briefly, the VR—defined as the ratio of the variance of *k*-period return to *k* times the variance of one-period return—is equal to the weighted sum of the autocorrelation coefficients for the stock return (with positive and declining weights) augmented by one. Under the null hypothesis of serial uncorrelatedness, the VR should be equal to one for any holding period *k*.

The major shortcoming of the currently available autocorrelation-based tests is the arbitrary selection of lag order *K* or holding period *k*, which often leads to conflicting results when different values are employed. Motivated by this concern, the empirical analysis conducted in this study utilizes WBAVR test developed by Jae (2009).

Moreover, most of the previous weak-form EMH studies apply past return-based predictability tests on the entire data sample. In the present study, the automatic autocorrelation-based tests over the sample period (1996 to 2010) are executed instead. This test of market efficiency is in line with the EMH hypothesis, which implies that market efficiency is a constant characteristic. The investigation performed in this work is

thus more aligned with practice, as market efficiency is expected to evolve over the long period of 16 years due to changes in macro institutions, market regulations, and information technologies. This view is consistent with the Adaptive Markets Hypothesis (AMH) of Lo (2004), which implies that market efficiency is not an all-or-none condition but is a characteristic that varies continuously over time and across markets.

3.3.2.2 Variance ratio estimation

Serial correlation test is one of the earlier tools employed in the weak-form EMH literature, pioneered by Fama (1965). This statistical procedure is testing the least restrictive version of the random walk hypothesis—the Random Walk model developed by Campbell, Lo and MacKinlay (1997), which only requires uncorrelatedness of price changes. Since the seminal work of Lo and MacKinlay (1988), the VR test has emerged as the primary tool for testing whether stock return series are serially uncorrelated. The VR test is based on the statistical property that if the stock price follows a random walk, then the variance of the k-period return is equal to k times the variance of the one-period return.

Hence, the VR, defined as the ratio of the variance of the k-period return to the product of k and the variance of the one-period return, should be equal to one for any holding period k, under the null hypothesis of serially uncorrelated stock returns.

The random walk is a stochastic process that is frequently used in model specification of financial time series. The discovery of the random walk in prices of financial assets is attributed to Kendall and Hill (1953). The random walk model can be represented by

$$P_t = P_{t-1} + \varepsilon_t \tag{3.4}$$

where P_t is the price of an asset at time *t*; ε_t is a white noise sequence. The RWH (Random Walk Hypothesis) is verified through VR test. The first work about VR tests was developed by Lo and MacKinlay (1988), and has since become known as simple variance ratio test. The key feature of this test is that, if a variable follows a random walk, its variance for *q* periods is *q* times greater than the variance for one period. Thus, the null hypothesis of this test states that the variances ratio is equal to 1.

$$VR(y;k_i) = \left\{ \frac{1}{TK} \sum_{i=k+1}^{T} \left(y_t + ... + y_{t-k} - k\hat{\mu} \right)^2 \right\} \div \left\{ \frac{1}{T} \sum_{t=1}^{T} \left(y_t - \hat{\mu} \right)^2 \right\} \tag{3.5}$$

where y_t is an observation from a time series at period *t*; μ is the mean of *y*; *T* is the number of observation; *k* is the number of lags. Lo and MacKinlay (1988) proposed the tests M_1 and M_2. If y_t is independent and identically distributed $\left(\text{i.i.d.}\right)$, then the test M_1 is asymptotically normally distributed. However, this supposition does not hold when in presence of conditional heteroskedasticity, when the more robust M_2 test should be applied. The M_1 and M_2 tests are represented by expressions (3.6) and (3.7) below.

$$M_1(y,k_i) = \left[VR(y;k) - 1 \right] \times \left[\frac{2(2k-1)(k-1)}{3kT} \right]^{-\frac{1}{2}} \tag{3.6}$$

$$M_2(y,k_i) = \left[VR(y;k) - 1 \right] \times \left\{ \sum_{j=1}^{k-1} \left[\frac{2(k-j)}{k} \right]^2 \delta_j \right\}^{-\frac{1}{2}} \tag{3.7}$$

$$\delta_j = \left\{ \sum_{t=j+1}^{T} (y_t - \hat{\mu})^2 (y_{t-j} - \hat{\mu})^2 \right\} \div \left\{ \left[\sum_{t1}^{T} (y_t - \hat{\mu}) \right]^2 \right\} \tag{3.8}$$

The test statistics can be written as a weighted sum of autocorrelation of stock returns, where ρ_i is the i^{th} order autocorrelation of the returns, k is the holding period and $\hat{\rho}_i$ is the estimator for ρ_i.

$$VR(k) = 1 + 2\sum_{i=1}^{k-1} \left(m - \frac{i}{k} \right) \hat{\rho}_i \tag{3.9}$$

Under the null hypothesis of random walk, $VR(k) = 1$ for all k, because the returns are serially uncorrelated and tend to zero. On the other hand, $VR(k) < 1$ indicates an overall negative serial correlation over the holding period k, whereas $VR(k) > 1$ points to an overall positive serial correlation. Since a more efficient price exhibits less autocorrelation in either positive or negative direction, a number of recent studies employed the absolute deviation of the variance ratio statistic from one as an inverse measure of relative market efficiency. However, interpreting these tests is difficult, as distinct values of k may produce different outputs.

3.3.2.3 Variance ratio estimation with automatic selection of the optimal holding period

In his subsequent study, Choi (1999) developed Automatic Variance Ratio (AVR), the test statistic of which is given above, where:

$$\hat{\rho}_t = \frac{\sum_{t=1}^{T-i}(y_t - \hat{\mu})(y_{t+i} - \hat{\mu})}{\sum_{t=1}^{T}(y_t - \hat{\mu})^2}, \tag{3.10}$$

while

$$m(x) = \frac{25}{12\pi^2 x^2}\left(\frac{\sin\left(\frac{6\pi x}{5}\right)}{\frac{6\pi x}{5}} - \cos\left(\frac{6\pi x}{5}\right)\right), \tag{3.11}$$

is the quadratic spectral kernel.

According to Choi (1999), $VR(k)$ is a consistent estimator for $2\pi f_y(0)$, where $f_y(0)$ is the normalized spectral density for y_t at the zero frequency. Choi (1999) showed that under $H_0^A : y_t$ is serially uncorrelated (Jae 2009).

(Or: $H_0^B : 2\pi f_y(0) = 1$)

$$AVR = \sqrt{(\frac{T}{k}}[VR(\hat{k}) - 1]) / \sqrt{2} \to N(0,1) \tag{3.12}$$

As $k \to \infty$, $T \to \infty$, $\frac{T}{K} \to \infty$ when y_t is i.i.d. with a finite fourth moment. The author further stated that the result in equatin (3.3) holds when y_t is generated from a martingale difference sequence with proper moment conditions. In order to make optimal selection of the lag truncation point *k* (holding period) , Choi (1999) adopted a data-dependent method for spectral density at the zero frequency (Jae 2009).

The corresponding AVR test statistics with the optimally chosen lag truncation point are denoted as $AVR(\hat{k})$. However, it should be noted that the $AVR(\hat{k})$ test is an asymptotic test that may exhibit deficient small sample properties. Thus, when y_t is subject to

conditional heteroskedasticity, the wild bootstrap can be employed to mitigate this effect as was done in the work by Jae (2006), who applied the wild bootstrap to the Lo–MacKinlay tests. The wild bootstrap for $AVR(\hat{k})$ can be conducted in three stages noted below:

I. Form a bootstrap sample of *T* observation $y_t^* = \eta_t y_t \ (t = 1, 2, ..., T)$ where η_t is a random sequence with $E(\eta_t) = 0$ and $E(E(\eta_t^2)) = 1$.

II. Calculate $AVR^*(\hat{k}^*)$, the AVR statistic obtained from $\{y_t^*\}_{t=1}^T$, and

III. Repeat (I) and (II) *B* times to form a bootstrap distribution $\{AVR^*(\hat{k}^*; j)\}_{j=1}^B$

The two-tailed *p*-value of the test is obtained as a proportion of the absolute value of *AVR*.

The bootstrap method provides an alternative approximation based on resampling of the observed data, which does not rely on the large sample theory. Thus, the bootstrap critical value (or *p*-value) can be more accurate than those based on asymptotic approximation. Due to these valuable properties, this approach has been widely used in econometrics, whereby many researchers found it more superior to the asymptotic method in many applications (Efron and Tibshirani, 1993; Jae 2009).

When returns are subject to an unknown form of conditional heteroskedasticity, statistical inference may be invalid, especially when small samples are used. For example, confidence interval for $V(k)$ based on *N*(0,1) may seriously underestimate the uncertainty associated with estimation. Therefore, the use of wild bootstrapped automatic variance ratio test is strongly recommended for small samples under conditional heteroskedasticity (Jae 2009; Kim, Shamsuddin and Lim, 2011).

3.3.3 Adaptive market hypothesis

The literature on market efficiency is vast, as the theme is of interest for both practitioner and academics. While significant portion of the extant literature focuses on empirical tests, which seek predictability in stock market prices, there is also a voluminous literature on short-term dependencies, with yet another strand that focuses on long-range dependencies.

As data processing methods inherent in EMH reduce noisiness of financial time series, they hide part of the information that could possibly foretell formation of long-term period, an approaching crisis, or a market raise. In this study, a newly introduced measure in finance literature is applied for trend analysis of financial time series, which considers the long-term correlation memory. This assumption contradicts the efficient market hypothesis, or at least recognizes presence of periods of temporary financial markets inefficiency. Long-term correlation memory analyses interdependences among different and separated observation periods of the time series (Sakalauskas and Kriksciuniene, 2013).

Some of the researchers (see Mandelbrot (1963), Lo and MacKinlay (1988), Sakalauskas and Kriksciuniene (2007) explore exceptions of the efficient market hypotheses, which occur due to regular or rare events, such as crises, seasonal impacts, markets news, calendar anomalies (day-of-the week, holiday and other phenomena), or particular features of the financial markets. According to Mandelbrot (1963), stock returns have long memory and cannot be explored as white noise process, as they reveal deviations from market efficiency hypothesis. Market anomalies present opportunity for the investors to exploit temporary predictability of the financial time series and obtain financial gains. The seasonal anomalies, investment manias, bubbles, and behavioral

patterns are more strongly expressed in emerging markets. In this regard, Hurst Exponent (HE) is the most common measure that can be applied to define the level of information efficiency with regard to long-term correlation memory.

In this part of research, the focus is on long-range dependences for the data sample that comprises 27 equity indices of emerging markets and has some important contributions from an empirical point of view. Firstly, a "rolling sample" approach is employed to show that efficiency seems to evolve over time.

The Hurst Exponent is the statistical measure of information efficiency and long term correlation memory, which allows analysis of randomness of time series. The value range of *HE* is in [0; 1], with 0.5 indicating that the analyzed time series is completely random. If HE is greater than 0.5 and approaches 1, the analyzed time series is persistent, as its trend is not likely to change direction in the nearest future. If, on the other hand, HE is below 0.5, the trend component of the time series is vague and fluctuating, and thus denotes anti-persistent series.

The main contribution of this part of the present study stems from highlighting the importance of studying time-varying HEs to assess market efficiency, instead of relying on single static measures of long-memory dependence. Furthermore, the rolling sample approach used here differs from most of the work published in extant literature.

3.3.3.1 Hurst exponent

The HE evaluation is carried out by two methodologies, one of which is the usual and most popular methodology introduced by Hurst (1950). Here, the R/S analysis is applied

to the log return time series to evaluate the HE. More explicitly, let $x(t)$ be be the price of a stock on a time *t* and $r(t)$ be the logarithmic return denoted by

$$r(t) = \ln\left(\frac{x(t+1)}{x(t)}\right) \tag{3.13}$$

The *R/S* statistic is the range of partial sums of deviations of times series from its mean, rescaled by its standard deviation. Thus, consider a sample of continuously compounded asset returns $\{r_1, r_2, ..., r_\tau\}$ and let $\overline{r}_\tau$ denote the sample mean $\frac{1}{\tau}\sum_\tau r_\tau$ where τ is the time span considered. Then the *R/S* statistic is given by

$$(R/S)_\tau \equiv \frac{1}{s_\tau}\left[\max_{1\le t\le\tau}\sum_{k=1}^{t}(r_k - \overline{r}_\tau) - \min_{1\le t\le\tau}\sum_{k=1}^{t}(r_t - \overline{r}_\tau)\right] \tag{3.14}$$

where s_τ is the usual standard deviation estimator

$$s_\tau \equiv \left[\frac{1}{\tau}\sum_t (r_t - \overline{r}_\tau)^2\right]^{\frac{1}{2}} \tag{3.15}$$

Hurst found that the rescaled range, *R/S*, for many records in time is very well described by the following empirical relation:

$$(R/S)_\tau \equiv (\tau/2)^H \tag{3.16}$$

The second HE evaluation methodology is a modified version of the *R/S* analysis considered in the work of Erramilli, Narayan and Willinger (1996). Here, the R/S analysis is applied to blocks of shuffled data, whereby a random permutation of the data series

within blocks of predetermined size (in general, small size blocks) is chosen, and the R/S analysis is applied to this shuffled data.

The main problem with the use of the R/S analysis is that it is sensitive to short-term autocorrelation, which is a widely accepted characteristic of financial time series volatility. Therefore, the R/S analysis for shuffled returns (returns calculated from shuffled data) is employed in this work.

3.3.4 Financial liberalization definition and measurement

Financial liberalization is a country's decision to eliminate boundaries and allow foreigners to enter the country's stock market; purchase shares and either repatriate the returns or spend it in the domestic economy (Henry, 2000). From another point of view, liberalization is based on highlighting the role of the market for re-allocation of capital and decreasing the government interference concurrently(Abiad, Oomes and Ueda, 2008).

Based on Henry (2007) financial liberalization is a decision by a country's government to move from a closed capital account regime, where capital may not move freely in and out of the country, to an open capital account system in which capital can enter and leave at will. In the financial literature, the liberalization concept refers to four main reforms, namely Opening of banking industry, Opening of capital account, Opening of stock market, and Deregulation of interest rate (Allegret, Courbis and Dulbecco, 2003; Kaminsky and Schmukler, 2008). Hence, when reporting on their work, it is important for researchers to clearly state the definition of liberalization measure used in the analysis. Currently, several ways for quantifying financial liberalization are in used, as summarized below.

The Chinn-Ito index (KAOPEN), developed in 2002, measures a country's degree of *capital account openness*. KAOPEN is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER).

The most controversial index refers to the announcement dates made by government as "*exogenous dates*" of financial liberalization and has been applied in a number of studies, where it was adopted as the liberalization index. However, this broadly common index does not seem robust enough in declaring the concept of liberalization. Liberalization is a gradual process that evolves over time, rather than occurring at a specific time point.

Another way of quantifying financial liberalization, which seems more practical than the one described above, is based on following the process of several financial time series and estimating the breaks in data series. According to Bekeart et al. (2002), "*endogenous*" dates of financial liberalization usually take place after "*exogenous*" dates. Thus, according to the authors, this measure can incorporate two aspects of liberalization, namely deregulation of banking system and interest rate, whereby both "endogenous" and "exogenous" dates should refer to "*de jure*" financial liberalization. An example of *de jure* indices is the index based on IMF Annual Report on Exchange Arrangements and Exchange Restriction (Grilli and Milesiferretti, 1995). Here, it should be noted that both types of liberalization—*exogenous* and *endogenous*—must be converted to binary variable format before being used in quantitative analysis.

In their research, Bekaert and Harvey (2002), as well as Beine and Candelon (2011), used a dummy variable to represent state of liberalization. Thus, if a country was considered liberalized, the variable was assigned a value of with value of 1 and 0 otherwise, even

though the deficiencies of these dichotomous measures of liberalization are well known. The most apparent drawback of adopting this approach is in its inability to measure the intensity of openness and consider an economy as either completely liberalized or fully closed (Chinn and Ito, 2002).

Alternatively, an intensive measure of liberalization—known as *de facto* financial liberalization—can be employed, as was done by Bekaert (1995), as well as Edison and Warnock (2003). While this measure is based on the capital inflows to GDP ratio, in some literature sources, *de facto* stock market openness is measured as the sum of equity inflows and outflows as a share of GDP. The annual capital flows are published by two sources, the most widely recognized being International Financial Statistics (IFS), published by the International Monetary Fund (IMF). However, Lane and Milesi-Ferretti (2007) provide the most reliable dataset, namely External Wealth of Nations Mark II (EWNII), which purifies the data published by the IMF. The key difference between the two datasets stems from the treatment of valuation effect, which requires adjustment for changes in the end-of-year US dollar value of the domestic stock market. These two indices suffer from cyclical fluctuations and can be adopted as an index for the third aspect of liberalization.

The more precise (based on actual data, rather than merely legislated, policy reforms) version of financial liberalization index, known as *Liberalization Intensity*, is based on the ratio of the market capitalization of a country's IFC Investable index and IFC Global index (Bekaert, Harvey and Lundblad, 2005). It describes the extent of the availability of the country's equity to foreigners. The IFC Global index is designed to represent the overall market portfolio for each country, whereas the IFC Investable index refers to a portfolio of domestic equities that are available to foreign investors. Thus, the ratio

between the two indices provides a quantitative measure of the availability of the country's equities to foreigners, with values ranging from zero (completely closed to foreign investors) to one (completely open market, with no foreign restrictions) (Bekaert, Harvey and Lundblad, 2005; Lim and Kim, 2011).

Although this approach is theoretically sound, the necessary data on market capitalization for the IFCI and IFCG is no longer publicly available. Therefore, the *Alternative Intensity*—interpreted in the same manner as the previous index, and calculated as the number of firms in the investable and global indices for each country—has been used in the extant literature on the subject. Thus, liberalization intensity and alternative intensity are the last form of liberalization (opening the stock market to foreigners) available to the practitioners and analysts.

In this research, third concept of liberalization is considered, namely opening of stock market, which is measured by net equity flows to GDP. This approach is taken, as the data is freely accessible and can be used to infer the intensity of financial openness.

Table 3.1: Summary of all liberalization measures

Type	Chinn-Ito-Index (KAOPEN)	Measure degree of capital account openness	Binary
De Jure	Exogenous dates of liberalization	Announcement dates made by government	Binary
	Endogenous dates of liberalization	Following the process of several financial times series	Binary
De Facto	De facto financial liberalization	Sum of equity inflows and outflows as a share of GDP: Annual capital flows: • IFS • EMN(II)	Not Binary
	Liberalization Intensity	Ratio of market capitalization of a country's IFCI and IFCG indices	Not Binary
	Alternative Intensity	Number of firms in IFCI and IFCG for each country	Not Binary

Source: Naghavi and Lau (2014)

3.4 Conceptual framework

In order to develop the new research method and to identify econometric techniques for future efforts, conceptual research methodology map and economic framework (see Figures 3.1-3.4) are developed, allowing the research findings to be easily mapped and assessed. The frameworks help define the key input and output variables and relationship addressed by different estimation methods herein.

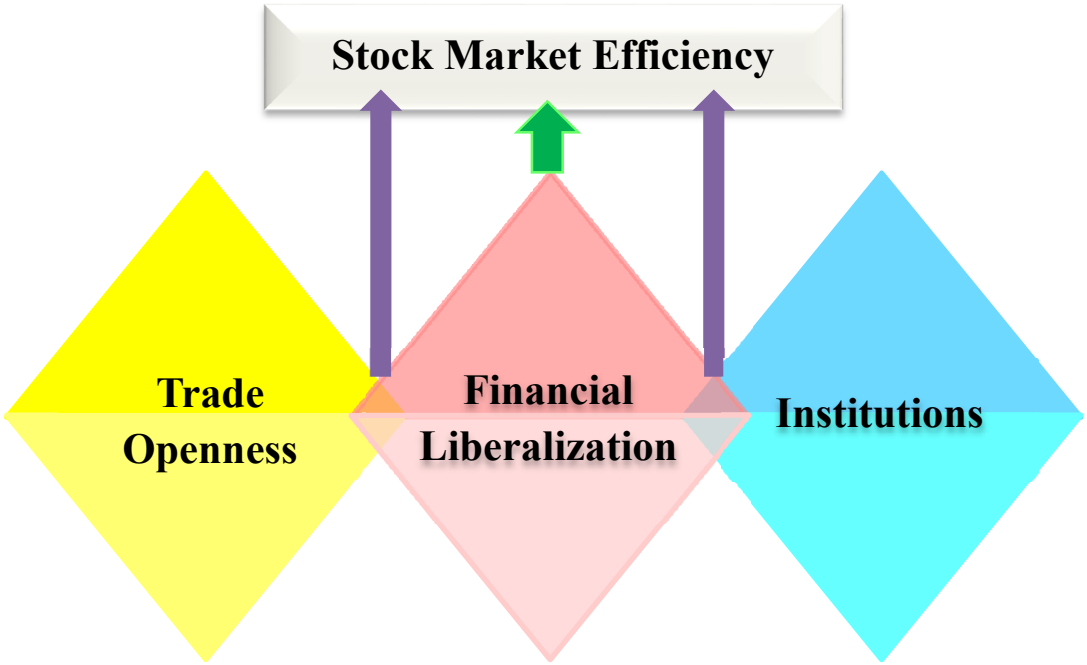


Figure 3.1: Conceptual framework

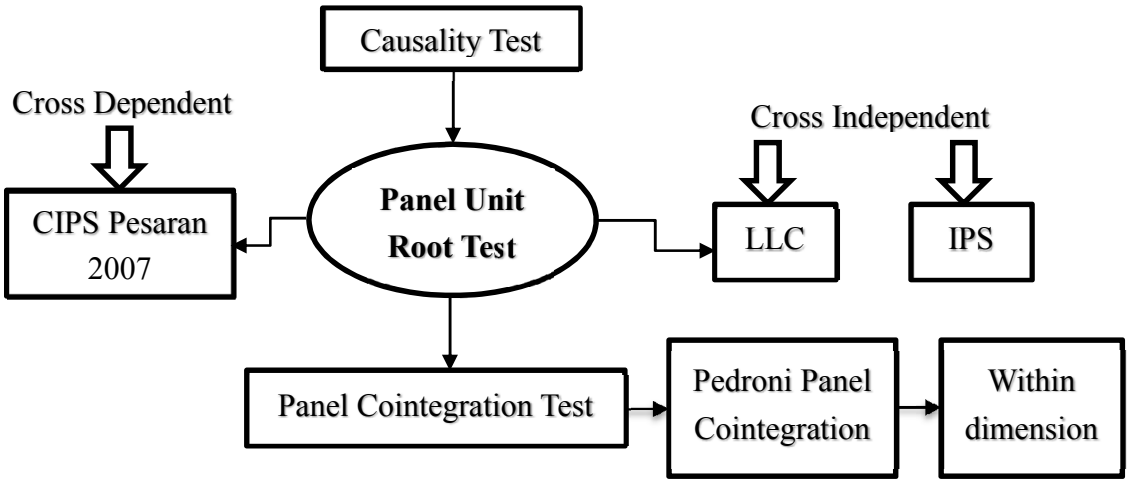


Figure 3.2: Econometric framework

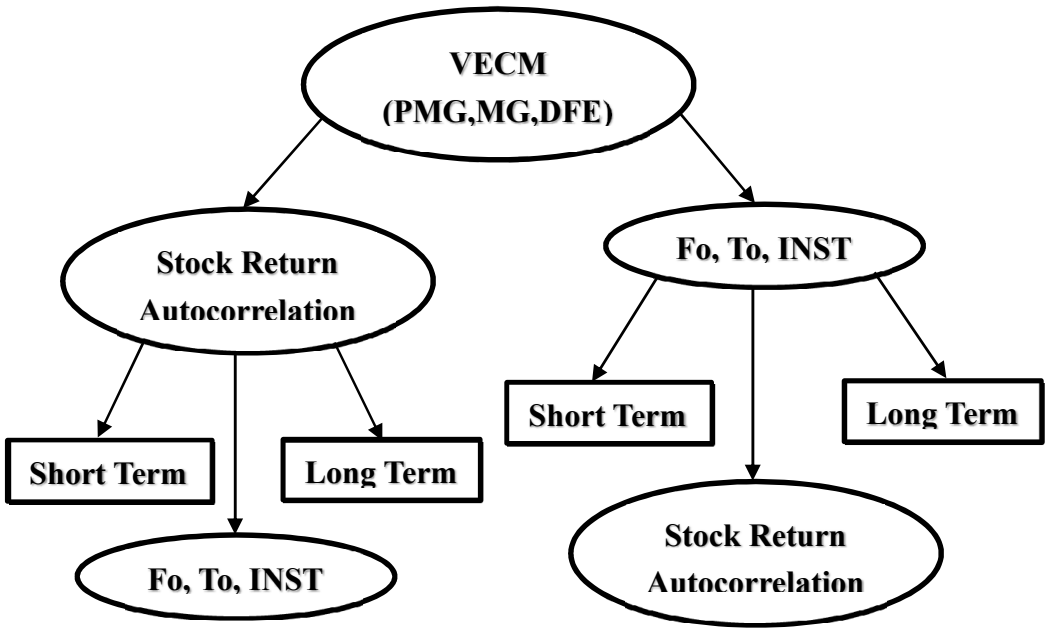


Figure 3.3: Econometric framework for granger causality

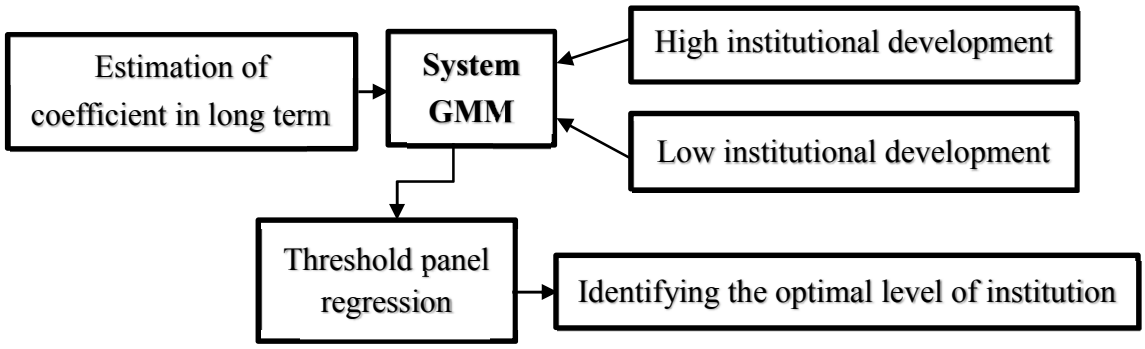


Figure 3.4: Econometric framework for long-term relationship and institution optimal level

3.5 Theoretical background

3.5.1 Theoretical model of Basu & Morey

The Basu and Morey model explicitly shows the relationship between the real and financial sectors of a quantity constrained economy by integrating a stochastic growth model with the asset pricing equation along the lines suggested by Brock (1978). In addition, the model stresses the role of intermediate imports as a supply-side constraint, resembling the work of Bardhan (1970) and Bruno and Sachs (1985). Here, it is worthy to consider a representative home country with an infinitely lived household, which makes decision about consumption (C) and saving in each period.

All households' savings are assumed to be in the form of investment in the home country's stock market only. In addition, there is no offshore holding of home country's shares and the home country's stock market is entirely closed to the foreigners. Each share thus represents a claim to the home country's capital stock. The representative home consumer thus behaves like a Lucas (1978) household. At a date *t*, the household enters with Z_t shares purchased in the previous period, which yields dividend D_t per unit of share and a capital gain from selling these shares. Formally, the household problem is expressed as:

$$\max(\mathrm{E}_0 \sum_{t=0}^{\infty} \beta^t U(C_t)) \tag{3.17}$$

$$s.t.\ P_t Z_{t+1} - P_{t-1} Z_t = D_t Z_t + (P_t - P_{t-1}) Z_t - C_t \tag{3.18}$$

Next, we consider the production sector of the economy. The firm under study owns the capital stock, produces, and invests.

In a closed economy, there is a state monopoly over the production of these intermediate inputs. Due to the poor public sector infrastructure, only a limited quantity, $\overline{V}$ of these inputs can be produced. These intermediate inputs are efficiently priced, whereby the price P_{vt} equals the marginal product (MPV_t). After the government auctions off these inputs to the firms at a user price Q_t, it rebates the net surplus $(Q_t - P_{vt})\mathrm{V}_t$ to the firms as a lump-sum (referred to as T_t). Once the home country opens up on the trade front, this quantity constraint on the imported intermediate inputs disappears for the reasons discussed below.

The home country now finances the optimal purchase of intermediate inputs through short-term loans from international credit agencies at a fixed world interest rate *r**. Since the optimal choice of intermediate input is a static decision, the loan the home country obtains at the start of each period is repaid at the end of that period with interest. The price of the intermediate input P_{vt} thus equals the world interest rate r^*. As a result, the home country now faces a perfectly elastic supply curve for intermediate inputs at a fixed world interest rate r^*. The government purchases the optimal level of intermediate inputs V_t^* such that $MPV_t = r^*$. The remaining process is unchanged.

The government charges a user price, Q_t and rebates the surplus $(Q_t - r^*)V_t^*$ to the firms as lump-sum. It is important to note that the home country's stock market is still closed to off-shore investors. Therefore, the domestic share continues to be a claim to home country's own capital stock alone. Note that, in a closed economy, as the government imposed quantity constraint, $\overline{V} < V_t^*$, the country cannot reap full economies of scale by

choosing the intermediate input at the efficient level V_t^*. Given the sequence $\{V_t\}$, $\{Q_t\}$ and $\{T_t\}$ the representative firm solves the following maximization problem.

$$\max_{\{K_t\}}(E_0\sum_{t=0}^{\infty}[\varepsilon_t F(K_t, V_t - Q_t V_t - I_t + T_t]\prod_{t=0}^{t} d_i) \tag{3.19}$$

S.t $I_t = K_{t+1} - (1-\delta)K_t$ and $K_0 =$ given

where K_t is the capital stock at the beginning of period *t*, I_t is gross investment in period *t*, $\varepsilon_t \in [a,b]$ is an idiosyncratic productivity shock to the total factor productivity realized at the beginning of period t, $\delta \in (0,1)$ is the rate of depreciation of the capital, and $F(K_t, V_t)$ represents constant returns to scale production function with the usual properties $F_k > 0$, $F_v > 0$, $F_{kk} < 0$ and $F_{kv} > 0$, where the subscripts denote the arguments of differentiation. Here, it is assumed that both V_t and K_t are necessary inputs in the production process in the sense that $F(K_t, 0) = 0$ and $F(0, V_t) = 0$, and the term $\prod_{t=0}^{t} d_i$ represents the stochastic discount factor of the firm at a date *t*. It should be pointed out that the discount factor is time varying and is endogenously determined. The fundamental source of uncertainty thus emanates from the technology along the lines of a real business cycle model, i.e., the productivity shock ε_t arises from exogenous technological innovations or vagaries of weather. In order to rule out an open economy transiting between closed and open states, the lowest bound a for ε_t is assumed to satisfy the following restriction:

$$\bar{V} < K_0 h^{-}(\frac{r^*}{a}) \tag{3.20}$$

where

$$h\left(\frac{V_t}{K_t}\right) = F_v\left(1, \frac{V_t}{K_y}\right) \tag{3.21}$$

The inequality restriction (3.20) ensures that even, if the open economy suffers the worst shock, its optimal choice of foreign input V_t^* still exceeds the closed economy's fixed supply V.

In an open economy, stock returns exhibit zero serial auto correlation, and the stock price follows the random walk hypothesis. The intuition behind this result is that, in a closed economy, home country's production is subject to diminishing returns with a fixed quantity of intermediate inputs. On the other hand, in an open economy, along its growth path, the home country now no longer faces any shortage of imported intermediate inputs. The level of imported intermediate inputs now grows on par with the capital stock, ensuring full productive efficiency. Consequently, as the return to capital does not decline as the economy grows, it facilitates self-sustained growth. The variation of the returns to capital, therefore, purely reflects the idiosyncratic shocks (ε_t) to productivity. The equilibrium stock returns thus show zero serial correlation and stock prices follow a random walk.

3.5.2 Basu and Morey link of openness and efficiency

In this newly developed model, trade opening is modeled as an elimination of a non-tariff restriction on the import of foreign intermediate inputs. In an autarkic environment, where the domestic production is starved due to lack of availability of complementary foreign

intermediate inputs, technological economies of scale are not reached and diminishing returns to capital consequently prevails. This technological inefficiency transmits to the financial sector, whereby the stock market deviates from efficiency by displaying mean reverting behavior.

As soon as the non-tariff barrier to the free flow of foreign intermediate inputs is removed, the resulting technological efficiency manifests through a random walk behavior of the stock market prices. However, as previously noted, financial opening alone will not promote stock market efficiency. Trade reform in the form of removal of non-tariff barriers to imports intermediate inputs is just as crucial, as it translates technological efficiency to financial market efficiency. This theoretical analysis offers a testable hypothesis regarding the link between the productive efficiency and financial market efficiency.

3.6 Econometric methodology and estimation techniques

Various estimation techniques have been applied in current study. The pertinent equations and sequential procedure for each technique are presented as below.

3.6.1 Unit root test

Prior to implementing the estimations, it is necessary to clarify whether there is a long-term relationship among variables, which is contingent of the existence of cointegration. Before applying the cointegration, the unit root test must be applied to each variable.

3.6.1.1 Panel unit root tests

Many recent studies have attempted to investigate the unit root in panel data and many of the analyses performed cover more than 20 years of panel data. Testing for stationary character of time series has been conducted by many scholars and has become an integral section of econometric analysis. While the topic was initially rather peripheral, it is now a very active research area. In the beginning, when the panel unit root research was still in its infancy, econometricians tended to view the extension of the conventional unit root analysis to panel data as a rather straightforward and less exciting exercise. However, it has since become clear that this is not the case. Today, panel unit root tests are standard econometric tools within most fields of empirical economics, especially in macroeconomics and financial economics. Easier access to panel data has led the researchers to take more interest in panel unit roots, which have consequently become more pervasive.

It is currently generally established that previous unit root tests, such as Dickey-Fuller (DF), augmented Dickey-Fuller (ADF), and Philips-Perron (PP) tests, are powerless in determining the stationarity of variables; therefore, using panel unit root test approaches is one way of increasing the power of the test. The differences in power between the previous stationary tests and panel unit root tests has been demonstrated using econometrics, and can be seen in works such as that published by Levin, Lin and Chu (2002), as well as Im, Pesaran and Shin (2003). Since none of the panel unit root tests is free from statistical inadequacies in terms of size and power properties, in the present study, the most developed panel unit root tests are carried out, as these are designed to rectify most of the potential drawbacks in order to determine the order of integration of the panel variables. Indeed, the work conducted on this issue over the last decade has revealed a number of fundamental differences in the way statistical inference with non-

stationary data is performed and it seems fair to say that panel unit root analysis has established itself as a legitimate branch of literature.

As noted above, two of the most influential contributions to this field of research are those of Levin, Lin, and Chu (2002) (LLC) and Im, Peseran, and Shin (2003) (IPS). These authors were among the first to develop the so-called first generation tests, which are appropriate when the cross-sectional units are independent of each other. These works are important for applied researchers, for whom vast amounts of panel data are now available, as well as for econometricians concerned with the development of new tests and methods for non-stationary panels. However, despite their notable value, LLC and IPS have been poorly investigated, as indicated by only a few studies that have, either directly or indirectly, focused on the works of Levin, Lin, and Chu (2002) and Im, Peseran, and Shin (2003).

In general, most methods applied in econometrics and statistics are based on certain established facts that are assumed to be well known. For example, time series unit root tests, like the one suggested by Dickey and Fuller (1979), henceforth denoted as DF, can suffer from poor power, if the autoregressive root is local-to-unity, especially in the presence of deterministic constant and trend terms. It is also established that the power of such tests can be improved by performing the detrending regression in a way that is efficient under the local alternative hypothesis—an idea that was first suggested by Elliott et al. (1996).

Given its common usage, it is easy to assume that demeaning in this way is the best approach to accommodating the nonzero mean. However, this is not true. Indeed, as Westerlund and Breitung (2013) have shown, the inclusion of the intercept introduces a

bias in the estimated AR coefficient, which has to be corrected somehow. However, the resulting corrected IPS and LLC tests are likely to suffer from low power and may even become inconsistent in some circumstances. In response to this issue, a few alternative demeaning procedures were proposed. For example, when a *variable* is contaminated by cross-section dependence in the form of common factors, a failure to account for these factors can cause the test statistic to become divergent. Thus, one should be careful not to approach the testing problem from a too narrow and stylized perspective.

In particular, it is a premise of this work that the usual practice of looking at the problem from mainly a time series perspective can be deceptive in its simplicity, causing many important issues, such as cross-sectional dependence, incidental trends, and joint limit restrictions, to be overlooked. To overcome this deficiency, Pesaran (2007) suggested augmenting the standard ADF regressions with the cross-section averages of lagged levels and first-differences of the individual series in the panel. The resulting test statistic is referred to as the cross-sectionally augmented version of the IPS test, denoted as CIPS.

Previous research indicates that the power of unit root tests would be improved by developing cross-sectional information. Levin, Lin and Chu (2002) propose a panel-based ADF test that restricts parameters γ_i by keeping them identical across cross-sectional region, as represented in the following expression:

$$\Delta y_{i,t} = \lambda_i y_{it-1} + \sum_{k=1}^{pt} c_{ik} \Delta y_{it-k} + Z_{it}\delta + \varepsilon_{it} \tag{3.22}$$

where

$y_{i,t}$ denotes each variable under consideration in the model, P is the number of lags for correlation free residuals, and Z_{it} indicates the vector of determinist variables in the model including any fixed effects or individual trends. Under the null hypothesis, all series in the panel are non-stationary processes; under the alternative, a fraction of the series in the panel is assumed to be stationary.

Here, $t = 1, 2, \ldots, T$ are the time periods,

and $i = 1, 2, \ldots, N$ denote the panel members.

Thus, the null hypothesis of $\lambda_1 = \lambda_2 = \lambda = 0$ for all i

is tested against the alternate $\lambda_1 = \lambda_2 = \lambda < 0$ for all i, with the test based on the statistic

$$t_\lambda = \frac{\hat{\lambda}}{s.e(\hat{\lambda})}$$

Levin, Lin and Chu (2002) (LLC) assumes homogeneity in the dynamics of the autoregressive (*AR*) coefficients for all panel members. Specifically, the LLC test assumes that each individual unit in the panel shares the same *AR*(1) coefficient, while allowing for individual effect, time effects, and eventually a time trend. In addition, lags of the dependent variables may be introduced in the model to allow for serial correlation in the errors

The Im, Pesaran and Shin (2003) test relaxes the assumptions of the LLC by allowing β to differ across units under the alternative hypothesis, which permits heterogeneity in autoregressive coefficients for all panel members. The t-bar test proposed by Im, Pesaran and Shin (2003) further assumes that all cross sections congregate towards the equilibrium value at dissimilar speeds under the alternative hypothesis. Two stages were proposed in constructing the *t*-bar test statistic. Firstly, the mean of the individual

Augmented Dickey-Fuller (ADF) *t*-statistics for each cross-sectional (*N*) in the sample is calculated. Secondly, the standardized *t*-bar statistic can be calculated using the following expression:

$$t-bar = \frac{\sqrt{N}}{\sqrt{vt}}(t_{\alpha} - k_t) \tag{3.23}$$

where t_{α} is the average of the individual ADF *t*-statistics for each of the cross-sectional elements with and without a trend, *N* is the panel size, and K_t and v_t are, respectively, the estimates of the mean and variance of each $t_{\alpha i}$. Im, Pesaran and Shin (2003), who performed Monte Carlo simulations in order to highlight the difficulty of the *t*-bar test, suggested that, when there is cross-sectional dependence in the disturbances, the test would no longer applicable. However, the authors recommended that, in the presence of cross-sectional dependence, the data can be modified by demeaning, whereby the standardized demeaned *t*-bar statistic would congregate to the standard normal in the limit.

While a number of panel unit root tests have been proposed, the empirical analysis performed in this study is based on a recent panel unit root test improved by Im and Pesaran (2003), which accounts for cross-sectional dependence. However, given that this test is comparatively new and less used, more information is needed, sourced from the applied economics literature, as follows. Im and Pesaran (2003) developed a panel unit root test by improving the augmented Dickey-Fuller (ADF) regression with cross-sectional, means of first differences, and lagged levels of the individual series. This test is known the cross-sectional augmented ADF (CADF) test, which assumes that all series

are non-stationary under the null hypothesis. The following regression represents the CADF test:

$$\Delta y_{it} = \alpha_i + \beta_i y_{it-1} + \eta_i \bar{y}_t + k_i \Delta \bar{y}_t + \varepsilon_{it} \tag{3.24}$$

where, $\bar{y}_t$ is the average of the variable y_t In this case, testing the null hypothesis is equivalent to testing the unit root, i.e. $H_0 : \beta_i = 0$ for all *i*, against the probably alternative hypothesis $H_1 : \beta_i < 0,\ i = 1, 2, \ldots, N,\ \beta_i = 0.$

The null hypothesis has also been tested via the t-test has, assuming that the distribution is non-normal, whereas critical values are produced by Pesaran(2003) as well Narayan, Narayan and Popp (2010).

All panel unit root tests are defined by Barlett kernel and Newey-West bandwidth and the optimal number of lags is chosen by Akaike Information Criterion (AIC). The probabilities for Fisher tests are computed using an asymptotic chi-square distribution, and all other tests assume asymptotic normality.

In this study, panel unit root tests are employed, which can be ordered in groups by heterogeneous and cross-section dependence or independence, in keeping with the tests developed by Levin, Lin and Chu (2002), Im, Pesaran and Shin (2003) and Pesaran (2007).

3.6.2 Panel cointegration tests

To study the short- and long-term relationships among variables, the vector error correction model (VECM) is employed in the panel data analysis. In time series analysis,

two variables are said to have a long-term relationship if they are co-integrated. It is assumed that variables are cointegrated, if the order of integration of the left-hand-side variable is equal to or greater than the highest order of integration of the right-hand-side variables. Otherwise, even without cointegration tests, they are obviously not cointegrated.

Before initiating the cointegration tests, the panel unit root tests need to be applied in order to establish the order of integration of the variables. This test is useful for obtaining the stationary variables for the Granger causality test. Depending on the Hausman and F test results, the VECM is developed by employing pooled mean group (PMG), mean group (MG), and dynamic fix effect (DFE) estimators to determine the causal relationships among variables. The idea of cointegration was first established by Granger and was developed further by Engle and Granger (1987), Johansen (1988) and Phillips and Ouliaris (1990), among others. The fundamental concept behind these works is that, if two or more time-series variables are individually integrated of order *n*, there is a possibility that at least one linear combination of them can be integrated at lower than *n*, indicating cointegration.

The cointegration variables display a strong stable-state relationship in the long-term, having general trends and co-movements similar to panel unit root tests. By extending the time series cointegration tests to panel cointegration, two groups of tests have been proposed. The first group of tests takes cointegration as the null hypothesis, and is employed in the works of McCoskey and Kao (1998) and Westerlund and Edgerton (2007) while the other group of tests takes no cointegration as the null hypothesis, and has been performed by Pedroni (1999), Kao, Chiang and Chen (1999), Larsson, Lyhagen and Löthgren (2001), and Groen and Kleibergen (2003).

Once the presence of a panel unit root has been recognized, the issue of whether there is a long-term equilibrium relationship among the variables emerges. In the empirical analysis performed in this study, the Pedroni panel cointegration test methods have been used. This test has revealed no possibility for cointegration under the null hypothesis, while employing the residuals derived from a panel regression allows generating the test statistics and obtaining the distributions.

Pedroni's cointegration test methodology—similar to the Im, Pesaran and Shin (2003) test—is a heterogeneous panel cointegration test that was improved by Pedroni (1999, 2004) by allowing cross-sectional interdependence with different individual effects. The following equation presents empirical model of Pedroni's cointegration test:

$$Y_{it} = \eta_i + \delta_{it} + \sum_{i=0}^{n} \beta_i X_{it} + \varepsilon_{it} \tag{3.25}$$

where $i = 1, 2, ..., N$ represents each country in the panel, and $t = 0, 1, 2, ..., T$ denotes the time periods covered. In addition, Y and X are dependent and independent variables, respectively, and η_i and δ_{it} are country or industry and time fix effects, respectively. Any deviation from the long-term relationship is accounted for by ε_{it}, which is estimated by residuals, and is structured as follows:

$$\hat{\varepsilon}_{it} = \hat{\rho}_i \hat{\varepsilon}_{it-1} + \hat{u}_{it} \tag{3.26}$$

Pedroni (1999, 2004) proposed seven different statistics to test the panel data long-term relationship, three of which are referred to as "between" dimension, while the remaining four, which are based on pooling, are denoted as the "within" dimension. Both test types focus on the null hypothesis of no cointegration. However, the differences stem from the

design of the alternative hypothesis, which tests $\rho_i = \rho < 1$ and $\rho_i < 1$ for all *i*, for the "within" and "between" dimension, respectively. Pedroni (1999) used Monte Carlo simulations for tabulating the finite sample distribution of the seven test statistics, all of which should be greater that the tabulated critical value in order for the null hypothesis of absence of cointegration not to be rejected.

A drawback of the tests proposed by Pedroni (1999) is that they are established on the hypothesis of general factor restriction and do not account for the possibility of cross-country dependence. This hypothesis proposes that the short-term parameters for the variables in their first differences are equal to the long-term parameters for the variables at their levels. Thus, if this limitation is not met, it can cause a significant loss of power for residual-based panel cointegration tests (Eggoh, Bangake and Rault, 2011).

3.6.3 Error Correction Model

3.6.3.1 Panel multivariate causality model

Generally, in bivariate models aiming to test Granger-causality, both restricted and unrestricted form are specified for variables. If two variables have unit root in level but they become stationary after first differencing, the standard form of the Granger causality test can be applied as follows:

$$\Delta Y_t = \alpha_{11} + \sum_{i=1}^{L11} \Delta Y_{t-i} + U_{11t}, \tag{3.27}$$

$$\Delta Y_t = \alpha_{12} + \sum_{i=1}^{L11} \beta_{11i} \Delta Y_{t-i} + \sum_{j=1}^{L12} \beta_{12j} \Delta X_{t-j} + U_{12t}, \tag{3.28}$$

$$\Delta X_t = \alpha_{21} + \sum_{i=1}^{L21} \beta_{21i} \Delta X_{t-i} + U_{21t}, \tag{3.29}$$

$$\Delta X_t = \alpha_{22} + \sum_{i=1}^{L21} \beta_{21i} \Delta X_{t-i} + \sum_{j=1}^{L22} \beta_{22j} \Delta Y_{t-j} + U_{22t}. \tag{3.30}$$

Equations (3.28) and (3.30) represent the unrestricted form, while equations (3.27) and (3.29) are the restricted forms. However, equations (3.27) and (3.28) are illustrated as a pair to distinguish whether the coefficient of the pas lags of *X* can be zero as a whole. Similarly, equations (3.29) and (3.30) illustrate another pair, which can be used to establish whether the coefficient of the pas lags of *Y* can be zero as a whole. If the estimated coefficients on lagged values of *X* in equation (3.28) are significant, this indicates that some variation of *Y* is explained by other variables, such as *X*, rather than by the legged values of *Y* itself. Thus, *X* is Granger-causes *Y*, and F-test can be applied to examine whether the coefficients of lagged values are zero.

Similar analysis can be performed to test whether *Y* Granger-causes *X*. If two variables also have unit root after first differencing, but they become stationary after second differencing due to examining for Granger-causality between two variables, equations (3.27)-(3.30) must be estimated with second differenced data. The main reason behind this requirement is that, in order to apply Eq. (3.27)-(3.30) for testing Granger-causality between two variables, stationary series must be used (Yoo, 2006). For specific condition, if *X* and *Y* are both non-stationary and cointegrated, any standard Granger-causal implication will be invalid and the best way to apply the causality test is to adopt structure of error-correction model (ECM) (Engle and Granger, 1987). Thus, in order to capture comprehensive results, the modified bivariate causality ECM in equations (3.28) and (3.30) is extended to multivariate causality ECM in equations. (3.32)-(3.35), as shown below.

The empirical investigation of dynamic causal relationship among stock market efficiency, effect of financial liberalization, trade openness, and role of institutions using modern econometrics techniques involves the following three steps. Here, whether each panel variable contains a unit root is examined first. If the variables contain a unit root, the second step tests for the presence of a long-term cointegration relationship between the panel variables. If such a relationship is found, panel vector error model is estimated in the final step, applying the new panel dynamic method. This allows determining the presence of the Granger causal relationship between the variables (Hossain, 2012).

The cointegration relationship tests are only adequate for indicating causal relationship, as they do not specify the direction of causality among variables. Consequently, the causal relationship among variables is typically examined using the Engle-Granger testing procedure. However, in the presence of a cointegration relationship, applying Engle and Granger (1987) causality test in the first differenced level of variables by vector auto-regression (VAR) structure will yield misleading results. Therefore, the insertion of an additional variable, such as the error correction term (ECT), to the VAR system would aid in capturing the long-term relationship (O'Mahony and Vecchi, 2005). The augmented error correction model, applied in order to test the presence of multivariate Granger causality, is formulated in the matrices given below.

$$\begin{bmatrix} Aut_{it} \\ FO_{it} \\ TO_{it} \\ INST_{it} \end{bmatrix} = \begin{bmatrix} C_1 \\ C_2 \\ C_3 \\ C_4 \end{bmatrix} + \sum_{i=0}^{p} \begin{bmatrix} \beta_{11,k}, k\beta_{12,k}, k\beta_{13,k}, k\beta_{14,k} \\ \beta_{21,k}, k\beta_{22,k}, k\beta_{23,k}, k\beta_{24,k} \\ \beta_{31,k}, k\beta_{32,k}, k\beta_{33,k}, k\beta_{34,k} \\ \beta_{41,k}, k\beta_{42,k}, k\beta_{43,k}, k\beta_{44,k} \end{bmatrix} \begin{bmatrix} Aut_{it} - k \\ FO_{it} - k \\ TO_{it} - k \\ INST_{it} - k \end{bmatrix} - \begin{bmatrix} \lambda_1 \\ \lambda_2 \\ \lambda_3 \\ \lambda_4 \end{bmatrix} ECM_{it} + \begin{bmatrix} \varepsilon_{1it} \\ \varepsilon_{2it} \\ \varepsilon_{3it} \\ \varepsilon_{4it} \end{bmatrix} \tag{3.31}$$

$$\begin{aligned} \Delta Autcor_{it} = \theta_{1i} &+ \sum_{p} \Delta\theta_{11ip} Autcor_{it-p} + \sum_{p} \theta_{12ip} \Delta FO_{it-p} \\ &+ \sum_{p} \theta_{13ip} \Delta TO_{it-p} + \sum_{p} \theta_{14ip} \Delta INST_{it-p} + \psi_{1i} ECT_{t-1} \end{aligned} \tag{3.32}$$

$$\Delta FO_{it} = \theta_{2i} + \sum_{p} \Delta\theta_{21ip} FO_{it-p} + \sum_{p} \theta_{22ip} \Delta Autcor_{it-p} + \sum_{p} \theta_{23ip} \Delta TO_{it-p} + \sum_{p} \theta_{24ip} \Delta INST_{it-p} + \psi_{2i} ECT_{t-1} \quad (3.33)$$

$$\Delta TO_{it} = \theta_{2i} + \sum_{p} \Delta\theta_{21ip} TO_{it-p} + \sum_{p} \theta_{22ip} \Delta Autcor_{it-p} + \sum_{p} \theta_{23ip} \Delta FO_{it-p} + \sum_{p} \theta_{24ip} \Delta INST_{it-p} + \psi_{2i} ECT_{t-1} \quad (3.34)$$

$$\Delta INST_{it} = \theta_{2i} + \sum_{p} \Delta\theta_{21ip} INST_{it-p} + \sum_{p} \theta_{22ip} \Delta FO_{it-p} + \sum_{p} \theta_{23ip} \Delta TO_{it-p} + \sum_{p} \theta_{24ip} \Delta Autcor_{it-p} + \psi_{2i} ECT_{t-1} \quad (3.35)$$

In the above expressions, the C 's, β 's and λ 's are the parameters that have to be estimated. In addition, Δ denotes the first difference, ECM_{it-1} represents the one period lagged error-term derived from the cointegration vector, and the ε s are serially independent with finite covariance and matrix and zero mean. In using the vector error correction model (VECM) for the above matrices, all variables are assumed to be endogenous. Therefore, the above VECM could be converted to the equations below in order to test for Granger causality. The F-test will be applied here to test the direction of any causal relationship among variables.

The hypotheses for examining short-term causality are:

$H_{01} : \beta_{11,k}, ..., \beta_{14,k} = 0$, meaning, *FO, TO* and *INST* do not Granger cause of *Autcor*

$H_{02} : \beta_{21,k}, ..., \beta_{24,k} = 0$, meaning, *Autcor, TO* and *INST* do not Granger cause of *FO*

$H_{03} : \beta_{31,k}, ..., \beta_{34,k} = 0$, meaning, *Autcor, FO* and *INST* do not Granger cause of *TO*

$H_{04} : \beta_{41,k}, ..., \beta_{44,k} = 0$, meaning, *Autcor, FO* and *TO* do not Granger cause of *INST*

Similarly, for long-term causality, the following hypotheses will be tested:

$H_{01} : \lambda_1 = 0$, meaning *FO, TO* and *INST* do not Granger cause of *Autcor*

$H_{02}: \lambda_2 = 0,$ meaning *Autcor, To* and *INST* do not Granger cause of *FO*

Moreover, the coefficient on the ECT indicate how fast deviations from the long-term equilibrium and eliminated. Based on the theoretical framework adopted in this study, which links the financial liberalization and stock return autocorrelation, the causality relationship between these two variables will be established. Thus, only the first two of the above equations— equations (3.32) and (3.33)—are applied.

3.6.3.2 Panel error correction model (ECM)

The concept of cointegration can be understood as an efficient co-movement among two or more economic variables in the long term. According to Engle and Granger (1987) procedure, if *X* and *Y* are both non-stationary, their linear combination could exhibit a random walk. However, the two variables may also have the characteristic that makes their particular combination, for example $Z = X\text{-}bY$, stationary. Consequently, if such a property holds true, *X* and *Y* are cointegrated. If *X* and *Y* are both non-stationary, and the linear combination of the series of two variables is also non-stationary, then standard Granger-causality test should apply. Conversely, if *X* and *Y* are both non-stationary and are cointegrated, then any standard Granger-causal inferences will give misleading results. Thus, a more comprehensive causality test based on ECM must be applied (Toda and Phillips, 1993).

The panel data used in the present study consists of 27 countries in the list of emerging markets for the 1996-2011 period. This estimator is also useful in cases where short- and long-term effects can be distinguished, thus enabling estimation of the latter on the financial liberalization on efficiency. The empirical process adopted in this work comprises (i) assessing the stationary of the panel variables, (ii) testing for the existence

of a cointegration relationship in the case where the variables are not stationary, and (iii) estimating the ECM model, in the case where cointegration is acknowledged. The tests used to check for stationary and cointegration are discussed in Chapter 4, which focuses on the panel ECM using the econometric approach to derive the short- and long-term causality relationships among variables. Firstly, the following *ARDL*(*p, q*) model is considered for *T* periods and *N* countries:

$$Y_{it} = \sum_{j=1}^{p} \lambda_{ij} Y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij} X_{i,t-j} + \mu_i + \varepsilon_{it} \tag{3.36}$$

where *Y* is output, *X* is the vector of the independent variables, μ_i are the fixed effects for each country, λ_{ij} are the coefficients of the lagged dependent variables, and δ_{ij} are the coefficients of the current and the lagged explanatory variables. This model yields the following ECM form:

$$\Delta Y_{it} = \pi_i Y_{i,t-1} + \beta_i X_{i,t-1} + \sum_{j=1}^{m-1} \delta_{ij} X_{i,t-j} + \sum_{j=0}^{n-1} \delta_{ij} X_{i,t-j} + \mu_i + \varepsilon_{it} \tag{3.37}$$

where β_i is the long-term parameter for each *N*, δ_{ij} are the short-term coefficients, and π_i are the error correction parameters. For imposing common β coefficients across industries or countries, the following expression can be applied:

$$\Delta Y_{it} = \pi_i Y_{i,t-1} + \beta_i X_{i,t-1} + \sum_{j=1}^{m-1} \delta_{ij} X_{i,t-j} + \sum_{j=0}^{n-1} \delta_{ij} X_{i,t-j} + \mu_i + \varepsilon_{it} \tag{3.38}$$

Three recently developed techniques for estimating models, such as the one proposed by Pesaran, Shin and Smith (1999), are the mean group (MG), the pooled mean (PMG), and

dynamic fixed effect (DFE) estimators. These panel data estimators are particularly recommended in cases in which the number of time observations (*T*) is large or is of same magnitude as the number of cross-sectional observations (*N*). In keeping with the traditional fixed effect estimators, here, homogeneity of slope coefficients is also assumed, while the MG estimators allow the slopes and intercepts to differ over the cross-sections. More specifically, the MG estimates the coefficients across each cross-section before calculating the mean.

The PMG estimators combine the fixed effects and MG, which allows the short-term coefficients to differ, but imposes the restriction on the long-term coefficients, which are equal across the individual sections (*N*). Thus, the PMG estimator allows estimating a common long-term relationship across sections without imposing the restricted assumptions of identical short-term dynamics across sections. Finally, the DFE estimators, like the PMG estimators, restrict the coefficients of the long-term vector to be equal across all panels, as proposed by Blackburne and Frank (2007).

There is a consistency-efficiency tradeoff when choosing among MG, PMG, and DFE. The MG estimators provide consistent estimates of the PMG estimators; however, they are less efficient compared to the mean of long-term coefficients. The PMG estimators are consistent and efficient, if homogeneity of long-term coefficient holds. The DFE model further restricts the speed of ECT and short-term coefficient to be equal, whereas the PMG estimator relies on a combination of pooling and averaging of the coefficients. To determine which estimator is more appropriate for the present study, Hausman (1978) specification test and F-test were used. Application of different methods among countries in the study sample is discussed in Chapter 4.

3.6.4 Test of cross sectional dependence

Consider the standard panel-data model given by:

$$y_{it} = \alpha_i + \beta' x_{it} + u_{it} \qquad i = 1,\ldots, N \text{and } t = 1,\ldots,T \tag{3.39}$$

where x_{it} is a $K \times 1$ vector of regressors, β is a $K \times 1$ vector of parameters to be estimated, and α_i represents time-invariant individual nuisance parameters. Under the null hypothesis, u_{it} is assumed to be independent and identically distributed (i.i.d.) over periods and across cross-sectional units. Under the alternative, while u_{it} may be correlated across cross-sections, the assumption of no serial correlation remains. Thus, the hypothesis of interest is:

$$\begin{aligned} &H_0 : \rho_{ij} = \rho_{ji} = cor(u_{it}, u_{jt}) = 0 \text{ for } i \neq j \\ &\text{versus} \\ &H_1 : \rho_{ij} = \rho_{ji} \neq 0 \text{ for some } i \neq j \end{aligned} \tag{3.40}$$

where ρ_{ij} is the product-moment correlation coefficient of the disturbances and is given by

$$\hat{\rho}_{ij} = \hat{\rho}_{ji} = \frac{\sum_{t=1}^{T} u_{it} u_{jt}}{\left(\sum_{t=1}^{T} u_{it}^2\right)^{\frac{1}{2}} \left(\sum_{t=1}^{T} u_{jt}^2\right)^{\frac{1}{2}}} \tag{3.41}$$

The number of possible pairings $\left(u_{it}, u_{jt}\right)$ increases with *N*.

3.6.4.1 Pesaran's CD test

In the context of seemingly unrelated regression estimation, Breusch and Pagan (1980) proposed an LM statistic, which is valid for fixed N as $T \to \infty$ and is given by

$$LM = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^2 \tag{3.42}$$

where $\hat{\rho}_{ij}$ is the sample estimate of the pairwise correlation of residuals, given by:

$$\hat{\rho}_{ij} = \hat{\rho}_{ji} = \frac{\sum_{t=1}^{T}\hat{u}_{it}\hat{u}_{jt}}{\left(\sum_{t=1}^{T}\hat{u}_{it}^2\right)^{\frac{1}{2}}\left(\sum_{t=1}^{T}\hat{u}_{jt}^2\right)^{\frac{1}{2}}} \tag{3.43}$$

and $\hat{u}_{it}$ is the estimate of u_{it} in equation (3.39). LM is asymptotically distributed as χ^2 with $N(N-1)/2$ degrees of freedom under the null hypothesis of interest. However, this test is likely to exhibit substantial size distortion when N is large and T is finite—a situation that is commonly encountered in empirical applications, primarily because the LM statistic is not correctly centered for finite T and bias is likely worsen as N increases. For those reasons, Pesaran (2004) has proposed the following alternative,

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum\nolimits_{j=i+1}^{N}\hat{\rho}_{ij}\right) \tag{3.44}$$

and has shown that, under the null hypothesis of no cross-sectional dependence, $CD \xrightarrow{d} N(0,1)$ for $N \to \infty$ and sufficiently large T.

Unlike the LM statistic, the CD statistic has mean at exactly zero for fixed values of *T* and *N*, under a wide range of panel-data models, including homogenous/heterogeneous dynamic models and nonstationary models. For homogenous and heterogeneous dynamic models, the standard FE and RE estimators are biased (see Nickell (1981) and Pesaran and Smith (1995). However, the CD test is still valid because, despite the small-sample bias of the parameter estimates, the FE/RE residuals will have exactly zero mean even for fixed *T*, provided that disturbances are symmetrically distributed.

3.6.5 System GMM and first-difference GMM

The main panel data estimation methods are based on the fixed and random effects models that are commonly applied in order to simultaneously account for heterogeneity and temporary fluctuations in the economic performance of cross-sections. In this study, several of the explanatory variables included in the regression are either endogenous or pre-determined, thus confounding the results.

Based on the work of Basu and Morey (2005) by opening the trade, technological economies of scale are transmitted to the financial sectors and will be exposed in stock returns. Therefore, stock returns are endogenous by nature. Meanwhile, based on the findings of Froot and Perold (1995), slow dissemination of market-wide information results in positive stock return correlation. Similarly, when the market reaction results in buying past winners and selling past losers, stock autocorrelation might have dynamic route. Therefore, stock return autocorrelation might be considered as a predetermined variable, which would indicate that system GMM should be applied.

In this condition, the traditional panel data estimation methods (either the fixed or the random effect estimator) are expected to produce inconsistent and biased results. New

estimation techniques, such as the first differences and system GMM panel data estimators (Arellano and Bover (1995); Blundell & bond ,1998), are appropriate as the explanatory variables are correlated with historical or even current realization of the error term (Roodman, 2006).

Another estimation difficulty in the model used in this study is the presence of unobservable country specific effects, which was addressed by using the GMM estimator as well. However, this approach necessitates a decision on which variables should be designated as instrumental variables.

GMM estimators are particularly useful for panel data with relatively small time dimension (*T*), relative to the number (*N*) of cross-sections (Roodman, 2009). In contrast, as the observation time becomes longer, the GMM estimator tends to provide misleading and inconsistent coefficient estimates, unless the slope coefficients are equal across cross-sections (Pesaran and Smith, 1995).

As previously noted, the augmented extension of the Arellano and Bond (1991) first-difference GMM estimator is the system GMM estimator that uses lagged level of endogenous variables as instruments. Sometimes, the lagged levels of the regressors are not powerful enough for the first-differenced GMM regressors. In this case, the augmented version "system GMM" should be used. Generally, the system GMM estimators use the levels equation to obtain a system of two equations—one in levels and one in differenced variables—as, by adding the second equation, supplementary instruments can be gained. Therefore, the variables in levels in the second equation are instrumented with their own first differences, which are usually increasing efficiency.

In sum, the system GMM estimators employ the first differences of the instrumented variables as additional instruments. As argued by Arellano and Bover (1995) and Blundell and Bonds (1998), by allowing for additional instruments, this system GMM estimator can dramatically improve the efficiency of the obtained estimates.

Due to these benefits, system GMM estimator was chosen for implementation in the present study, as N is large relative to T ($N = 27$, $T = 15$), and this approach will be used address the issue of the endogeneity of regressors. The GMM estimator, either the first difference or the system version, has one- and two-step variants. The two-step estimator is considered more efficient; however, the standard errors are downward biased and render GMM estimates unsuitable for inference (Arellano and Bond, 1991). This problem is mitigated in the system GMM version because it incorporates the finite sample correction to the two-step covariance matrix. For this reason, the basic analyses performed here have been based on regressions using two-step GMM estimators.

The GMM estimators report two diagnostic tests. The first one is the Sargan and Hansen test, which checks for the validity of normal-type instruments and GMM-type instruments. The hypothesis being tested with the Hansen and Sargen test is that the two types of instruments are uncorrelated with the residuals, and are thus acceptable. If the null hypothesis is confirmed statistically (not rejected), the instruments leave behind the test and are considered valid by this criterion. These estimators are also statements tests for serial correlation, which is applied to the first differenced residuals and the upper differences. If the null hypothesis of no autocorrelation is rejected, the test implies that lags of the used instruments are in fact endogenous and are consequently considered unacceptable.

With respect to the number of lags used in the GMM regressions, it is generally accepted that, as the number of lags grows, the likelihood of finding proper instruments would increase. On the other hand, when the number of moment conditions increases, this leads to a decrease in the size of the sample, magnifies the estimate bias, and provides less power of the diagnostic tests (Roodman, 2006).

In sum, as pointed out by Roodman (2009), The Arellano and Bond (1991) and Arellano and Bover (1995), Blundell and Bonds (1998) dynamic panel estimators are becoming increasingly more popular. These estimators are typically applied in situations characterized by:

1) "small T, large N" panels, whereby there are few time observations and many observed elements
2) A linear functional model
3) A single left-hand-side variable that is dynamic, depending on its own past observations
4) Explanatory variables that are not strictly exogenous, i.e., correlated with past and possibly current observations of the error term
5) Heteroskedasticity and autocorrelation within observed elements, but not between them
6) Fixed individual effects

Arellano and Bond (1991) by creation and supplementary assumption, indicated that the first differences of instrument variables are uncorrelated with the fixed effects. As a result, allowing the introduction of additional instruments is possible, which can considerably improve efficiency. The result is system GMM, which constructs a set of two equations—the original, as well as the transformed one (Roodman, 2009). In addition, diagnostic

tests, such as over-identification and serial correlation tests, are applied to ensure there is no bias due to correlation with the error term.

3.6.6 Threshold panel data

Threshold regression models specify that individual observations can be divided into classes based on the value of an observed variable (Hansen, 1999). Econometric techniques for threshold regression had not been well developed prior to the work of Hansen (1999). However, Hansen's threshold model is not without problems. Its most important limitation is that all regressors are required to be exogenous, making this model non-dynamic. In the model used in the present study, Hansen estimation would be inconsistent, because stock return auto-correlation is endogenous by construction.

The observed data are sourced from a balanced panel $\{y_{it}, q_{it}, x_{it}, 1 \le i \le n, 1 \le t \le T\}$, where the subscript *i* indexes the individual and the subscript *t* indexes time. The dependent variable y_{it} and the threshold variable q_{it} are scalars, and the regressor x_{it} is a *k* vector. The structural equation of interest is given by:

$$y_{it} = \delta_i + \beta_1' x_{it} I(q_{it} \le \gamma) + \beta_2' x_{it} I(q_{it} > \gamma) + \varepsilon_{it} \tag{3.45}$$

where $I(.)$ is the indicator function. An alternative intuitive way of writing the above regression is:

$$y_{it} = \begin{cases} \sigma_i + \beta_1' x_{it} + \varepsilon_{it}, q_{it} \le \gamma \\ \sigma_i + \beta_2' x_{it} + \varepsilon_{it}, q_{it} > \gamma \end{cases} \tag{3.46}$$

Another compact representation of above is given by:

$$x_{it}(\lambda)=\begin{pmatrix} x_{it}I(q_{it}\le\gamma) \\ x_{it}I(q_{it}>\gamma)\end{pmatrix} \quad \text{and} \quad \beta=\left(\beta_1'\beta_2'\right)' \tag{3.47}$$

$$y_{it}=\delta_i+\beta' x_{it}(\gamma)+\varepsilon_{it} \tag{3.48}$$

The observations are divided into two regimes depending on whether the threshold variable q_{it} is above or below the threshold γ. The regimes are distinguished by differing regression slopes β_1 and β_2. For the identification of β_1 and β_2, it is required that the elements of x_{it} are not time invariant. It is further assumed that the threshold variable q_{it} is not time invariant. Caselli, Esquivel and Lefort (1996) argued that estimates could be inconsistent in cross-country growth regressions due to: (i) country-specific fixed effects, and (ii) the inclusion of endogenous variables among explanatory regressors in the model. In the current model design, these two issues are appropriately addressed, yielding consistent estimates.

3.6.6.1 Elimination of fixed effect

In the first stage, the country-specific fixed effects σ_i are eliminated from the model to estimate the slope coefficients and the potential threshold point. According to Nickell (1981) and Bond (2002), within-group transformation does not eliminate dynamic panel bias because the transformed lagged dependent variable (x_{it}^{1*}) negatively correlates with the transformed error term ε_{it}^{*}. Thus, in the present study, another common transformation method called "forward orthogonal deviation"—proposed by Arellano and Bover (1995)—is used. Thus, forward orthogonal deviation transformation is applied to eliminate individual fixed effects. Therefore, for the error term, the required transformation is given by

$$\varepsilon_{it}^{*} = c_t[\varepsilon_{it} - \frac{1}{(T-t)}(\varepsilon_{i(t+1)} + ... + \varepsilon_{iT})] \tag{3.49}$$

where $c_t = \sqrt{\frac{T-t}{T-t+1}}$ and $\text{var}(\varepsilon_{it}) = \sigma^2 I_T$ is not serially correlated and $\text{var}(\varepsilon_{it}^{*}) = \sigma^2 I_{T\text{-}1}$ has no serial correlation either. Applying this procedure to equation (3.45) yields:

$$y_{it}^{*} = \beta_0 + \beta_1 \tilde{\pi}_{it}^{*} d(\tilde{\pi}_{it} \le \gamma) + \beta_2 \tilde{\pi}_{it}^{*}(1 - d[\tilde{\pi}_{it} > \gamma]) + \theta' x_{it}^{*} + \varepsilon_{it}^{*}, \tag{3.50}$$

where $t = 1, \ldots, T-1$ and superscript * denotes data after the transformation.

3.6.6.2 Dealing with endogeneity

Structural equation (3.39) requires a set of suitable instruments to address the problem of endogeneity. Thus, the lags of dependent variable are used as instruments for the predetermined regressor. For the transformed lag of the dependent variable (x_{it}^{1*}), the untransformed value x_{it}^{1} is used. As there are no clear guidelines regarding the identification restrictions, following the collapsed-form instrument method Roodman (2006), the following (*T*-1) moment conditions are adopted, thus employing the entire available set of lags as instruments:

$$E(x_{it}^{1}, \varepsilon_{it}^{*}) = 0 \quad \text{where } t = 2, \ldots, T-1 \tag{3.51}$$

Next, the instrumental variable parameter, or 2SLS estimator, is estimated through a two-step procedure. In the first step, a reduced-form regression for the endogenous variable (x_{it}^{1*}) is constructed as a function of the instruments z_{it} and all exogenous variables:

$$x_{it}^{1*} = \lambda_0 + \lambda_1' \sum_{j=1}^{T} z_{i,t-j} + \lambda_2 \tilde{\pi}_{it}^{*} d(\tilde{\pi}_{it} \le \gamma) + \lambda_3 \tilde{\pi}_{it}^{*} (1 - d[\tilde{\pi}_{it} > \gamma]) + \theta'(x_{it}^{2})^{*} + \upsilon_{it} \quad (3.52)$$

where $E(\upsilon_{it}, z_{it}) = 0$. Next, the reduced-form parameter γ is computed by the least-square method, as well as the fitted value of the endogenous variable $\hat{x}_{it}^{1*}$. Following that, x_{it}^{1*} is replaced by its fitted value $\hat{x}_{it}^{1*}$ in equation (3.45), which can be written as:

$$y_{it}^{*} = \beta_0 + \rho \hat{x}_{it}^{1*} + \beta_1 \tilde{\pi}_{it}^{*} d(\tilde{\pi}_{it} \le \gamma) + \beta 2 \tilde{\pi}_{it}^{*} (1 - d[\tilde{\pi}_{it} > \gamma]) + \theta' x_{it}^{2*} + \varepsilon_{it}^{*} \quad (3.53)$$

In the second step, the instrumental variable parameter $\hat{\beta}_{iv}$ is estimated from equation (3.47) for any given threshold γ. Then, the residual sum of square (RSS) can be found, as a function of γ, as shown below

$$\hat{\varepsilon}_i = Y - X\hat{\beta}_{IV} \quad (3.54)$$

$$S(\gamma) = \varepsilon_i' * \hat{\varepsilon}_i \quad (3.55)$$

where *S* is the residual sum of square.

3.6.6.3 Computation of threshold value

In the third step, the threshold level of institution is calculated by using the conditional least square method. To estimate the threshold γ, the procedure described above is repeated, changing the threshold level of institution ranging from $\underline{\gamma}$ to $\overline{\gamma}$ with a decimal value of increment. Finally, the threshold value γ is selected as the value associated with the smallest RSS. The minimization search takes the following form:

$$\hat{\gamma} = \arg\min S_n(\gamma) \tag{3.56}$$

Once the threshold value of $\hat{\gamma}$ is determined, in the second stage, the slope coefficients (β_1 and β_2) are estimated and the impact of other control variables on dependent variable (stock market efficiency) is determined using GMM. In this case, the previously used instruments and the previous estimated threshold $\hat{\gamma}$ are used. Finally, a test can be conducted in order to establish whether the threshold level is significant by testing the equality $\beta_1 = \beta_2$, which is equivalent to testing the following null hypothesis:

$H_0 : \beta_1 = \beta_2$

3.7 Data and scope of the study

In this study, the actual values of daily indices of 27 emerging stock markets are used. The closing prices for the major stock index in each market, denominated in their respective local currency units, are collected from Datastream. Due to the availability of all sample countries, the sample period spans from January 1st 1996 to December 30th, 2011. As the establishment of stock market is a new phenomenon in emerging markets, the data availability for a long period is one the serious limitation of the study. For most of the countries stock price were available only for the last 3 years which is insufficient to conduct a panel data analysis. Therefore, the country samples has automatically shrink.

Calculating the stock market efficiency, first, the log return $r_t = ln(p_t / p_{t-1})$ is calculated, where p_t is the closing price of the index on day *t*. Secondly, two different models from two school of thoughts have been applied to define informational efficiency of stock markets.

As it is discussed in 3.2, there is a broad spectrum of test to measure stock market efficiency from *static* and *dynamic* aspect. For *Static* aspect of efficiency, based on (Jae (2009); Kim, Shamsuddin and Lim (2011)) when the returns are subject to an unknown form of conditional heteroskedasticity, the use of wild bootstrapped automatic variance ratio test is strongly recommended. As $AVR(\hat{k})$ test is an asymptotic test that may exhibit deficient small sample properties, the wild bootstrap test can be employed to mitigate this effect. For *dynamic* aspect of efficiency, a newly introduced measure in finance literature is applied which considers the long term correlation memory.

The study sample comprises of Czech Republic, Hungary, Malaysia, Mexico, South Africa, Thailand, Turkey, Chile, China, Colombia, Egypt, India, Indonesia, Pakistan, Peru, Philippines, Russia, Argentina, Bangladesh, Croatia, Estonia, Kenya, Mauritius, Oman, Romania, Sri Lanka, and Tunisia. These countries were chosen based on the latest version (September 2011) of the FTSE list of emerging stock markets.

In developing countries, there are gaps between *de jure* announcement date of liberalizing and *de facto* implementation date. According to Kim and Lim (2011), although greater level of de facto trade openness is associated with a higher degree of stock market efficiency, this positive relationship does not hold when *de jure* measure is used. This implies that official trade reforms are insufficient to take advantage of returns to scale if they are not accompanied by a corresponding increase in the actual level of trade flows. Hence, in the current model, *de facto* trade openness, defined by the trade volume/GDP ratio, is used. For financial openness, as mentioned above, calculating net capital flows/GDP ratio for selected countries allows capturing the *de facto* financial openness index. In the work presented here, the stock market opening is of interest, which can be

represented in net equity flows to GDP, for two main reasons—the required data is freely accessible and can be used to infer the intensity of financial openness.

As highlighted by Kaufmann, Kraay and Mastruzzi (2005) in the World Bank's WGI research report, precision of the governance estimates has been boosted due to the increased number of independent data sources. The key advantages of the WGI stem from the time-varying characteristic, as the effect of time invariant characteristic cannot otherwise be distinguished from the country-specific effects.

A number of interaction variables have been used to measure the right circumstances in which financial liberalization can lead to improve efficiency. Many authors have attempted to analyze institution effect by employing variables that measure general institutional quality, such as indicators of corruption, law and order, and bureaucracy quality, extracted from International Country Risk Guide. However, following the comprehensive work by Kaufmann, Kraay and Mastruzzi (2005), which aimed to establish new generation institutional variables referred to as " Governance Indicator", the research focus has shifted to recruiting them.

CHAPTER 4:

CAUSALITY RELATIONSHIP BETWEEN FINANCIAL LIBERALIZATION AND STOCK MARKET EFFICIENCY

4.1 Introduction

The on-going debate on the direction of the causality between financial liberalization and stock price behavior has prompted this research, the aim of which is to empirically investigate the direction of causality between financial liberalization and stock market efficiency using recently developed approaches. Based on the widely adopted theory, financial liberalization stimulates stock market efficiency. On the other hand, many authors indicate that countries with more efficient markets tend to be more open towards foreign investment. These arguments suggest that, if financial openness enhances efficiency, efficiency may reciprocally stimulate further liberalization. Due to the paucity of empirical evidence of the positive relationship between financial liberalization and efficiency, the causal link has not yet been established.

The main objective of this part of the study is to investigate the directional relationship between efficiency of emerging stock market and financial liberalization in the short and long term.

4.2 Contradictory results

Although numerous researchers have studied empirical effects of financial liberalization on stock market efficiency, there is no consistent conclusion. For example Kim and Singal (2000); Ciner and Karagozoglu (2008), and Cajueiro, Gogas and Tabak (2009) have shown that stock market seems to be less autocorrelated subsequent to market opening,

rendering it more efficient. On the other hand, Kawakatsu and Morey (1999) and Nikiforos (2004), Lim and Kim (2011) posited that there is no evidence of improving the efficiency after liberalization. A part from the contradictory result in the pertinent literature, there is also another type of argument that rapid liberalization of the financial system was a precondition for financial crisis in South East Asia. This would imply that countries are more likely to experience financial crises when their financial markets are open to foreign capital (Mehrez and Kaufmann, 2000). As discussed earlier, this effect might, however, be mitigated if institutional support is capable of ensuring that countries enjoy the benefits of financial globalization.

As a result, the research in this field has shifted toward conditioning the effect of liberalization on the quality of institutions. Despite this joint effort, the findings pertaining to the conditioning the liberalization are still mixed. According to Carrieri, Chaieb and Errunza (2013), improvements in corporate governance and institutions complement market liberalization policies and help in further integrating of emerging markets. Ben Naceur, Ghazouani and Omran (2008) found that a more developed financial market prior to liberalization reinforced the positive impact of liberalization on stock market development. On the other hand, Edison et al. (2002) provided no evidence of a growth effect, even when controlling for institutional characteristics or the financial development level. Similarly, Honig (2008) found little evidence of a stronger effect in countries with better institutional control. Hence, the review of extant literature reveals conflicting view of this relationship, even after conditioning for the liberalization.

Based on economic theories, foreign investors typically require local firms to produce accurate and timely disclosures and show evidence of strong adherence to international norms of corporate governance. This practice, in turn, improves the quality of information

available to the domestic market participants, leading to a greater degree of informational efficiency (Lim and Kim, 2011). However, the inconsistency in the reported finding may give rise to the efficiency-let to- liberalization hypothesis which is not compatible with economic theories.

Assuming that removing capital market restrictions should promote financial development, reverse causality from development to capital account openness is a possible explanation for the weak results published in pertinent literature. It is possible that countries characterized by low efficiency opt for liberalization because of the assumed efficiency-enhancing effects, resulting in a weaker correlation from liberalization towards higher efficiency; or perhaps more efficient markets are more eager to liberalize their capital accounts, while less efficient markets are more prone to adopt more stringent capital controls. According to another description, a more efficient stock market may be a proxy for the extent of information asymmetries that may cause volatility, leading the country towards liberalization (Li et al., 2004). Based on the work by Shin (2012), it can be posited that more developed stock market in which sound domestic financial institutions participate would lead the economy towards liberalization. Therefore, the causality relationship between financial liberalization and stock market efficiency is going to be investigated in this chapter to see if the empirical result is consistent with efficiency-let to –liberalization hypothesis.

Additionally, testing the efficiency-led to-liberalization hypothesis provides the opportunity to consider the relationship over a time horizon. Discussing the necessity of institutions as pre-requisite to reap to benefits of liberalization, the time horizon in which institutions act is also another crucial factor to be considered. As institutions are deep factors which move slowly, they appeared to work over a reasonably long horizon. The

likelihood of contradictory effects of liberalization over different time horizons leads us to investigate the veracity of J curve hypothesis. J-curve hypothesis seeks to analyze if short-term deterioration is consistent with long-term improvements on stock market efficiency while liberalizing the domestic capital market. The J-curve hypothesis was first introduced in the seminal work of Magee (1973) and Since then has been applied mostly with aggregate or bilateral trade data. The current study thus takes the initiative to analyze J-curve in a new concept that links it to the short- and long-term effects of financial liberalization.

Consequently, the following chapters are going to elaborate when, how, and under what circumstances economies should liberalize.

4.3 Model specification and data

In order to examine whether financial liberalization can improve the stock market efficiency, the model specifications described below are utilized in this work.

To investigate whether the methods of measuring stock market efficiency affect the results, the same model will be executed, while applying two different forms of dependent variable. In equation (4.1), the dependent variable was calculated based on the EMH approach, which considers the *static* form of efficiency. The Automatic Variance Ratio test was applied for this approach. In order to capture the *dynamic* format of efficiency, equation (4.2) has taken Hurst Exponent method to measure the dependent variable.

$$|VR_{it} - 1| = \alpha_i + \beta_{1i} FO_{it} + \beta_{2i} TO + \beta_{3i} INST_{it} + \varepsilon_{it} \tag{4.1}$$

$$HE_{it} = \alpha_i + \beta_{1i} FO_{it} + \beta_{2i} TO + \beta_{3i} INST_{it} + \varepsilon_{it} \tag{4.2}$$

The dependent variable $|VR_{it}-1|$ is an inverse measure of informational efficiency for country *i* in year *t* from EMH approach, HE is another measure of informational efficiency from AMH hypothesis, and FO_{it} is the proxy for financial openness followed by two control variables, namely trade openness (TO_{it}) and institution ($INST_{it}$). $INST$ is the average of the six Governance Indicator components for each year. Finally, the subscript *i* denotes each of the 27 countries included in the analysis of the annual data for the 1996-2011 period. To check the causal relationship between financial liberalization and stock market efficiency the institution variable is considered as a mediatory variable. Therefore, all dimensions have been combined to generate a representative for institution concept.

Under the null hypothesis of a random walk with uncorrelated increments, variance ratios (VRs) should be equal to one at all lags. VRs significantly above one indicate positive serial correlation, whereas values below one indicate negative autocorrelations. Because both negative and positive autocorrelation represent departures from a random walk, the absolute value of the VR statistic minus one ($|VR-1|$) is used as a measure of relative efficiency. This approach is advantageous in that, if a market consists of stocks subject to both over- and under-reaction to past returns, both would be captured. Hence, the panel regression analysis employs $|\widehat{VR(k)}-1|$ is used as the dependent variable to examine the empirical relationship between openness and the degree of informational efficiency.

Table 4.1 shows the summary statistic of EMH stock return efficiency based on daily data from 02/01/1996 to 29/12/2011 for a total of 4176 observations, whereby the stock price data are provided by Datastream. Table 4.2 represents stock return efficiency derived from time-varying HE method, which is representative for the AMH perspective.

The estimation of the Hurst exponent for time windows with 1040 observations each, thousands of times is performed. To calculate rolling Hurst exponent, the first 1040 observations is selected, rolled the sample one point forward to eliminate the first observation and include the next one for the new time window, and repeat this procedure until the end of the series, in a rolling sample approach. Applying moving method to the data, shows that the degree of market efficiency varies through time. It means the rolling Hurst Exponent *(HE)* to get a specific data for the dependent variable for each year.

Table 4.2 presents the descriptive statistics for Hurst Exponent for shuffled equity returns. As we can see these Hurst Exponents- representative for AMH perspective- are high ranging from 0.4128 for Egypt to 0.9098 for Sri Lanka.[4]

The mutual interactions of financial liberalization and stock market autocorrelation are of particular interest in the current estimation model. Within the existing econometrics literature, recently developed panel error-correction model (panel ECM) allows examining the long- and short-term effects of financial liberalization on stock market efficiency. However, the prerequisite for implementing the estimations is to clarify whether there is a long-term relationship, which is contingent on the testing of panel unit root and existence of panel cointegration.

The LLC statistics developed by Levin, Lin and Chu (2002), IPS developed by Im, Pesaran and Shin (2003), and the CIPS developed by Pesaran (2007) are the three most widely adopted tools for testing the existence of panel unit root. If the null hypothesis that a panel unit root exists is not rejected, the cointegration relationship among the variables presented in equations (4.1) and (4.2) should be investigated further to ascertain that this

[4] Figures in the Appendix A present time-varying Hurst Exponent for each country (with and without shuffling)

expression yields are not spurious. In this work, the residuals ε_{it}, obtained by estimating equations (4.1) and (4.2), are used to test the null hypothesis of no cointegration between the variables. It is clear from the econometric specification slope that coefficients $\beta_i = (\beta_{1i}, \beta_{2i}, \beta_{3i})$ are allowed to be heterogeneous across the countries included in the study sample.

Table 4.1: Summary statistics of stock return informational efficiency (EMH approach) from January 1996 to December 2011 derived from R package

Countries	Mean	Standard Deviation	Median	Minimum	Maximum
Argentina	0.0982	0.0659	0.0837	0.0005	0.3074
Bangladesh	0.1337	0.2004	0.0691	0.0008	0.8424
Chile	0.5699	0.3964	0.4145	0.0000	1.3212
China	0.0426	0.0598	0.0155	0.0008	0.2116
Colombia	0.1773	0.2226	0.0535	0.0000	0.6387
Czech Republic	0.2035	0.2289	0.1181	0.0181	0.8307
Croatia	0.1961	0.2053	0.0797	0.0000	0.6359
Egypt	0.3222	0.2735	0.2940	0.0008	0.9887
Estonia	0.3306	0.2167	0.2551	0.0000	0.7981
Hungary	0.1300	0.1921	0.0816	0.0004	0.8291
India	0.0921	0.0995	0.0497	0.0004	0.3518
Indonesia	0.2017	0.1589	0.1688	0.0012	0.5493
Kenya	1.0480	0.7843	0.8727	0.0016	2.2965
Mauritius	0.6975	0.3903	0.6946	0.0063	1.4161
Malaysia	0.2597	0.1523	0.2407	0.0002	0.4734
Mexico	0.1084	0.0820	0.1400	0.0017	0.2262
Oman	0.3844	0.3790	0.3215	0.0000	1.7012
Philippines	0.2637	0.1180	0.3119	0.0026	0.3771
Pakistan	0.1490	0.2428	0.0821	0.0032	1.0565
Peru	0.4015	0.2212	0.3849	0.0810	0.8937
Romania	0.2745	0.2948	0.2229	0.0000	1.2615
Russia	0.1719	0.1285	0.1570	0.0052	0.4733
South Africa	0.1511	0.1589	0.1233	0.0009	0.5193
Sri Lanka	0.6955	0.8088	0.4392	0.0552	3.5205
Thailand	0.1735	0.1518	0.1531	0.0004	0.4417
Turkey	0.0817	0.0859	0.0446	0.0001	0.3034
Tunisia	0.6196	0.5710	0.4826	0.0000	1.8193

Table 4.2: Summary statistics of stock return informational efficiency (AMH approach) from January 1996 to December 2011 derived from Matlab package

Countries	Mean	Standard Deviation	Median	Minimum	Maximum
Argentina	0.6318	0.0495	0.6372	0.5533	0.7428
Bangladesh	0.6507	0.0552	0.6551	0.5488	0.7304
Chile	0.6919	0.0608	0.6756	0.6053	0.8068
China	0.6264	0.0507	0.6182	0.5258	0.7300
Colombia	0.5979	0.3367	0.6889	0.5944	0.7803
Czech Republic	0.6454	0.1675	0.6446	0.5639	0.7773
Croatia	0.6289	0.1592	0.6372	0.5359	0.7267
Egypt	0.6272	0.0703	0.6330	0.4128	0.7420
Estonia	0.6900	0.1742	0.6814	0.5773	0.7951
Hungary	0.6263	0.0303	0.6324	0.6869	0.6869
India	0.6305	0.0462	0.6351	0.5472	0.7077
Indonesia	0.6493	0.0511	0.6533	0.5061	0.7206
Kenya	0.6844	0.0774	0.6953	0.5465	0.8594
Mauritius	0.7243	0.0632	0.7230	0.5771	0.8397
Mexico	0.6194	0.0501	0.6142	0.5351	0.6884
Oman	0.6586	0.1728	0.6647	0.5231	0.7732
Philippines	0.6604	0.0484	0.6695	0.5674	0.7287
Pakistan	0.5635	0.0337	0.6514	0.5716	0.7301
Peru	0.6854	0.0489	0.6864	0.5925	0.7889
Romania	0.6591	0.2227	0.6621	0.5547	0.7379
Russia	0.6434	0.0440	0.6489	0.6533	0.7124
South Africa	0.6211	0.0571	0.6218	0.7523	0.5414
Sri Lanka	0.7056	0.0804	0.6896	0.5710	0.9098
Thailand	0.6379	0.0410	0.6447	0.5313	0.7038
Turkey	0.6325	0.0302	0.6332	0.5743	0.7089
Tunisia	0.6891	0.2326	0.7101	0.5681	0.7803

Note: The block size is chosen to be 10 for shuffling data.

4.4 Panel unit root test

Cointegration analysis is an appropriate technique for investigating the long-term relationship among stock return autocorrelation, financial openness, trade openness, and institutions. Before applying this long-term relationship by using the panel cointegration procedure, the stationarity properties of the variables need to be investigated. Therefore, it is necessary to test the order in which the variables are integrated in the model. It should be noted, however, that the power of standard time-series unit root test may be low, given the sample size and time spans. Therefore, in this work, the recently developed panel unit root tests are adopted. For testing the order of integration for each variable, the panel unit root tests developed by Levin, Lin and Chu (2002) [LLC], Im, Pesaran and Shin (2003) [IPS], and Pesaran (2007) [CIPS].

Table 4.3 shows the results of the LLC and IPS tests, both of which suggest that the null hypothesis of non-stationarity should be rejected for *Autcor* and *HE* series. However, the results of the order of integration for *FO, TO,* and *INST* series are not consistent, likely due to violating the assumption of cross-section independence. As it is discussed in chapter three, an important assumption underlying the IPS test is that of the cross-sectional independence across the individual time series in the panel.

Since the panel unit root tests, the results of which are shown in Table 4.3, have been criticized due to being based on cross-sectional independence, it is necessary to test for cross-sectional dependence of the errors and to re-consider the unit root properties of the variables included in the model. It is important to ensure that, if a mixture of different orders of integrated variables is employed, a sensible interpretation of the long-term relationship is likely to emerge.

Table 4.3: Panel unit root test-LLC and IPS test

Series	LLC		IPS	
	Intercept only	Intercept and trend	Intercept only	Intercept and trend
Autcor	-14.12(0.00)***	-6.69(0.00)***	-8.73(0.00)***	-9.28(0.00)***
HE	-10.17(0.00)***	-7.34(0.00)***	-14.47(0.00)***	-15.19(0.00)***
FO	-0.46(0.32)	-5.02(0.00)***	0.81(0.079)*	-1.12(0.13)
ΔFO	-14.50(0.00)***	-4.30(0.00)***	-11.71(0.00)***	-8.15(0.00)***
TO	-0.78(0.21)	-11.38(0.00)***	-2.42(0.008)***	-3.05(0.001)***
ΔTO	-22.29(0.00)***	-19.63(0.00)***	-13.39(0.00)***	-8.12(0.00)***
INST	-11.64(0.00)***	-13.36(0.01)**	-0.3416(0.64)	-3.52(0.00)***
ΔINST	-6.32(0.00)***	-59.25(0.00)***	-16.11(0.00)***	-13.52(0.00)***

Note: Probability values are in brackets. *** denotes statistical significance at the 1% level. ** denotes statistical significance at 5% level and * denotes statistical significance at 10% level. Numbers in the parenthesis are p-value.

This process starts by looking at the CD (cross-sectional dependence) test developed by Pesaran (2004), which approaches a normal distribution as the number of countries tends to infinity, and is based on the average of the pairwise correlation of the OLS residuals from individual panel regressions given by equations (4.1) and (4.2).

Table 4.4 reports the cross-sectional dependence of the residuals from the $ADF(\rho)$ regressions of the stock autocorrelation, financial openness, trade openness, and role of institutions, as well as their differences over the 1996-2011 period across the 27 countries included in the sample. For each ρ (i.e., 1, 2, and 3), the reported CD statistics are highly significant. The presence of the cross-sectional dependence implies that the use of the standard panel unit root tests, such as LLC and IPS, is not valid in this case.

In practice, error section dependence may arise for various reasons; for example, it may be due to the presence of spatial correlations specified on the basis of economic and social distance (Conley, 1999) or relative location, as well as due to the presence of unobserved

components that give rise to a common factor specification in the disturbances with a fixed number of factors (eg.Joreskog and Goldberger (1975)).

Table 4.4: CD test statistic of ADF (ρ) regression

Variable	ADF(0)	ADF(1)	ADF(2)
a) With an intercept			
Autcor	36.15	16.35	7.61
HE	24.16	12.55	5.78
FO	5.72	3.41	-2.66
TO	-4.59	-3.37	-3.28
INST	8.35	8.91	3.56
Δ*Autcor*	21.68	38.18	21.68
Δ*FO*	43.88	17.27	5.30
Δ*TO*	26.13	17.58	3.39
Δ*INST*	57.94	19.99	9.47
b) With and intercept and a liner trend			
Autcor	27.00	9.97	6.92
HE	24.60	6.54	5.24
FO	4.55	3.33	2.60
TO	4.52	3.95	3.60
INST	6.40	5.30	2.60

Notes: ρ is the th-order Augmented Dickey-Fuller test statistics, $ADF(\rho)$, for *Autcor*, *FO, TO*, and *INST*, and is computed for each cross-section unit separately in two cases, namely (a) with an intercept only, and (b) with an intercept and linear time trend. $CD = \sqrt{2T/J(J-1)}\sum_{j=1}^{J-1}\sum_{k=j+1}^{J}\hat{\rho}_{jk}$, with $\hat{\rho}_{jk}$ being the correlation coefficient of the $ADF(\rho)$ regression residuals between j th and k th cross-section units, tends to $N(0, 1)$ under the null hypothesis of no cross-sectional error dependence.

Thus, given the above results, the panel unit root tests are performed by applying the cross-sectionally augmented IPS (CIPS) test proposed by Pesaran (2004), even though it is relatively new and thus less used in the applied economics literature. As explained in the previous chapter, the test was developed by augmenting the Augmented Dickey–Fuller (ADF) regression with cross-sectional averages of lagged levels and the first

differences of the individual series, and is thus known as the cross-sectionally augmented ADF (CADF) test.

The CADF statistics are reported in Table 4.5 for different lag orders, indicating that, the result of the order of integration for *FO, TO* and *INST* turns out to be consistent. As it is shown, the unit root test hypothesis cannot be rejected at the 5% significance level. Additionally, the unit root tests for *Autcor* and *HE* as dependent variables which were clearly rejected in previous tests, cannot be rejected at level (the trend is either included or excluded from the test). Thus, the unit root test for the first difference of *Autcor*, *HE* , *FO, TO*, and *INST* variables is significantly rejected and all variables are denoted as *I(1)*. Consequently, our model includes only *I(1)* variables.

In order to check if there is danger of spurious regression, we will check the order of integration of the residuals of the estimated model.

Table 4.5: Pesaran's CIPS panel unit root test

Variable	CADF(0)	CADF (1)	CADF (2)
a) With an intercept			
Autcor	-3.81***	-2.86***	-2.18*
FO	-1.62	-1.27	-1.31
TO	-1.43	-1.55	-1.44
INST	-1.54	-1.03	-1.43
ΔFO	-3.89***	-2.22***	-2.14*
ΔTO	-3.35***	-2.24***	-2.39***
$\Delta INST$	-3.48***	-3.03***	-2.90***
b) With and intercept and a liner trend			
Autcor	-3.89***	-2.98***	-2.70**
FO	-2.46	-2.19	-2.15
TO	-2.16	-2.17	-1.73
INST	-2.10	-2.63*	-1.62
ΔFO	-4.03***	-2.73***	-2.97***
ΔTO	-3.42***	-3.37***	-2.84***
$\Delta INST$	-3.71***	-2.97***	-2.76***

Notes: The reported values are $CIPS(\rho)$ statistics, which are cross-sectional averages of cross-sectionally Augmented Dickey-Fuller ($CADF(\rho)$) test statistic.

4.5 Panel level effect

In order to obtain the residuals of the model, it is necessary to first estimate the equations represented in the beginning of the chapter. (equations (4.1) and (4.2)). The results for the three estimation types for equations (4.1) and (4.2) are shown in Table 4.6. and 4.7. respectively.

Cross-section independency assumption among the units of the panel data can be rarely found in empirical economic analyses. Cross-section dependence appears naturally when dealing with economic data due to, for instance, market integration processes, globalization of economic activity, offshoring processes or because of presence of common shocks. Therefore, recent econometric tools have devoted considerable attention

to devising procedures, relaxing the assumption of cross-section independency. There may be different sources of cross-section dependency. The pervasive cross-section dependency is due to the notion of "neighbors". However, "neighbor" does not necessarily need to be defined in terms of physical contiguity, such as neighbor regions or cities, but may also be defined *inter alia* in terms of economic distance, usually, trade partnerships (Chudik, Pesaran and Tosetti, 2011).

To eliminate cross-sectional dependence (CD) asymptotically, common correlated effects (CCE) type estimators developed by Pesaran (2006) have been applied. One of the estimators pools observations over cross-sectional units and is called CCE pooled (CCEP) estimator. The other estimator, CCE mean group (CCEMG) estimator, is just a simple average of the individual countries coefficients. The CCE methods are shown to be robust to different types of cross-section dependence of errors, possible unit roots in the factors and slope heterogeneity. To compare CCE estimators with common estimators, in which errors are considered cross sectionally independent, the mean group (MG) estimator also has been applied.

The first column reports the Mean Group (MG) estimates, assuming that errors are cross-sectionally independent. The second and third column represent the coefficients of Common Correlated Effect Mean Group and (CCEMG) (see Pesaran and Tosetti (2011)) and Common Correlated Effect Pooled (CCEP), respectively, which attempt to augment the MG estimate with simple cross-sectional regressor averages. Therefore, the CCE type estimates assume that errors are cross-sectionally dependent. Not surprisingly, there is also evidence of cross-sectional dependence for the MG estimation errors. For the CCEP and CCEMG estimations, equations (4.1) and (4.2) are augmented by simple cross-sectional averages of all regressors and the dependent variable.

$$Autcor_{jt} = \alpha_j + d_{jt} + \beta_{j1} Factfo_{jt} + \beta_{j2} Factto_{jt} + \beta_{j3} INST_{jt} + b_{j0} \overline{Autcor_t} + b_{j1} \overline{Factfo_t} + b_{j2} \overline{Factto_t} + b_{j3} \overline{INST_t} + \varepsilon_{jt} \quad (4.3)$$

$$HE_{jt} = \alpha_j + d_{jt} + \beta_{j1} Factfo_{jt} + \beta_{j2} Factto_{jt} + \beta_{j3} INST_{jt} + b_{j0} \overline{Autcor_t} + b_{j1} \overline{Factfo_t} + b_{j2} \overline{Factto_t} + b_{j3} \overline{INST_t} + \varepsilon_{jt} \quad (4.4)$$

Table 4.6: Estimation results for the 1996-2011 period (Dependent variable: Autcor)

Variables	MG	CCEMG	CCEP
FO	0.27 (0.127)	0.28(0.026)***	0.28 (0.035)***
TO	0.00 (0.627)	-0.00(0.627)	-0.00 (0.770)
INST	-0.03 (0.083)*	-0.12(0.011)***	-0.15 (0.080)*
CD test statistic	2.06***	-1.60	-0.19

* Indicates marginal significance at the 10% level, ** Indicates marginal significance at 5% level, *** Indicates marginal significance at 1% level. Numbers in the parenthesis are *p*-value.

Table 4.7: Estimation results for the 1996-2011 period (*Dependent variable: HE*)

Variables	MG	CCEMG	CCEP
FO	0.27 (0.127)	0.28(0.026)***	0.28 (0.035)***
TO	0.00 (0.627)	-0.00(0.627)	-0.00 (0.770)
INST	-0.03 (0.083)*	-0.12(0.011)***	-0.15 (0.080)*
CD test statistic	2.06***	-1.60	-0.19

* Indicates marginal significance at the 10% level, ** Indicates marginal significance at 5% level, *** Indicates marginal significance at 1% level. Numbers in the parenthesis are *p*-value.

From the CD test statistic, it is clear that this augmentation has reduced cross-sectional dependences to such an extent that, at the 10% significance level, the null hypothesis of no cross-sectional dependence cannot be rejected for either of the two types of CCE estimates.

4.6 Panel cointegration

The residuals $\hat{\varepsilon}_{jt}$, obtained from CCEMG estimation given in equations (4.3) and (4.4), is used to test the null hypothesis of no cointegration between stock market efficiency and financial liberalization, trade openness, and role of institutions. The CCEMG estimation procedure applied in the above equations asymptotically eliminates the weak, as well as strong, forms of cross-sectional dependence. Thus, the cointegration test is based on the IPS procedure, as the goal is to determine whether the residuals $\hat{\varepsilon}_{jt}$ contain a unit root or not. The panel cointegration test results are displayed in Table 4.8 and 4.9, suggesting that the null hypothesis of no cointegration should be rejected even at the 1% significance level and for all augmentation orders $(\text{i.e. } \rho = 0,1 \text{ and } 2)$. It represent that all the variables are cointegrated.

Table 4.8: Panel cointegration test results (dependent variable: *Autcor*)

IPS test on residuals of CCEMG estimation		
ADF (0)	ADF (1)	ADF (2)
-23.41***	-11.96***	-9.71***

Table 4.9: Panel cointegration test results (dependent variable: *HE*)

IPS test on residuals of CCEMG estimation		
ADF (0)	ADF (1)	ADF (2)
-21.36***	-11.56***	-13.41***

4.7 Long-term and short-term panel Granger causality results

Based on cointegration analysis, a long-term equilibrium relationship among financial and trade openness, institutions, and stock market efficiency is already identified. In this section, the casual relationship between the variables in the panel context is examined. Testing for Granger causality, a model with a dynamic error correction representation is specified. In this approach, the traditional VAR model is augmented with a one-period lagged error correction term that is obtained from the cointegrated model based on OLS. Thus, the Granger causality test is based on the following regressions:

$$\Delta Autcor_{it} = \theta_{1i} + \sum_{p} \Delta\theta_{11ip} Autcor_{it-p} + \sum_{p} \theta_{12ip} \Delta FO_{it-p} + \sum_{p} \theta_{13ip} \Delta TO_{it-p} + \sum_{p} \theta_{14ip} \Delta INST_{it-p} + \psi_{1i} ECT_{t-1} \quad (4.5)$$

$$\Delta FO_{it} = \theta_{2i} + \sum_{p} \Delta\theta_{21ip} FO_{it-p} + \sum_{p} \theta_{22ip} \Delta autcor_{it-p} + \sum_{p} \theta_{23ip} \Delta TO_{it-p} + \sum_{p} \theta_{24ip} \Delta INST_{it-p} + \psi_{2i} ECT_{t-1} \quad (4.6)$$

All the above variables have been predefined and Δ determines the first difference of these variables, whereas *p* initializes the optimal lag length. According to Pesaran, Shin and Smith (1999), the first difference explains the short-term causal relationships between the variables, whereas the one-period lagged error correction term simultaneously explains the long-term causality. At present, several procedures are available, which can be successfully applied when estimating the above models.

At one extreme, simple pooled mean estimator initializes with a fully homogenous coefficient model, and is based on an assumption that the coefficients and parameters will remain identical across countries. At the other extreme, the fully heterogeneous coefficient process does not impose any constraints on the cross-country coefficients;

therefore, the results can be interpreted on country-by-country basis. Located between these extremes, the method of dynamic fixed-effect (DFE) allows the panel intercepts to differ across different groups, while assuming the homogeneity of all error variances and slope coefficients.

With respect to slope heterogeneity, Pesaran and Smith (1995) warned that the DFE estimates are affected by a potentially serious heterogeneity bias, especially in samples including a small number of countries. To overcome this issue, Pesaran, Shin and Smith (1999) proposed the Pooled Mean Group (PMG) estimator—which assumes that the long-term parameters in different cross-sections are identical, while still allowing the short-term coefficients (including the speed of adjustment), error variances, and particularly the intercepts, to differ across groups within the cross-section.

Next, equations (4.5) and (4.6) are estimated using the MG, PMG and DFE. The short-term causality is tested based on $H_0 = \theta_{12ip} = 0$ for ΔFO, $H_0 = \theta_{13ip} = 0$ for ΔTO, and $H_0 : \theta_{14ip} = 0$ for $\Delta INST$ for all i in equation (4.5). Similarly, using $H_0 : \theta_{22ip} = 0$ for $\Delta Autcor$, $H_0 = \theta_{23ip} = 0$ for ΔTO, and $H_0 = \theta_{24ip} = 0$ for $\Delta INST$, it is tested for all i in equation (4.6). The null hypothesis for long-term causality is $\psi_{ji} = 0$, where j =1, 2, 3 and the optimal lag length is selected using the Schwarz Information Criterion. The estimation results pertaining to the long- and short-term parameters linking stock autocorrelation, financial openness, trade openness, and role of institutions by the MG, PMG and DFE estimators are reported in Table 4.10.

Thus far, we have established both short- and long-term Granger causality from financial openness towards the efficiency, and vice versa. As can be seen in Table 4.10, there is

not a consistent sign for the error-correction coefficients in the three models to conclude about causal relationship. The error-correction coefficient estimates are statistically significant for the PMG estimator. From econometric point of view, ECT coefficient should have a negative sign, indicating a shift towards equilibrium. Empirical findings indicate the direction of the causality from financial openness, trade openness, and role of institutions towards efficiency, as the ECT coefficient is negative and dynamically stable range. Meanwhile, for the reverse causality from efficiency towards financial openness, the speed of adjustment to the long-term is positive and strongly significant. The positive sign does not reveal any information on the convergence or divergence of the variables. Therefore, while the causality is directed from stock market efficiency, trade openness, and institutions towards more financial openness, no conclusion can be derived based on PMG

PMG estimation confirms the long-term causality relationship from financial liberalization, trade openness, and role of institutions to stock market efficiency at 1% significance level. However, the short-term coefficients on trade, financial openness, and role of institutions are either non-significant, or significant with positive sign, indicating greater stock autocorrelation in the short term. As in PMG estimation, the short-term coefficients are not restricted to be identical across the studied countries, no single pooled estimate for each coefficient exists. Consequently, in the short term, financial liberalization coefficient becomes positively significant, while two remaining coefficients are non-significant. In other words, financial liberalization may lead to greater stock autocorrelation in the short term, which is in contrast to the expectations under the efficiency concept.

Meanwhile, the results derived from MG estimation are different in a way that the coefficients of adjustment to the long run (ECT coefficient) are not significant in both models. It means that neither liberalization- led to – efficiency nor efficiency led to – liberalization hypotheses can be supported in long run. Interestingly, insignificant short-run coefficients represents the idea that there is not a causal relationship between financial liberalization and stock market efficiency even in the short-term. The results estimated by MG estimators cannot support the causality relationship between financial liberalization and stock market efficiency in short and long-term.

Finally, the DFE estimation appears to support the bi-directional causality relationship between financial liberalization and stock market efficiency in long run. When the ECT coefficients are negatively significant, it means that causality relationship does exist from stock market efficiency, trade openness and institution towards financial openness as well as from financial openness, trade openness and institution towards stock market efficiency. Similar to MG and PMG results, the causality relationship cannot be supported in the short run.

One possible explanation for either negative or non-significant short-term effects is that greater exposure to competition, technology, and changes in prices of factors and products as a result of trade openness, accompanied by a greater ease of access to capital due to financial liberalization, has shocked the economy. Thus, due to a sudden shock, the country's economy is not capable of a suitable response in the short term. Based on the results shown in Table 4.10, even the existence of the institutions as mediators is not sufficient to take advantage of the liberalization process in the short term.

Although the findings of causal relationship between financial liberalization and stock market efficiency in the short-run is consistent with three different estimators, the long run inconsistent findings put serious doubt about the veracity of these estimators.

The efficiency-leads to-liberalization hypothesis, which investigates the direction of the causality from more efficient stock markets to further opening of the financial markets, is not supported in either short or long term. Moreover, negative coefficients of the ECM terms support the idea of uni-directional causal relationship from financial openness towards efficiency. However, the beneficial effects of the financial liberalization are highly time horizon dependent. The positive sign of the financial liberalization difference in the PMG model supports the J-curve hypothesis for the effect of financial liberalization on the stock market efficiency during the investigated time horizon. The results reported here have demonstrated that, in the period immediately after opening, financial liberalization can undermine the stock market efficiency, yet exhibit beneficial effects it in the longer period.

Table 4.10: Panel Granger Causality (EMH approach)

	Source of causation (Independent Variable) **Short term**					**Long term**			
PMG									
	$\Delta Autcor$	ΔFO	ΔTO	$\Delta INST$	ECM_{t-1}	*Autcor*	*FO*	*TO*	*INST*
$\Delta Autcor$	-	2.44(0.06)**	-0.20(0.23)	0.16 (0.93)	**-0.90(0.00)*****	-	-0.13(0.04)**	-0.01(0.003)***	-0.06(0.08)*
ΔFO	0.01(0.22)	-	0.00(0.33)	0.00(0.53)	0.62(0.00)***	0.01(0.36)	-	0.00(0.00)***	-0.30(0.00)***
MG									
$\Delta Autcor$	-	-0.16(0.92)	0.00(0.92)	0.24(0.40)	-0.98(0.32)	-	-0.11(0.01)***	-0.00(0.03)**	-0.06(0.09)*
ΔFO	0.02(0.08)*	-	-0.00(0.29)	-0.09(0.17)	0.39(0.24)	0.12(0.59)	-	0.00(0.09)*	-1.21(0.17)
DFE									
$\Delta Autcor$	-	0.22(0.48)	0.00(0.56)	0.00(0.78)	-0.84(0.00)***		-0.10(0.03)**	-0.00(0.03)**	-0.05(0.08)*
ΔFO	-0.00(0.27)	-	-0.00(0.90)	-0.00(0.86)	-0.28(0.00)***	0.09(0.27)	-	0.00(0.73)	-0.00(0.95)

Note: The reported values in parenthesis are the *p*-values of the test. ** indicates significance at 5% level, and ***indicates significance at 1% level. Numbers in the parenthesis are *p*-value.

Table 4.11: Panel Granger causality (AMH approach)

	Source of causation (Independent Variable) **Short term**					**Long term**			
PMG									
	ΔHE	ΔFO	ΔTO	$\Delta INST$	ECM_{t-1}	HE	FO	TO	$INST$
ΔHE	-	-1.43(0.09)*	-0.34(0.04)**	-0.22 (0.65)	**-0.95(0.00)*****	-	0.23(0.02)**	0.00(0.02)***	0.04(0.08)*
ΔFO	0.01(0.22)	-	0.00(0.05)**	0.54(0.13)	0.85(0.00)***	0.01(0.25)	-	0.00(0.00)***	-0.40(0.38)
MG									
ΔHE	-	-0.11(0.66)	-0.00(0.00)***	-0.22(0.45)	-0.67(0.59)	-	0.05(0.09)*	0.00(0.07)*	0.11(0.37)
ΔFO	0.01(0.05)**	-	-0.00(0.23)	-0.05(0.14)	0.35(0.12)	0.25(0.03)**	-	0.00(0.19)	-0.87(0.11)
DFE									
ΔHE	-	-0.06(0.27)	-0.00(0.48)	-0.00(0.34)	-0.75(0.00)***		0.12(0.01)***	0.00(0.03)**	-0.01(0.07)*
ΔFO	-0.02(0.35)	-	-0.00(0.23)	-0.10(0.26)	-0.46 (0.00)***	0.05(0.21)	-	0.00(0.65)	-0.00(0.44)

Note: The reported values in parenthesis are the *p*-values of the test. ** indicates significance at 5% level, and ***indicates significance at 1% level. Numbers in the parenthesis are *p*-value.

Nevertheless, when attempting to establish the causal relationship, it is noteworthy that pooled mean group does not consider cross-sectional dependency. In contrast, the MG regressions reveal presence of considerable cross-sectional dependence. Estimation results presented in Table 4.6 and 4.7 indicate that CD test for MG estimation rejects the null hypothesis of no cross-sectional dependency, while estimating the model with CEEMG and CEP significantly reduces the cross-sectional dependency. Therefore, equations (4.1) and (4.2) can be augmented by simple cross-sectional averages of the regressors in equations (4.3) and (4.4). To rectify the flaws of previous estimators in determining the direction of causality in long run CCEMG and CCEP estimators have been applied, in order to re-assess the short- and long-term relationship between financial liberalization and stock market efficiency. In other words, to check the robustness of the results, the augmented version of PMG, MG and DFE estimators have been applied to make sure the new findings are in the same line with the findings mentioned above.

The initial three columns of Table 4.12. show long- and short-term coefficients of the effects of financial liberalization, trade openness, and role of institutions on stock market efficiency. This does not only sheds more light on the short-term effects, which are either detrimental or neutral, but also confirms the long-term beneficial effects of financial liberalization on stock market efficiency. Therefore, empirical findings of the CCEMG and CCEP estimates further support the J-curve type of effects of financial liberalization on stock market efficiency.

The last three columns of Table 4.12 present the long- and short-term estimation results pertaining to the causal relationship in the direction from the stock market efficiency toward financial liberalization. As can be seen, none of the coefficients is significant in either short or long term, which is consistent with the PMG model outcome for the casual

relationship. Although it is claimed in the extant literature that findings pertaining to the cross-sectional estimates, such as PMG, could be misleading, those reported here are in line with the cross-sectional dependency estimates.

The CD test results presented in Table 4.12 indicate presence of a considerable cross-sectional dependence across the countries in the studied sample. Therefore, focus can be shifted onto the CCEMG estimates that induce cross-section dependence, which is time-variant and thus unobservable when the liberalization effect across panel members is heterogeneous.

The fact that CCEMG coefficients are significantly greater than those produced by the MG and CCEP approaches suggests that, in the short term, not only the role of institutions and trade openness do not affect the stock market efficiency, but financial liberalization has an adverse effect on efficiency. However, during the time horizon under investigation, the effect of the financial and trade openness, as well as that of the institutions, changes, so that all three improve the efficiency. Thus, in order to fully benefit from financial liberalization, policy implications should consider a longer time horizon, as the external shocks take time to positively affect the efficiency. Moreover, for the reverse causality running from financial openness towards efficiency, neither short-term nor the long-term effect seems significant. Therefore, HE results approve the causality direction derived from EMH approach.

Table 4.12: Panel error correction estimates for the 1996-2011 period (EMH approach)

	MG	CCEMG	CCEP		MG	CCEMG	CCEP
$\Delta Autcor_{t-1}$	0.50(0.00)***	0.54(0.00)***	-0.52(0.00)***	ΔFO_{t-1}	-0.04(0.60)	-0.26(0.00)***	0.42(0.00)***
ΔFO_t	0.27(0.01)***	0.29(0.02)**	0.18(0.04)***	$\Delta Autcor_t$	0.01(0.49)	-0.04(0.55)	-0.01(0.36)
ΔTO_t	0.00(0.05)**	0.00(0.08)**	0.00(0.44)	ΔTO_t	0.00(0.90)	-0.00(0.260)	0.00(0.64)
$\Delta INST_t$	-0.03(0.83)	0.04(0.84)	0.03(0.21)	$\Delta INST_t$	-0.03(0.27)	0.12(0.74)	0.00(0.9)
FO	-0.22(0.05)**	-0.86(0.03)**	-0.85(0.08)*	$Autcor$	0.02(0.36)	-0.04(0.33)	0.03(0.38)
TO	-0.00(0.06)*	-0.00(0.05)**	-0.00(0.05)**	TO	-0.00(0.70)	0.00(0.97)	-0.00(0.86)
$INST$	-0.12(0.36)	-0.17(0.013)**	-0.14(0.09)*	$INST$	-0.02(0.43)	-0.3(0.27)	-0.00(0.89)
CD test statistic	-3.77(0.04)**	-0.02(0.94)	1.33(0.58)*	CD test statistic	2.89(0.04)**	0.86(0.38)	0.14(0.88)

Note: The reported values in parenthesis are the *p*-values of the test. ** indicates significance at 5% level, and ***indicates significance at 1% level. Numbers in the parenthesis are *p*-value.

Table 4.13: Panel error correction estimates for the 1996-2011 period (AMH approach)

	MG	CCEMG	CCEP		MG	CCEMG	CCEP
ΔHE_{t-1}	0.27(0.00)*	0.42(0.34)	-0.65(0.06)**	ΔFO_{t-1}	-0.03(0.54)	-0.25(0.00)***	0.34(0.00)***
ΔFO_t	0.15(0.00)***	0.24(0.04)***	0.16(0.04)***	ΔHE_t	0.01(0.35)	-0.34(0.56)	-0.11(0.06)*
ΔTO_t	0.00(0.05)**	-0.00(0.08)**	0.00(0.44)	ΔTO_t	0.00(0.95)	-0.00(0.260)	0.00(0.64)
$\Delta INST_t$	-0.02(0.56)	0.04(0.72)	0.03(0.23)	$\Delta INST_t$	-0.03(0.32)	-0.15(0.55)	0.00(0.9)
FO	0.18(0.04)**	0.67(0.03)**	0.83(0.05)**	*HE*	0.03(0.31)	-0.13(0.63)	0.03(0.38)
TO	0.00(0.07)*	0.00(0.05)**	0.00(0.05)**	*TO*	-0.04(0.60)	0.00(0.54)	-0.00(0.06)**
INST	0.14(0.12)	0.13(0.034)**	0.14(0.09)*	*INST*	-0.15(0.29)	-0.32(0.17)	-0.00(0.89)
CD test statistic	0.50(0.00)***	0.54(0.00)***	-0.52(0.00)***	CD test statistic	-0.04(0.60)	-0.26(0.00)***	0.42(0.00)***

Note: The reported values in parenthesis are the *p*-values of the test. ** indicates significance at 5% level, and ***indicates significance at 1% level. Numbers in the parenthesis are *p*-value.

As can be seen, the results of long-term estimation, applying two different dependent variables, are consistent. When *Autcor* is dependent variable, financial liberalization has negative sign, implying that it has the ability to reduce stock autocorrelation. Likewise, in the dynamic approach of stock market efficiency, in which the dependent variable is extracted from Hurst Exponent method, financial openness would lead to more stock market efficiency and the mediating role of institutions and trade openness has ceased the deteriorating effect of financial liberalization in short-run (Tables 4.12 and 4.13).

It should be noted that considering cross-sectional dependency, the causality relationship is consistent in both approaches. Efficiency- led to- financial liberalization hypothesis is not supported in empirical findings, indicating that the results are the support for economic theories. It supports the neoliberal economists who support more openness to reach to more economic welfare. However, the short run devastating effect of financial liberalization on stock market efficiency has highlighted the importance of time horizon to reap the benefits of financial liberalization. The contradiction between short-run and long-run findings provides the idea of J-Curve hypothesis on the causality relationship between financial liberalization and stock market efficiency. While the negative sign of the ECM lag indicates that the long-term relationship does exist among variables, the individual effects of these mediating variables cannot be discerned based on this model. Therefore, it might be prudent to consider a different method, as well as attempt to shed more light on the efficient level of institutions, which has been emphasized in recent literature.

CHAPTER 5:

LONG TERM RELATIONSHIP

5.1 Introduction

While panel causality considers short-term and long-term causality relationships from financial liberalization, trade openness, and institution to more efficiency, it does not indicate the long-term coefficient accurately. The traditional panel data estimation methods (either fixed effect or random effect estimator) are likely to produce biased and inconsistent results because of the endogeneity problem. Therefore, the system GMM panel data estimator is employed in this work in order to address the issue of the endogeneity of regressors. Meanwhile, one of the constraint of the study which is data availability, has shortened the period of study. For example, newly established institutions data by Kaufmann, Kraay and Mastruzzi (2005) has been designed from 1996 afterwards. Therefore, the short time period of the study leaves no space to be worried for heterogeneity of coefficient. That provides another support for applying GMM estimator.

Beyond the choice of econometric technique, one of the contributions of this research is the estimation of multiplicative interaction model, which will hopefully allow for better disentangling the relationship between stock market efficiency, financial liberalization, trade openness and institutions. This is due to the improvement in the model's specification that occurs when unconditional marginal effects are estimated in the presence of cross-dependencies among explanatory variables that require the estimation of conditional marginal effects (i.e., the impact of some explanatory variables on the dependent variable depend on the value of the other explanatory variable). It will be argued here that financial openness, trade openness and institutions are not independent of one another and therefore, require the efficiency impact to be assessed through the

correct estimation of conditional marginal effect of these variables on stock market efficiency.

As previously noted, the GMM estimator has one- and two-step variants. The two-step estimator is considered more efficient; however, the standard errors are downward biased and render GMM estimates unsuitable for inference (Arellano and Bond, 1991). This problem is mitigated in the system GMM version, which incorporates the finite sample correction to the two-step covariance matrix (Windmeijer, 2005).

5.2 Data and model specification

Finally, a simple multiplicative interaction model takes the form below :

$$\begin{aligned}\left|VR_{it}-1\right| &= \hat{\beta}_1 Laut_{it} + \hat{\beta}_2 FO_{it} + \hat{\beta}_2 TO_{it} + \hat{\beta}_3 GI_{it} + \hat{\beta}_4 \left(FO_{it} \times GI_{it}\right) \\ &\quad + \hat{\beta}_5 \left(TO_{it} \times FO_{it}\right) + \delta_1 + \lambda_t + \epsilon_{it}\end{aligned} \tag{5.1}$$

$$\begin{aligned}HE &= \hat{\beta}_1 FO_{it} + \hat{\beta}_2 TO_{it} + \hat{\beta}_3 GI_{it} + \hat{\beta}_4 \left(FO_{it} \times GI_{it}\right) \\ &\quad + \hat{\beta}_5 \left(TO_{it} \times FO_{it}\right) + \delta_1 + \lambda_t + \epsilon_{it}\end{aligned} \tag{5.2}$$

where the dependent variable $\left|VR_{it}-1\right|$ is an inverse measure of informational efficiency for country *i* in year *t* from EMH approach and HE_{it} is the index to measure informational efficiency from AMH approach, FO_{it} is the proxy for financial openness, followed by set of control variables—trade openness (TO_{it}) and governance indicators (GI_{it}). The interactive effect between financial openness and quality of governance, as well as between trade openness and financial openness, is also investigated. Here, δ_1 represents

the country fixed effect used to control for time-invariant country-specific factors, ϵ_{it} is the error term, and λ_t is common time specific effect.

Most of the literature use linear additive models and disregards the possibility that explanatory variables may be conditioned by one another. Therefore, this research takes the initiative to use multiplicative interaction model in the context of the relationship between financial liberalization and stock market efficiency.

To investigate the inconsistent results pertaining to the long-term relationship between financial liberalization and stock market efficiency, Generalized Method of Moments (GMM) is employed for the first time in this context. In this model specification, lagged stock return autocorrelation is an endogenous variable, while the other explanatory variables are treated as exogenous. Hence, the endogeneity of this variable in its lagged form as a regressor is controlled by using an internal instrument, namely lagged levels and lagged difference. Moreover, in previous section, it was shown that, by applying CD test, cross-sectional dependency is significant in errors. One way to reduce the amount of cross-sectional dependence and therefore the bias of the GMM estimators is to transform the data in terms of the deviations from time-specific averages. This is equivalent to including common time-specific effects in the regression model, which is standard practice in the estimation of short dynamic panels, as a way of capturing common variations in the dependent variable. Finally, λ_{it} is inserted in the model to make the model less biased.

In developing countries, there are gaps between the *de jure* announcement date of liberalization and the *de facto* implementation date. According to Kim and Lim's (2011)

recent work, although greater level of *de facto* trade openness is associated with a higher degree of stock market efficiency, this positive relationship does not hold when *de jure* measure is used. This implies that official trade reforms are insufficient to take advantage of returns to scale if they are not accompanied by a corresponding increase in the actual level of trade flows. Hence, in the current model, *de facto* trade openness, defined by the trade volume/GDP ratio, is adopted.

For financial openness, as mentioned above, the most precise database can no longer be accessed freely. Thus, the Lane & Milesti-Ferreti dataset (EWNII) is modified for the purpose of this study, and by calculating net capital flows/GDP for selected countries, it is possible to capture the *de facto* financial openness index.

As highlighted by Kaufmann and Kraay (2008), in the World Bank's WGI research report, the standard errors of the governance indicators have declined substantially since 2008, reflecting the improved precision of the governance estimates due to the increased number of independent data sources. The key advantages of the WGI stem from the time-varying characteristic, as otherwise the effect of time invariant characteristic cannot be distinguished from country-specific effects.

5.2.1 Variables correlations

The pairwise correlations for stock market autocorrelation (the efficiency proxy in EMH approach), *de facto* financial liberalization, *de facto* trade openness with each of governance indicators as well as , Hurst Exponent (the efficiency proxy in AMH approach), *de facto* financial liberalization, *de facto* trade openness and each of governance indicators have been presented in Table 5.1. It is represented that there is no

high correlation between the variables. Therefore, applying the variables in the same model, the biased result due to multi-collinearity does not look an issue. The pairwise correlations for all governance indicators shown in Table 5.2 reveal that all the governance indicator components have very high positive correlations with each other, indicating a potential problem of multi-collinearity that would arise if all the governance indicators were included in one regression model. The correlation coefficients range from 0.46 to 0.85, with Rule of Law (G5) and Control of Corruption (G6) having the highest coefficient of 0.87. The lowest correlation coefficient of 0.443 was observed between Voice and Accountability (G1) and Government Effectiveness (G3). For this reason, the component of governance indicators cannot be applied simultaneously in a singular regression.

ation between stock market efficiency proxies, financial liberalization, trade openness and each of governance indicators from 1996 to 2011

Autcor	Financial openness	Trade openness		*HE*	Financial openness	Trade openness
1			*HE*	1		
0.1	1		Financial openness	0.09	1	
0.03	0.46	1	Trade openness	0.02	0.05	1
0.04	0.18	0.31	Voice and Accountability	-0.006	-0.04	0.12
0.02	0.24	0.45	Political stability	-0.0630	0.28	0.07
0.01	0.29	0.55	Governance Effectiveness	0.01	0.48	0.06
0.05	0.24	0.38	Regulatory of Quality	0.05	0.37	0.05
0.09	0.30	0.46	Rule of Law	0.04	0.39	0.50
0.13	0.32	0.44	Control of Corruption	0.08	0.29	0.35

Table 5.2: Correlations between governance indicators from 1996 to 2011

	Voice and Accountability	Political Stability	Governance Effectiveness	Regulatory Quality	Rule of Law	Control of Corruption
Voice and Accountability	1					
Political stability	0.46	1				
Governance Effectiveness	0.47	0.58	1			
Regulatory of Quality	0.57	0.63	0.57	1		
Rule of Law	0.54	0.78	0.75	0.65	1	
Control of Corruption	0.53	0.75	0.65	0.66	0.87	1

Note: This table shows pairwise coefficient for component of Governance Indicator. G1 through G6 are the six-governance indicator measuring various dimensions of country-level governance. G1 is Voice and Accountability; G2 is Political Stability and Absence of Violence; G3 is Government Effectiveness; G4 is regulatory Quality; G5 is Rule of Law; and G6 is Control of Corruption.

Table 5.3 presents descriptive statistics of financial openness, trade openness, and governance indicators over the sample period. With respect to Government indicators, Regulatory Quality (G4) has the highest positive average score, followed by Government Effectiveness (G3), showing that higher score corresponds to a better outcome. Negative average scores of the remaining components point towards the increasing likelihood of domestic instability, such as governance unaccountability, political instability, and dominance of corruption in official bureaucracy. In addition, G2 score has the highest standard deviation, indicating that political stability varies substantially across countries.

Table 5.3: Descriptive statistics from 1996 to 2011

Variables	Mean	Standard Deviation	Median	Minimum	Maximum
Openness					
De Facto trade openness	76.3118	42.3818	63.0227	0.0000	220.4068
De Facto financial openness	0.1899	0.1734	0.1700	-0.0700	0.8400
Governance Indicators					
Voice and Accountability(G1)	-0.0833	0.7000	0.0000	-1.7041	1.2245
Political Stability and absence of violence(G2)	-0.2900	0.7860	-0.0239	-2.7040	1.1613
Government effectiveness(G3)	0.0568	0.5895	0.0000	2.4124	1.2743
Regulatory Quality(G4)	0.1795	0.5274	0.0000	-1.0481	1.5445
Rule of Law(G5)	-0.0499	0.5737	0.0000	-1.0963	1.2943
Control of Corruption(G6)	-0.1476	0.5539	-0.1382	-1.6238	1.5493

5.3 Long-term estimation

5.3.1 High-governance countries (Individual governance indicators)

The sample of countries was divided into two groups of high and low governance scores, based on each of the six governance indicators, namely, Voice and Accountability (G1), Political Stability and Absence of Violence/ Terrorism (G2), Government Effectiveness (G3), Regulatory Quality (G4), Rule of Law (G5), and Control of Corruption (G6). When the average score of governance indicator *i* is lower than the median of all countries' equally weighted values, the country is assigned to the low score group, denoted as "weak governance structure". Conversely, the group with high governance score comprises

countries with strong governance framework in which the average governance score for each indicator is higher than the median (Naghavi and Lau, 2014).

The results of the financial liberalization effect on stock autocorrelation analysis for High-Governance countries are summarized in Table 5.4. As can be seen, the effect of financial openness *per se* is statistically significant and positive, indicating that the actions implemented by policy makers to open financial markets increase the stock autocorrelation, while adversely affecting efficiency. Trade openness affects stock market efficiency in the same manner. The impact of institutional development in the form of Voice and Accountability is negative, but not significant, suggesting that institutional development in the form of G1 alone does not contribute to improving stock market efficiency (β_2). However, the interaction effect of institutional development and financial openness is negative and significant (β_5). These results indicate that, while the roles of institutions and financial openness individually do not seem to be effective in affecting stock autocorrelation, their interaction is capable of reducing the stock autocorrelation $(\beta_5 \text{ and } \beta_6)$.

Voice and Accountability (G1) refers to the extent to which a country's citizens have a say in selecting governments and holding those in power responsible for their action.(Low, Kew and Tee, 2011). Based on the results obtained here, the responsibility of people in power is a positive sign for foreigners to invest in domestic stock market. Similarly, while trade openness and financial openness individually lead to greater stock autocorrelation, their combined effect decreases the stock autocorrelation, while indicating more efficiency.

The data reported in the second column of Table 5.4 indicates that the effects of *de facto* trade and financial openness are statically significant, and have a positive impact on stock autocorrelation (β_2 and β_3).

Table 5.4: High-G countries, EMH approach of efficiency-Individual governance indicators (1996-2011)

Stock autocorrelation	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Lag stock autocorrelation $Laut_{it}(\beta_1)$	-0.261*** (0.000)	-0.387*** (0.000)	-0.358*** (0.000)	-0.452*** (0.001)	-0.257*** (0.000)	-0.169*** 0.000)
Financial openness $FO_{it}(\beta_2)$	1.345 *** (0.000)	2.046*** (0.000)	4.378*** (0.001)	1.957*** (0.000)	0.745*** (0.006)	1.187** (0.002)
Trade openness $TO_{it}(\beta_3)$	0.003*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.004*** (0.000)	0.003*** (0.000)	0.004*** (0.000)
Governance indicator $GI_{it}(\beta_4)$	-0.045 (0.663)	0.216 (0.124)	0.286 (0.233)	-0.148** (0.018)	0.153* (0.076)	-0.186 (0.291)
Interaction effect $FO_{it} \times GI_{it}(\beta_5)$	-0.432 *** (0.005)	-1.465** (0.047)	-1.341*** (0.000)	-0.513* (0.087)	-1.314*** (0.000)	-0.215 (0.964)
Interaction effect $TO_{it} \times FO_{it}(\beta_6)$	-0.003*** (0.000)	-0.012*** (0.006)	-0.032*** (0.008)	-0.015*** (0.001)	-0.003** (0.045)	-0.005** (0.042)
Number of observation	129	129	129	148	159	148
Number of countries	13	12	13	15	16	15
Number of instrument	13	11	12	13	14	24
Sargan test	0.97	0.95	0.880	0.95	0.97	0.95
Arellano-Bond test for AR(1)	0.00	0.002	0.00	0.001	0.00	0.002
Arellano-Bond test for AR(2)	0.82	0.4628	0.11	0.11	0.4466	0.3840
Time dummy	No	No	Yes	Yes	No	No

* Indicates marginal significance at the 10% level, ** Indicates marginal significance at 5% level, *** Indicates marginal significance at 1% level. Numbers in the parenthesis are *p*-value.

Table 5.5: High-G countries, AMH approach of efficiency-Individual governance indicators (1996-2011)

Stock market efficiency	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Financial openness $FO_{it}(\beta_2)$	0.357 *** (0.165)	0.239 (0.277)	0.014 (0.804)	1.48*** (0.000)	1.638*** (0.000)	1.781** (0.000)
Trade openness $TO_{it}(\beta_3)$	0.000 (0.678)	0.000 (0.608)	0.000*** (0.828)	0.007*** (0.000)	0.007*** (0.000)	0.007*** (0.000)
Governance indicator $GI_{it}(\beta_4)$	0.037 (0.240)	0.073 (0.149)	0.057 (0.175)	0.072 (0.225)	-0.039* (0.609)	-0.139 (0.133)
Interaction effect $FO_{it} \times GI_{it}(\beta_5)$	0.927 ** (0.040)	0.283* (0.081)	0.212* (0.090)	0.610* (0.065)	0.259*** (0.001)	0.516** (0.041)
Interaction effect $TO_{it} \times FO_{it}(\beta_6)$	-0.000*** (0.000)	-0.000*** (0.008)	-0.000*** (0.008)	0.017*** (0.000)	0.018*** (0.000)	0.019** (0.000)
Number of observation	129	129	129	148	159	148
Number of countries	13	12	13	15	16	15
Number of instrument	10	8	12	9	10	11
Sargan test	0.56	0.49	0.42	0.41	0.41	0.61
Arellano-Bond test for AR(2)	0.421	0.691	0.450	0.729	0.664	0.462
Time dummy	Yes	Yes	Yes	Yes	Yes	Yes

* Indicates marginal significance at the 10% level, ** Indicates marginal significance at 5% level, *** Indicates marginal significance at 1% level. Numbers in the parenthesis are *p*-value.

On the other hand, the effect of financial openness, when combined with the effects of institutional development and trade openness, is negative $(\beta_5 \text{ and } \beta_6)$. This suggests that any kind of openness by itself hinders the stock market from effective behavior; however, this effect will convert to efficient mode in the presence of an interaction effect of openness and institutional development. Models 3 and 4 of High-Governance countries obviously show that the individual effects of liberalization and institutional development significantly affect stock autocorrelation, albeit in an undesirable way $(\beta_2 \text{ and } \beta_3)$. Nevertheless, the interactive term between financial openness and G3 and G4 components of governance indicators lead to a decrease in stock autocorrelation $(\beta_5 \text{ and } \beta_6)$.

Countries with better Regulatory Quality have little restraint in financial markets. Thus, countries with a high score for Regulatory Quality provide a more attractive investment climate for foreigner investors. The empirical results demonstrate that individual liberalization types (trade and finance), as well as individual components of governance indicator, might not induce efficiency in stock market. However, when they occur simultaneously in an economy, the country can reap the benefits.

Model 5, considering rule of law in high-governance countries, leads to the same conclusion as other governance indicator components. The positive coefficient on the individual effect and the negative coefficient on the interaction effect emphasize the role of trade openness and institutional development as an auxiliary leverage for financial liberalization to have an effective influence on the stock markets. The Rule of Law (G5) measures the quality of investor protection. Thus, countries rated high on this indicator enjoy the powerful legal enforcement of contracts and judicial independence And have basic conditions for a foreign cash inflow to be invested (Low, Kew and Tee, 2011).

The truly different results appear in the last column of Table 5.4, which shows the findings pertaining to the liberalization and the role of Control of Corruption. While trade and financial liberalization still maintain a positive influence on stock autocorrelation, the interaction effect of financial openness and institutional development is not meaningful. Interestingly, the interaction of both types of openness is still significant. This result reveals that, irrespective of domestic economic conditions, trade openness is necessary for a country to take advantage of financial openness (Naghavi and Lau, 2014).

In order to establish whether the static and dynamic methods of efficiency would affect the results, equation (5.2) is applied to the same data set, input into six separate models, for all dimensions of governance institutions. The empirical results presented in Table 5.5 confirm the general idea that the interaction effects of governance and financial liberalization would increase the efficiency only in countries benefiting from good level of governance supervision. Financial liberalization coefficients, as well as the interaction effect of financial liberalization with governance indicators, are positively significant, indicating the importance of the role of quality institutions. However, there some specific differences between the results presented in Table 5.5 and those results of the EMH approach for the same dataset.

Firstly, the interaction effect of the last dimension of governance indicator with financial openness, which was not significant in Table 5.4, has now become significant. Secondly, the deteriorating effects of trade openness and financial openness as an individual variable are shown to be either improving or insignificant. Lastly, the interaction effect of financial openness and trade openness does have neutral effect on stock market efficiency in some models. These discrepancies imply that the leveraging effects of trade openness for stock markets benefit from financial liberalization.

In order to ascertain that the aforementioned contradictory results are due to different measurement methods of efficiency, in the following sections, the governance variables will be re-shaped prior to comparing the results obtained by applying the EMH and AMH approaches.

5.3.2 Low-governance countries (Individual governance indicators)

For Low-Governance countries, similar to High-Governance countries (the pertinent results are reported in Table 5.4 and Table 5.5), the lag-dependent variable confirms that the veracity of the dynamic model is significant at the 1% level for the EMH approach. In four of the six models applied, trade openness is also significant in supporting Basu and Morey's (2005) theoretical model.

The data presented in Tables 5.6 and 5.7 indicates that there is no relationship between financial liberalization and stock market efficiency in countries with low level of institutions. The regression results obtained by applying all six components in individual regressions for *static* type of efficiency are given in Table 5.6, whereas, Table 5.7 shows this relationship for *dynamic* types of efficiency. Interestingly, the results given in the two tables are similar, though there are some differences in the coefficients of individual effects of trade and financial liberalization. As shown in Table 5.7, neither the interaction effect of trade and financial openness nor the interaction effect of financial openness and institutions are significant in this category of countries. The interesting results appear on the coefficients of trade openness, which is positive, indicating that trade openness itself in low-governance countries would lead to greater stock autocorrelation. Once more, it emphasizes the importance of institutional background of a country before implementing the openness, as a sudden opening of goods market might otherwise lead towards the danger of crisis.

Table 5.6: Low-G countries, EMH approach of efficiency-Individual governance indicators (1996-2011)

Stock autocorrelation	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Lag stock autocorrelation $Laut_{it}(\beta_1)$	-0.153*** (0.005)	-0.254*** (0.000)	-0.144* (0.079)	-0.086*** (0.002)	-0.191*** (0.000)	-0.252*** (0.000)
Financial openness $FO_{it}(\beta_2)$	0.647 (0.511)	-0.584 (0.692)	1.390 (0.429)	1.323 (0.557)	-0.016*** (0.003)	1.320 (0.685)
Trade openness $TO_{it}(\beta_3)$	0.002*** (0.000)	0.003 (0.309)	0.007*** (0.005)	0.011*** (0.000)	0.009 (0.994)	0.010*** (0.000)
Governance indicator $GI_{it}(\beta_4)$	0.0942 (0.484)	-0.017 (0.466)	-0.170 (0.377)	-0.185 (0.696)	-0.032 (0.863)	-0.044 (0.758)
Interaction effect $FO_{it} \times GI_{it}(\beta_5)$	-0.064 (0.934)	-0.010 (0.871)	-0.073 (0.927)	0.396 (0.991)	-1.296 (0.114)	-0.129 (0.881)
Interaction effect $TO_{it} \times FO_{it}(\beta_6)$	-0.002 (0.502)	0.004 (0.811)	-0.027 (0.270)	-0.015 (0.662)	-0.004 (0.898)	-0.012 (0.722)
Number of observation	149	149	149	130	119	130
Number of countries	15	15	15	13	12	13
Number of instrument	33	33	60	61	32	32
Sargan test	0.9994	0.84	0.654	0.855	0.910	0.978
Arellano-Bond test for AR(1)	0.00	0.003	0.00	0.001	0.001	0.00
Arellano-Bond test for AR(2)	0.0809	0.1281	0.1673	0.1161	0.1191	0.1028
Time dummy	Yes	Yes	Yes	Yes	Yes	Yes

* Indicates marginal significance at the 10% level, ** Indicates marginal significance at 5% level, *** Indicates marginal significance at 1% level. Numbers in the parenthesis are *p*-value.

The empirical results of the relationship between financial liberalization and stock market efficiency when *dynamic* approach of efficiency is used provide a clear indication of the importance of the institutional development, considering mediating role of trade openness and institutions. The negative sign of the financial openness in four of the six models applied indicates the deteriorating effect of financial liberalization in countries with low level of institutions. Similarly, trade openness does not support the Basu and Morey theoretical model in any of the models, as the authors indicated that trade openness was

linked to less stock autocorrelation without considering the role of institutions. Although the small coefficients of trade openness shows that trade openness does not have big influence in stock market efficiency, the negative sign proves that even the small effect can render the market less efficient. Another important difference appears in the interaction terms, where they become statistically significant. The negative sign provides an alarming hint that, in countries with low level of institutions, sudden opening of the capital market, as well as goods market, will lead to the danger of crisis.

Comparing the AMH and EMH results, it can be concluded that both approaches yield results that are in almost the same direction. This implies that the key element in taking advantage of the liberalization is the role of governance. In order to gain a deeper insight into the role of institutions and confirm the veracity of the results, the six dimensions of governance indicators are reshaped, in order to investigate whether they will lead to the same conclusion.

Table 5.7: Low-G countries, AMH approach of efficiency-Individual governance indicators (1996-2011)

Stock market efficiency	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Financial openness $FO_{it}(\beta_2)$	-0.366*** (0.004)	-0.073 (0.502)	0.359 (0.245)	-2.407*** (0.000)	-2.637*** (0.003)	-1.739*** (0.000)
Trade openness $TO_{it}(\beta_3)$	-0.000* (0.074)	0.001* (0.069)	- 0.001 (0.368)	-0.008*** (0.000)	-0.008*** (0.000)	0.007*** (0.000)
Governance indicator $GI_{it}(\beta_4)$	-0.000 (0.934)	-0.005 (0.735)	-0.048 (0.265)	-0.491*** (0.000)	-0.288*** (0.000)	-0.166* (0.065)
Interaction effect $FO_{it} \times GI_{it}(\beta_5)$	-0.019 (0.794)	-0.129* (0.072)	-0.117 (0.992)	-2.436*** (0.000)	-1.029*** (0.001)	-0.153 (0.729)
Interaction effect $TO_{it} \times FO_{it}(\beta_6)$	0.002* (0.055)	-0.002* (0.072)	-0.007* (0.056)	-0.029*** (0.000)	-0.035 (0.000)	-0.020*** (0.000)
Number of observation	149	149	149	130	119	130
Number of countries	15	15	15	13	12	13
Number of instrument	33	33	21	33	21	1
Sargan test	0.861	1.000	0.368	1.000	0.366	0.9981
Arellano-Bond test for AR(1)	0.01	0.00	0.01	0.001	0.00	0.00
Arellano-Bond test for AR(2)	0.134	0.129	0.192	0.451	0.371	0.1028
Time dummy	Yes	Yes	Yes	Yes	Yes	Yes

*Indicates marginal significance at the 10% level, ** Indicates marginal significance at 5% level, *** Indicates marginal significance at 1% level. Numbers in the parenthesis are *p*-value.

5.4 Factor analysis

Pairwise correlation analyses do not account for the deeper intercorrelation structure of the data. Factor analysis can help establish whether the different components of WGI are measuring the same or different phenomena by identifying underlying components or factors that explain the pattern of correlations in a dataset. Factor Analysis (FA) is mathematically defined as an orthogonal linear transformation that converts the data to a new coordinate system. FA can also be used for dimensionality reduction in a data set by

retaining those characteristics of the data set that contribute most to its variance. Various authors have aggregated certain indices to better capture the common features of the existing data.

To reduce the dimensionality of the governance indicators while retaining the variation of the data set, the six components of governance indicator are aggregated based on the FA methodology, yielding two dimensions. The central idea of FA is to reduce the dimensionality of a data set consisting of a large number of interrelated variables, while retaining as much of the variation present in the data set as possible (Jolliffe, 2004).
In order to identify the governance indicators and group them with respect to their functionality in affecting liberalization, FA was conducted on six components of the governance indicators and the results are presented in Table 5.8.

The first dimension clarifies the internal and domestic aspect of the institutions, while the second component mostly pertains to the external factors, which can be considered an external attraction for foreigner investors.

The first factor accounts for 65% of the variance, and all of the six components of Vanda, Polst, Goveff, Regqua, Rulaw, and Corr load on this factor. The second factor accounts for 16%, while the remaining factors account for less than 1% each. The high percentage of these five components loading on the first factor shows that they capture broadly similar phenomena (greater than 0.7). Therefore, these five components can be merged into a single factor, denoted as “Encouraging Foreigners Factor” (EFF). Therefore, the governance indicators have been grouped with respect to their functionality. Based on the

results presented in Table 5.8, two broad categories of governance institutions have been distinguished.

The first category contains only the component of Voice and Accountability, whereas the second category incorporates the remaining five components, named EFF. This consolidated factor aims to reflect the ability of the government in preparing a business-friendly environment for investors. The first indicator of the EFF category is "political stability", which measures the political, civil, and human rights in a country. Similarly, the second dimension has been constructed by "governance effectiveness", which measures the competence of bureaucracy and the quality of public sector. "Regulatory quality" is the third aspect of the EFF category and considers sound policies and market-friendly policies. The forth element of the EFF category pertains to the quality of contract enforcement, the police, and the court, as well as the likelihood of crime and violence. The last part of the EFF is "control of corruption", defined as the abuse of public office for private gains. Given that all these five components are considering the administrative and judicial aspect of a country and identify to what extent its government would support external investors, the aggregation of those five WGI components is justified. The only other dimension is "Voice and Accountability", which includes internal aspects of life in a country and identifies human rights, as well as political and civil freedom of its citizens.

Clarifying how these five components can be interrelated, the overlapping definition among these components have been discussed. It prevents the WGI indexes from successfully representing six distinct concept.

Regulatory Quality: When governments establish numerous barriers to conducting business, it creates opportunities for public officials to collect bribes before delivering a service. Therefore, it will be a channel for corruption. . Regulatory quality index is intended to measure the extent to which the formal (and informal) regulations that govern the relation between the public and the private sector (definition of Rule of Law) foster growth rather than costly transfers (from the private client to the public regulator, or the other way) Thus regulatory quality implicates corruption and rule of law.

Governance Effectiveness: It uses public resources, often for public gain, so that the spending is not a deadweight loss (Regulatory Quality). Effective governments charge for services that citizens want, implying again, no or minimal deadweight loss. The Governance Effectiveness index is intended to measure the ability of governments to deliver these public services, the quality of the civil service (the 'agents' of delivery), and the independence of the bureaucracy from political influence, including the credibility of bureaucratic commitment to its policies ('unbribed ability' implicating Corruption). There is thus a causal or definitional overlap among the three concepts of Governance Effectiveness, Regulatory Quality and Corruption.

Rule of law (RL): Corrupt deals are enforced in a black market, where contracts are enforced not by public law but by private bandits. Rule of law implies an open, 'white', transparent market, where contracts are enforced by a 'rule' that is publicly known to parties outside the contract and applied equitably no matter who the enforcer or the contract parties are. The variable is intended to measure the probability that contracts and laws or rules are enforced collectively, and accountably, rather than privately. Corrupt

activities are typically illegal, indicating rule of law weaknesses. Thus, Rule of Law and Corruption are also related by definition, if not by cause.

Political stability: Governments, political parties, and political officials with a long time horizon know that economic growth is the friend of longevity, and they will not support highly ineffective government (Governance Effectiveness) and an excess of rules, and prefer the rule of law to the rule of bandits (Rule of Law). When government transitions are decided by well-defined and long-lived rules, rather than by violent overthrow or perennial coups, government officials are more likely to have a longer time horizon, and to seek investment for growth (and political survival) rather than corrupt transfers. The Political Stability index is intended to measure the expected orderliness of political transitions according to established rules. Thus, it is related to Corruption, Rule of Law and Governance Effectiveness

According to above discussion, there is theoretical justification to merge five components, which relatively consistent with Langbein and Knack (2009) study. Therefore, it is difficult to claim that each WGI is distinct.

Table 5.8: Factor analysis of governance indicators

Factor	Eigenvalue	Proportion	cumulative	Variable	Loadings
Factor 1	3.89	0.65	0.65	Vanda	0.27
Factor 2	0.96	0.16	0.81	Plost	0.83
Factor 3	0.41	0.06	0.87	Goveff	0.84
Factor 4	0.39	0.06	0.93	Regqua	0.83
Factor 5	0.25	0.04	0.97	Rulaw	0.93
Factor 6	0.13	0.03	1.00	Corr	0.91

Similar to the work presented in the previous sections, in order to compare the results, the countries were categorized into two groups of high and low institutional level. Once again, all countries with the average score of an institutional dimension exceeding the median were categorized in the high level of institutions group, with the remaining countries comprising the low-institutional level group.

5.4.1 High-governance countries (Re-shaping the governance indicators)

As explained in the preceding chapters, in order to assess the robustness of the results obtained, as well as investigate whether the different methods measuring the efficiency might influence the findings, two separate methods of scaling the stock market efficiency were applied, as these emerged from two different schools of thought, namely "Efficient market hypothesis" and "Adaptive market hypothesis".

The empirical results presented above reveal slightly different conclusions for static and dynamic aspects of stock market efficiency. In this section, the work on establishing whether, even after aggregating the different dimensions of governance indicators, the results of EMH and AMH would be still in the same line is presented.

The effects of financial liberalization on stock market efficiency based on equations (5.1) and (5.2) have been analyzed after integrating the five components and the empirical results presented in Table 5.9 confirm those presented in Table 5.4.

As it is shown in Table 5.9, applying the EMH approach, both internal and external aspects of institutions play significant role in taking the advantage of financial liberalization. However, the influence of the EFF dimension is stronger than that of the

internal dimension (Voice and Accountability). This finding highlights the role of governance in providing a stable economic and political situations in which foreign investors might find some incentives to invest in domestic stock markets.

As it is shown in Table 5.10, when the dependent variable has been measured by the HE method, Voice and Accountability influence is different from the EFF effect. For the first model (Vanda dimension of institution), not only the individual effect of financial liberalization and trade openness is not significant, but the interaction effect of financial openness and institutions does not seem meaningful either. However, for the second dimension of institution, namely the EFF, the interaction effect of financial liberalization and institutions is significant and positive. This highlights the importance of political foreign policy, which is the main component of the EFF dimension of governance. In other words, it might be prudent to consider two sides (internal and external) for the institutions, in which high quality of external dimension has been proven necessary to reap the benefits of financial liberalization. The greater coefficients in the second model also confirm the importance of the foreign aspects of governance in the context of liberalization.

The significant coefficients of interaction effects of financial and trade openness in this category of countries further indicate that trade openness is a pre-requisite for opening the capital market for investors.

It is worth noting here that whether the efficiency is *static* or *dynamic* does not influence the effect of financial liberalization on stock market efficiency. That makes the results

more robust and allows us to conclude that the role of external aspects of institutions is the only crucial part in taking advantage of the benefits of financial liberalization.

Table 5.9: High G-countries, EMH approach, Institutions aggregation (1996-2011)

Stock autocorrelation	Model 1	Model 2
Lag stock autocorrelation $Laut_{it}(\beta_1)$	0.34*** (0.000)	0.99* (0.078)
Financial openness $FO_{it}(\beta_2)$	1.687** (0.052)	1.480*** (0.000)
Trade openness $TO_{it}(\beta_3)$	0.004*** (0.006)	0.006*** (0.000)
Governance indicator $GI_{it}(\beta_4)$	-0.470** (0.005)	-0.290* (0.071)
Interaction effect $FO_{it} \times GI_{it}(\beta_5)$	-1.451 ** (0.005)	-0.002** (0.010)
Interaction effect $TO_{it} \times FO_{it}(\beta_6)$	-0.02*** (0.004)	-0.014*** (0.000)
Number of observation	225	129
Number of countries	15	15
Number of instrument	30	25
Sargan test	0.652	0.581
Arellano-Bond test for AR(1)	0.00	0.00
Arellano-Bond test for AR(2)	0.82	0.388
Time dummy	Yes	Yes

* Indicates marginal significance at the 10% level, ** Indicates marginal significance at 5% level, *** Indicates marginal significance at 1% level. Numbers in the parenthesis are *p*-value.

Table 5.10: High-G countries, AMH approach, Institutions aggregation (1996-2011)

Stock autocorrelation	Vanda	EFF
Financial openness $FO_{it}(\beta_2)$	0.176 (0.225)	0.128 (0.424)
Trade openness $TO_{it}(\beta_3)$	0.003 (0.397)	0.004 (0.347)
Governance indicator $GI_{it}(\beta_4)$	0.04** (0.04)	0.01 (0.531)
Interaction effect $FO_{it} \times GI_{it}(\beta_5)$	0.085 (0.763)	0.192 *** (0.002)
Interaction effect $TO_{it} \times FO_{it}(\beta_6)$	0.080** (0.034)	0.042** (0.024)
Number of observation	225	225
Number of countries	15	13
Number of instrument	32	38
Sargan test	0.79	0.38
Arellano-Bond test for AR(1)	0.00	0.00
Arellano-Bond test for AR(2)	0.46	0.62
Time dummy	Yes	Yes

* Indicates marginal significance at the 10% level, ** Indicates marginal significance at 5% level, *** Indicates marginal significance at 1% level. Numbers in the parenthesis are *p*-value.

5.4.2 Low-governance countries (Re-shaping the institution governance)

Thus far, the analyses pertaining to the relationship between financial liberalization and stock market efficiency in low governance countries with new-structured format of institutions were performed. The findings of these models provide a solid support for the hypothesis presented in the preceding sections. It can be concluded that the missing link in the theoretical model of Basu and Morey (2005) is the role of governance in terms of more rules and regulations. In the context of liberalization, low level of voice and accountability appears to have no significant effect on stock market efficiency. This indicates that the internal aspects of governance do not seem relevant in the process of liberalization.

External aspect of liberalization, in terms of policies, rules, and regulations that can ease the environment for foreigner investors, on the other hand, play a crucial role in leading the market either towards efficiency or crisis. In countries characterized by low institutional development, sudden opening up of capital markets and goods markets has a negative effect on the stock market efficiency. These findings imply that uncertainty in the investors' property rights, combined with instable political and economic situation, as well as lack of sufficient judicial system, would be a critical hindrance to these countries' attempts to fully benefit from financial liberalization.

As it can be understood from the data presented in Table 5.11 and 5.12, the adverse effects of financial openness and trade openness in the second model are stronger than those yielded by the first model. Therefore, the external aspect of governance seem to exhibit a more significant influence than the internal dimension, which only considers the citizen freedom and does not address foreigner rights.

The results shown in Table 5.11 and 5.12 are consistent across all models. Thus, it can be concluded that, when a country does not enjoy the high level of institutional quality, a sudden opening up of its capital market, not only may not improve the transparency of the stock markets, but would also lead to less efficiency and, in the worst cases, would result in the capital flight. Focusing on the external aspect of institutions, the significant and negative coefficient of the interaction between financial liberalization and governance indicator shows that the market might fall in the risk of a crisis.

Table 5.11: Low-G countries, EMH approach, Institutions aggregation (1996-2011)

Stock autocorrelation	Model 1	Model 2
Lag stock autocorrelation $Laut_{it}$ (β_1)	0.325*** (0.000)	0.325*** (0.000)
Financial openness $FO_{it}(\beta_2)$	1.687** (0.052)	1.687** (0.052)
Trade openness $TO_{it}(\beta_3)$	0.002*** (0.049)	0.002*** (0.627)
Governance indicator $GI_{it}(\beta_4)$	0.001*** (0.000)	0.792 (0.531)
Interaction effect $FO_{it} \times GI_{it}(\beta_5)$	0.104 ** (0.048)	0.115 (0.692)
Interaction effect $TO_{it} \times FO_{it}(\beta_6)$	0.080** (0.017)	0.01 (0.680)
Number of observation	225	225
Number of countries	15	15
Number of instrument	20	25
Sargan test	0.47	0.63
Arellano-Bond test for AR(1)	0.001	0.001
Arellano-Bond test for AR(2)	0.6	0.6
Time dummy	Yes	Yes

* Indicates marginal significance at the 10% level, ** Indicates marginal significance at 5% level, *** Indicates marginal significance at 1% level. Numbers in the parenthesis are *p*-value.

Moreover, when a country faces a low-level of institutions (in terms of both the external and internal aspects), liberalization of goods market as well as capital market will lead to more efficiency, and even the significant negative coefficient of the interaction between financial and trade openness might be a warning sign. As discussed extensively in the literature, liberalization should be accompanied by ensuring high quality of institutions in order not to be trapped by the probable crisis due to it.

Table 5.12: Low-G countries, AMH approach, Institutions aggregation (1996-2011)

Stock autocorrelation	Vanda	EFF
Financial openness $FO_{it}(\beta_2)$	-0.176 (0.354)	-0.168 (0.276)
Trade openness $TO_{it}(\beta_3)$	0.001** (0.025)	0.009 (0.144)
Governance indicator $GI_{it}(\beta_4)$	-0.01 (0.71)	-0.04 (0.531)
Interaction effect $FO_{it} \times GI_{it}(\beta_5)$	-0.032 (0.763)	-0.114 *** (0.002)
Interaction effect $TO_{it} \times FO_{it}(\beta_6)$	-0.044** (0.013)	-0.042** (0.024)
Number of observation	195	195
Number of countries	20	20
Number of instrument	15	13
Sargan test	0.41	0.38
Arellano-Bond test for AR(1)	0.00	0.00
Arellano-Bond test for AR(2)	0.6	0.6
Time dummy	Yes	Yes

* Indicates marginal significance at the 10% level, ** Indicates marginal significance at 5% level, *** Indicates marginal significance at 1% level. Numbers in the parenthesis are *p*-value.

5.5 Conclusion

When examining the effects of liberalization, whereby attracting foreign capital is deemed essential, some components of governance indicators seem crucial in providing a guarantee for foreign investors. Based on the FA findings, five of the initial six components of WGI could be grouped into a single component, in which political, economic, and judicial stability of a country is evaluated. Therefore, the initial problem was reduced to a two-dimensional concept focusing on institutions. The first dimension—Voice and Accountability—shows the extent of freedom of citizens. The second dimension, which is produced by aggregating five components, identifies the basic environment that is needed to attract investors. The regression results reveal that the

second aspect of the newly generated governance indicator plays a decisive role in reaping the benefits of financial liberalization.

Moreover, to make the result more robust, the same regression was run while applying different dependent variables derived from different schools of thought. The findings have shown that the role of governance is the only crucial factor in the liberalization context.

In Low-Governance countries, neither financial liberalization nor its interaction effect supports the idea of decreasing stock autocorrelation. In countries characterized by low governance, investors expect to be compensated for the perceived risk by high stock returns, which deviates the market from efficiency. In this category, high likelihood of political instability provides risky conditions for investment, and thus investors demand higher returns, which contradicts the concept of stock market efficiency. As the only difference between these two groups stems from the quality of institutions, based on the findings presented here, the condition of quality of institutions should be included into Basu and Morey theoretical model. Therefore, the findings give a clue on the non-lienar (U-shaped) relationship between financial liberalization and stock market efficiency. It means that before a certain level of institutional development is attained, financial liberalization would lead to less efficiency and even capital flight, while after a certain level of institutions liberalization would improve stock market efficiency.

Looking at previous literature, the missing link in the theoretical prediction is the role of domestic institutions. Hence, this study has taken the task to examine the role by adding the institutional quality as measured by WGI – a time-varying index. The results of our

study lend empirical support to the existence of a significant link between financial openness and stock market efficiency. To our knowledge, this is the only study that is consistent with the theoretical framework that posits the existence of robust positive relation between financial openness and stock market efficiency.

Furthermore, the coefficients of interaction between financial liberalization and the first dimension of institution in EMH and AMH approach yielded conflicting results. In the EMH approach, this coefficient does not seem significant, while in the AMH approach it is statistically significant. One possible explanation for this discrepancy can refer to the intrinsic description of this component. In other words, the failure of the first aspects of WGI, i.e., voice and accountability, to enhance the effect of liberalization, suggests that the internal dimension of government does not seem relevant in this context. In contrast, the external aspects of WGI—such as the factors pertaining to the government's ability to encourage and protect investments, as well as its international outlook—were shown to be necessary in order for a country to benefit from liberalization. Consequently, the findings obtained in this study are consistent with the theoretical framework that posits the existence of a robust positive relationship between financial openness and stock market efficiency.

To analyze the accuracy of the above proposition, more precise analysis is needed, which leads to the last study objective. Statistically, it is ambiguous to claim that the high quality of governance will lead to enhance stock market efficiency, while low governance level would result in the danger of crisis. Thus, the third study objective aims to establish the threshold level above which the governance level should be considered *high* and *low* otherwise.

CHAPTER 6:

THRESHOLD PANEL

6.1 Introduction

The results discussed in Chapter 5 indicate that high level of institutional development as a leverage should be accompanied by financial liberalization in order to contribute to the improvement of stock market efficiency. However, these results do not reveal how high the suitable level of institutions should be to benefit from liberalization. The empirical results presented in the previous chapter indicate the necessity of a threshold level for institution, which can be considered as a milestone.

Financial liberalization is expected to influence stock market efficiency differently, depending on whether a country is below or above that threshold level of institution. This issue is addressed in this chapter, which investigates the threshold level for all dimensions of institutional variable.

The GMM regression analysis for two country groups, which are categorized based on the institutional level, has suggested that there might be a U-shape relationship between financial openness and stock market efficiency. Using the threshold estimation method, a threshold stage of institutional development that is crucial for emerging markets to reap the benefits of liberalization can be identified. Below the threshold level, capital flight increases as the level of openness increases. However, financial liberalization will not cause capital flight and financial crisis, provided that the institutions are strong enough to support the funding provided by foreign investors. Thus, the question is—how *HIGH* should the level of institution be?

Significant contributions in the econometric estimation of the threshold level of variables have been recently made by Hansen (1999) and Kremer, Bick and Nautz (2013).

Equation (6.1) which is a dynamic model has been estimated by Kremer, Bick and Nautz (2013) threshold panel estimation, while equation (6.2) that is not a dynamic model has been estimated by using Hansen (1999) threshold panel.

Therefore, in this study, the panel threshold model is applied in order to investigate the accurate nexus between financial liberalization and stock market efficiency. As mentioned before, in each part of the analysis, to evaluate the robustness of results, the models were applied to two sets of the dependent variables derived from the AMH and EMH approaches. Once again, it should be emphasized that the dynamic threshold panel should be applied, as stock autocorrelation might be influenced by past returns. GMM estimation in Chapter 5 has already approved the veracity of the dynamic model.

6.2 Econometric framework and model specification

Based on the GMM regression results, non-linearity between financial openness and stock market efficiency suggests a U-shaped relationship. Here, the analysis moves one step further by continuing on the threshold regression.

In testing the U-shaped relationship hypothesis, the following threshold model is applied to conduct the cross-country threshold regressions:

$$Autcor_{it}^{*} = \beta_0 + \rho Autcor_{it-1}^{*} + \beta_1 \widetilde{INST}_{it}^{*} d(\widetilde{INST}_{it} \le \lambda) + \beta_2 \widetilde{INST}_{it}^{*} \left(1 - d(\widetilde{INST}_{it} > \lambda)\right) + \beta_3 FO_{it}^{*} + \beta_4 TO_{it}^{*} + \beta_5 \left(\widetilde{INST}_{it}^{*} \times FO_{it}^{*}\right) + \beta_6 (FO_{iy}^{*} \times TO_{it}^{*}) \quad (6.1)$$

$$HE_{it}^{*} = \beta_0 + \beta_1 \widetilde{INST}_{it}^{*} d(\widetilde{INST}_{it} \le \lambda) + \beta_2 \widetilde{INST}_{it}^{*} \left(1 - d(\widetilde{INST}_{it} > \lambda)\right)$$
$$+ \beta_3 FO_{it}^{*} + \beta_4 TO_{it}^{*} + \beta_5 \left(\widetilde{INST}_{it}^{*} \times FO_{it}^{*}\right) + \beta_6 (FO_{iy}^{*} \times TO_{it}^{*}) \quad (6.2)$$

where $\widetilde{INST}_{it}$ denotes a continuous function which takes into account both positive and negative institution observations. $\widetilde{INST}_{it}$ is a threshold variable that is exogenous and time variant, λ is the threshold level of institution and $d(.)$ represents the indicator function, taking on a value of either 1 or 0, depending on whether the threshold variable is less or more than the threshold level. This effectively splits the sample observations into two groups with different slopes. The rest of the variables in equations (6.1) and (6.2) are described in previous chapters. The focus of these regressions is the threshold effect of institutional development on stock market efficiency, and the estimation of the exact threshold value. The conditional least square method is used for equations (6.1) and (6.2) to evaluate the potential threshold point. At this stage, it is assumed that only stock autocorrelation in the previous time is a predetermined regressor, the remaining control variables are taken as exogenous, and all valid sets of lags are chosen as instruments, following Roodman (2009) collapsed form instruments matrix.

In the second stage, the impact of financial liberalization on stock market efficiency is investigated using the GMM method. Here, it is assumed that stock autocorrelation for one period before (lagged period) is a predetermined regressor, and that the remaining control variables are exogenous. For the instruments, all available lags of the predetermined variable are considered as instruments for increasing efficiency. However, to ensure robustness and avoid over-fitting the instrumental variables, the current lag of the predetermined variable is also treated as an instrument.

The focus of this estimation is the threshold effect of institutional development on stock market efficiency, and the estimation of the exact threshold value.

6.3 Threshold level of institutional variables

Table 6.1 and 6.2 show the threshold level of each of the two newly structured dimensions[5] of Governance Indicators, above which a one-unit increase in financial openness has a positive impact on stock market efficiency.

Table 6.1: The results for threshold value of Vanda and EFF (EMH approach)
threshold variable less than threshold

Threshold estimation 90% confidence interval	Vanda	EFF
	-0.116 [-1.007 0.21]	0.072 [-0.01 0.128]
Impact of liberalization		
β_1	0.014 (0.015)	-0.04 (0.020)
Impact of covariates		
TO	0.184 (0.107)	0.083 (0.221)
GI	2.141 (0.301)	0.113 (0.717)
FO*GI	0.448 (0.250)	0.002 (0.737)
FO*TO	0.020** (0.033)	0.083 0.221

* Indicates marginal significance at the 10% level, ** Indicates marginal significance at 5% level, *** Indicates marginal significance at 1% level. Numbers in the parenthesis are *p*-value.

In the threshold regression analysis, two formats of dependent variables are also applied, in order to check if the perspective as well as the method used to measure efficiency would affect the regression results.

[5] The threshold level for each of the six dimensions of governance indicators (before applying FA) has been estimated and the GMM estimation has also been performed for countries below and above the threshold level in order to check the robustness of the analysis.

The results of the two approaches of incorporating the dependent variables are quite consistent, indicating that irrespective of the stock market efficiency measurement approach, the effect of financial liberalization on stock market efficiency is affected by the level of institutional development. Comparing the coefficients of Vanda and EFF, it can be suggested that the external aspects of institutions have a greater leveraging effect on financial liberalization and would influence stock market efficiency more efficiently.

Table 6.2: The results for threshold value of Vanda and EFF (AMH approach)
threshold variable less than threshold

Threshold estimation 90% confidence interval	Vanda	EFF
	0.589 [-0.61 0.33]	0.051 [0.03 0.09]
Impact of liberalization		
β_1	-0.230 (0.545)	-0.24 (0.002)
Impact of covariates		
TO	-0.003** (0.032)	-0.06 (0.126)
GI	-1.058* (0.177)	-3.44 (0.039)
FO*GI	-0.632** (0.648)	-3.353*** (0.003)
FO*TO	-0.295** (0.518)	-1.128** (0.066)

* Indicates marginal significance at the 10% level, ** Indicates marginal significance at 5% level, *** Indicates marginal significance at 1% level. Numbers in the parenthesis are *p*-value.

As shown in Table 6.1 and 6.2, for both efficiency approaches, in countries with institutions below the threshold level, the stock market is in serious danger of losing the capital. Therefore, opening up the capital market may endanger the countries suffering from the level of institutions below the threshold level. Interestingly, both dimensions of institutions (internal and external) yield similar results. On the other hand, the external aspects of institutions have greater potential to improve the positive effects of

liberalization. In other words, both the external and internal aspects of the economic stability of a country seem necessary for reaping the benefits of liberalization.

The conflicting results presented in Chapter 5, due to which a definitive conclusion could not be made, have been rectified in this chapter, based on determining the exact level of institutional threshold.

Once the accurate threshold level has been identified, both external and internal aspects of institutions have proved the hypothesis regarding the prerequisite condition of trade openness as well as institutional development in order to boost stock market transparency. Otherwise, financial liberalization by itself is incapable of improving the efficiency, and it might even increase the probability of a crisis.

Table 6.3: The results for threshold value of Vanda and EFF (EMH approach)
threshold variable above than threshold

Threshold estimation 90% confidence interval	Vanda	EFF
	-0.116 [-1.007 0.21]	0.072 [-0.01 0.128]
Impact of liberalization		
β_1	0.449 (0.215)	2.135 (0.110)
Impact of covariates		
TO	-2.412 (0.619)	-0.001 (0.435)
GI	-1.612 (0.385)	-0.314 (0.009)
FO*GI	-0.683 (0.178)	-2.314 (0.061)
FO*TO	-0.04 (0.029)	-1.035 (0.087)

* Indicates marginal significance at the 10% level, ** Indicates marginal significance at 5% level, *** Indicates marginal significance at 1% level. Numbers in the parenthesis are *p*-value.

Table 6.4: The results for threshold value of Vanda and EFF (AMH approach)
Threshold variable above than threshold

	Vanda	EFF
Threshold estimation 90% confidence interval	0.589 [-0.61 -0.33]	0.051 [0.03 0.09]
Impact of liberalization		
β_1	0.230 (0.545)	2.135 (0.110)
Impact of covariates		
TO	1.11 (0.540)	1.85 (0.126)
GI	0.29 (0.385)	1.390 (0.590)
FO*GI	0.581 (0.810)	0.532 (0.426)
FO*TO	0.01 (0.018)	0.01 (0.216)

* Indicates marginal significance at the 10% level, ** Indicates marginal significance at 5% level, *** Indicates marginal significance at 1% level. Numbers in the parenthesis are *p*-value.

The results presented in Table 6.3 and 6.4 indicate that the hypotheses pertaining to the financial liberalization being beneficial to the leveraging effects of institutions and trade openness can be accepted. Furthermore, the new format of governance indicator reflects the importance of governance rules and policies in attracting foreign investors. The findings further suggest that, while the effects of internal and external aspects of institutions are consistent, the significance of the latter is highlighted in the liberalization phenomena.

Voice and accountability, as the internal aspect pertaining to the state capacity to function and fulfill its obligations towards its citizens, is a necessary but not sufficient condition for countries to overcome the negative effects of liberalization. Therefore, the external aspects are much more significant in the context of liberalization.

The external aspect of governance is demonstrated through the exercise of political, economic, and administrative authority to manage foreigners' affairs. The EFF dimension identified through the FA subsumes the complex mechanisms, processes, relationships, and institutions through which foreigners articulate their interests, exercise their rights and obligations, and mediate their differences. Further examining the factors comprising the EFF dimension, the key indicators encompassing EFF can be categorized into three groups: **performance, adaptability, and stability.** These three main factors are the basis of the EFF aspect of the governance dimension, which can be considered as a country's principal rules needed to rescue its economy from plunging into adverse effects of liberalization.

Performing institutions, such as strong judicial service, with capacity to deliver basic public services and to design and implement policies, are critically important for countries to resist against plausible shocks of liberalization such as capital flight.

Institutional performance is the foundation of the state's capacity to manage its executive, legislative, and judiciary function in order to ensure protection of human, economic, social, civil, and political rights.

Adaptability refers to the institution's capacity to anticipate and respond to changing needs and shifting priorities. In other words, it refers to ability to perform in future conditions and to innovate to meet future needs. Adaptable institutions are flexible and able to continuously provide investment opportunities, allowing a country to anticipate and respond to crises with innovative solutions. Well-performing institutions, accompanied by adaptable ones, provide a country with a platform to generate new

innovative ideas to respond to probable crises. These arguments thus confirm the crucial role of the performing and adaptable characteristics of institutions.

The last factor that needs to be considered is stability, defined as the degree to which a country enjoys efficient political and economic environment. If political chaos were to ensue due to demonstrations, revolutions, and rebel actions, a country's foreign perspectives would be substantially undermined. The risky conditions of instable economic and political environment are recognized as the main hindrance for foreign investors, who would deem loss of assets and properties probable and would withdraw from the country's financial system.

Consequently, a well-balanced combination of performing, adaptable, and stable intuitions serves as a guarantee for investors to enter domestic stock markets. As proven by empirical findings, the quality of institutions has long been recognized as an important component of a well-functioning market. They can create or destroy incentives for individuals to engage in trade and invest in human and physical capital.

6.4 Threshold level for each dimension

The sample for threshold value estimation corresponds to that used in the previous chapters, whereby the data on the 27 countries included pertains to the period between 1996 and 2011. The results are shown in Tables 6.5 and 6.6, which report the likelihood ratio test statistics for the statistical significance of threshold effects, as well as their 1000 bootstrap P-value. The findings indicate that the test for a single threshold of Voice and Accountability is significant with a 1000 bootstrap *p*-value of 0.006. Therefore, there is evidence of a single threshold effect of G1 on the efficiency of emerging stock markets.

Henceforth, the single threshold model is used to obtain the remaining estimation results, thereby the countries are grouped according to their respective regimes. Thus, 5 countries are assigned to the group with high level of Voice and Accountability $(G1 \leq -0.22)$ and 22 countries to that where Voice and Accountability is low $(G1 > -0.22)$. The same procedure is applied for the all dimensions of Governance Indicator.

Table 6.5: The results for threshold value of G1, G2 and G3

Test for single threshold			
Threshold variable	Voice and Accountability	Political Stability	Governance Effectiveness
Likelihood ratio stat	8.670	18.601	12.195
Bootstrap p-value	0.006***	0.001***	0.003***
Threshold estimate	-0.214	**-1.802**	**0.469**
95% confidence interval	[-1.380 0.879]	[-1.802 -1.266]	[-0.248 0.479]

Notes: This table presents the test results for threshold effects using Kremer, Bick and Nautz (2013)Threshold model. The dependent variable is stock return autocorrelation. Cross-sectional data are used for 27 countries between 1996–and 2011. *p*-values are from repeating bootstrap procedures 1000 times for each of the three bootstrap tests.

Similarly, as shown in the second column of Table 6.5 the test for a single threshold of Political Stability is significant with a 1000 bootstrap *p*-value of 0.001, while the tests for double and triple thresholds of Political Stability are not significant. These results provide strong evidence that two stages for stock market efficiency exist in terms of country political stability level. Thus, the countries can be segregated into two development regimes based on the level of Political Stability. In relation to the sample used in this study, this means that 8 countries are categorized in low level of political Stability $(G2 \leq -1.80)$ and the remaining 19 have high level of Political Stability $(G2 > -1.80)$.

Likewise, 1000 bootstrap replications are applied for each of the three bootstrap tests. As shown in the third column of Table 6.5, the single threshold is significant at the 1% level. However, the tests for double and triple threshold cannot be rejected, indicating that only two different regimes exist for Governance Effectiveness. Thus, countries with a governance effectiveness indicator below 0.47 are classified as having low institutional level (17 countries), while others are considered as having high level of institutional development (10 countries).

Table 6.6: The results for threshold level of G4, G5 and G6

Test for single threshold			
Threshold variable	Regulatory Quality	Rule of Law	Control of Corruption
Likelihood ratio stat	9.362	9.830	7.670
Bootstrap p-value	0.005***	0.006***	0.006***
Threshold estimate	**0.722**	**1.001**	**-1.048**
95% confidence int	[-0.335 1.469]	[-0.946 1.110]	[-1.520 1.403]

Notes: This table presents the test results for threshold effects using Kremer, Bick and Nautz (2013) Threshold model. The dependent variable is stock return autocorrelation. Cross-sectional data are used for 27 countries between 1996–and 2010. *p*-values are from repeating bootstrap procedures 1000 times for each of the three bootstrap tests.

The single threshold of the regulatory quality is also significant at 1% level. The results of the first column of Table 6.6 present the strong evidence for the two stages in the regulatory quality of institutions. Consequently, 19 countries that have $G4 \le 0.72$ are labeled as "low institution countries", while the remaining 8 with $G4 > 0.72$ are considered "high institutional countries".

As shown in the second column of Table 6.6, the test for a single threshold of Rule of Law is significant with a 1000 bootstrap *p*-value of 0.006. This allows the countries in the study sample to be separated into two development regimes—19 countries with

$G5 \leq 1.00$ are grouped into the "low level of institution" group, and the remaining 8 into "high level of institution". Lastly, the third column of Table 6.6 shows the significant first level of the threshold and insignificant second and third level of threshold. Consequently, countries with a control of corruption indicator below -1.04 are classified into the low institutional level group (four countries), while those exceeding this threshold are assigned into the high institutional level group. The threshold effect of trade openness on stock market efficiency is also tested, using trade openness as the threshold variable. However, the 1000 bootstrap *p*-value for trade openness is 0.7596 for single threshold, which is far beyond any acceptable significance level. Therefore, the linear relationship between trade openness and stock market efficiency cannot be rejected.

After finding the estimated values for threshold level of institutions, it is possible to perform a separate GMM for each group. For this purpose, the countries in the study sample are divided into two different stages of institution for each of the six dimensions of WGI, according to the average of each of the six dimensions. Table 6.7 presents the results for countries below the first threshold level. For countries in the first stage (low institutions), the relationship between financial liberalization and stock price autocorrelation is either positive or insignificant, while for countries in the second stage, the relationship is negative and statistically significant, thus leading to greater efficiency. In other words, there is no strong and clear relationship between financial liberalization and stock market efficiency for the countries below the threshold. These estimation results confirm the hypothesis of the non-linear relationship between financial liberalization and stock market efficiency. For the countries characterized by low level of institutions, financial liberalization at best does not induce any negative change, will be the source of crisis in the worst case.

Table 6.7: Threshold estimation: Above single threshold level

Stock autocorrelation	Model 1 G1> -0.22	Model 2 G2 > -1.80	Model 3 G3 > 0.47	Model 4 G4 > 0.72	Model 5 G5 > 1.00	Model 6 G6 > -1.04
Lag stock autocorrelation $Laut_{it}$ (β_1)	-0.158*** (0.000)	-0.330*** (0.000)	-0.325*** (0.000)	-0.260*** (0.001)	-0.160*** (0.000)	-0.287*** (0.000)
Financial openness FO_{it} (β_2)	-3.774 *** (0.000)	-0.110 (0.721)	-0.058 (0.806)	-2.485*** (0.000)	-0.504 (0.422)	0.971*** (0.000)
Trade openness TO_{it} (β_3)	-0.000 (0.953)	-0.004 (0.622)	-0.001 (0.435)	-0.007*** (0.000)	0.005*** (0.014)	0.004*** (0.000)
Governance indicator GI_{it} (β_4)	-1.060*** (0.001)	0.190*** (0.000)	-0.314*** (0.009)	-0.034 (0.787)	-0.644 *** (0.000)	0.043 (0.373)
Interaction effect $FO_{it} \times GI_{it}$ (β_5)	-2.200 ** (0.026)	-0.360** (0.014)	-2.314* (0.061)	-0.543*** (0.092)	-2.289*** (0.000)	-0.312* (0.071)
Interaction effect $TO_{it} \times FO_{it}$ (β_6)	-0.011** (0.044)	-0.145* (0.086)	-1.035* (0.087)	-0.025*** (0.06)	-0.011* (0.076)	-0.012** (0.000)
Time dummy	Yes	Yes	Yes	Yes	Yes	Yes

As the results in Table 6.8 demonstrate, the interaction effect of financial openness and governance institutions, as well as the interaction of trade and financial openness, is statistically significant.

It should be noted here that the difference between the above table and the similar table in the previous chapter (Table 5.3) refers to the classification of the samples. In Chapter 5, the countries were categorized based on the simple comparison of mode and average of each WGI component. This simple method for classification does not have any theoretical justification and is not reliable grounds for making any definitive conclusions or making decisive economic suggestions. It is just a method for re-arranging the sample,

allowing a more eloquent categorized conclusion to be made. However, the sampling of countries in the current chapter is based on the identified threshold value, which is calculated by applying the method proposed by (threshold values are reported in Tables 6.5 and 6.6). Thus, the acquired threshold boundary is a decisive line above which countries are likely to gain benefit from liberalization; otherwise, they may enter into a financial crisis.

Comparison of the results presented in this table with those in the corresponding table in Chapter 5 (Tables 5.3 and 5.4) explicitly highlights the difference between the last columns of these tables. The results of Table 5.3 show that control of corruption does not play a significant role in enhancing the effect of financial liberalization. Consequently, in line with the work by Naghavi and Lau (2014), there is possibility that control of corruption might refers to internal aspect of governance indicators. However, the FA has shown that the concept of control of corruption also might be different from political stability, governance effectiveness, regulatory quality, and rule of law. Therefore, threshold analysis may resolve the conflict and clarify the ambiguous findings presented in Chapter 5.

Having calculated the threshold level of all governance indicators' dimensions, consistent findings are obtained. Control of corruption exhibits the effects comparable to those of other dimensions. Thus, improving the sampling method yielded a different conclusion. As shown in Table 6.7, the control of corruption, like other components of governance indicators, should be above the threshold line, in order for a country to take advantage of the positive financial liberalization effects.

Table 6.8: Threshold estimation: Below single threshold level

Stock autocorrelation	Model 1 G1 ≤ -0.22	Model 2 G2 ≤ -1.80	Model 3 G3 ≤ 0.47	Model 4 G4 ≤ 0.72	Model 5 G5 ≤ 1.00	Model 6 G6 ≤ -1.04
Lag stock autocorrelation $Laut_{it}$ (β_1)	-0.465*** (0.005)	-0.214** (0.013)	-0.353*** (0.000)	-0.364*** (0.000)	-0.152 (0.000)	-0.249*** (0.000)
Financial openness FO_{it} (β_2)	0.230 (0.545)	0.2188 (0.144)	0.414 (0.394)	0.171 (0.365)	-1.534 (0.326)	0.742 (0.874)
Trade openness TO_{it} (β_3)	0.003 (0.064)	0.006 (0.233)	0.001 (0.411)	0.000 (0.952)	0.000 (0.880)	0.018 (0.162)
Governance indicator GI_{it} (β_4)	0.071 (0.385)	-0.315 (0.017)	-0.083 (0.221)	-0.054 (0.571)	-0.094 (0.553)	-0.080 (0.852)
Interaction effect $FO_{it} \times GI_{it}$ (β_5)	-0.204 (0.420)	0.851 (0.003)	-0.113 (0.717)	-0.189 (0.620)	1.664 (0.000)	-1.717 (0.689)
Interaction effect $TO_{it} \times FO_{it}$ (β_6)	-0.006 (0.157)	0.006 (0.747)	-0.002 (0.737)	-0.000 (0.783)	-0.013 (0.72)	-0.056 (0.606)
Time dummy	Yes	Yes	Yes	Yes	No	No

As shown in Table 6.8, neither financial openness nor trade openness alone has the ability to affect the stock market in a positive or negative direction. The interaction of financial openness and institutions, as well as financial and trade openness, shows a negative sign; however, neither interaction is statistically significant. This confirms the notion that, when a country is not institutionally developed the effect of financial liberalization is neutral at best. Moreover, a comparison between the above table and the corresponding table in Chapter 5 reveals broad similarities.

6.5 Conclusion

The efficiency level of stock market across time and countries is significantly associated with a country's institutions level, as measured by WGI. Therefore, stock market efficiency in emerging financial markets has a unique non-linear relationship with institutions level. It can be concluded that existing incongruent findings reported in the extant literature, even after conditioning for the effects of financial liberalization, stem from the unknown threshold level of institutions. If countries attempt to improve the level of institutions, it has to reach a specific threshold level in order to benefit the financial liberalization. The U-shaped association between financial liberalization and stock market efficiency explicitly reveals that countries with low level of institutions are in danger of entering into a crisis in case of sudden opening of stock market, while countries in which the institution level is above the threshold will reap the benefits of liberalization. The inconsistent result pertaining to Control of corruption in the GMM regression is probably due to inappropriate categorization of countries, as the optimal level is calculated based on econometric analysis, and all six dimensions of WGI produce the same results.

CHAPTER 7:

CONCLUSION

7.1 General conclusion related to the objectives

The first goal of the work presented here was to examine the Granger causal relationship between financial liberalization and stock market efficiency, with trade openness and institutions as mediating variables. This objective was aided by the recent development of a panel Granger causality test that proffers both the long- and short-term causality. In line with the above, the work conducted as a part of this study, whereby a panel data study comprising 27 emerging markets was conducted, makes a novel contribution to the extant literature. The findings on the short-term effects of financial liberalization imply that, in the short-term, stock markets not only do not benefit from financial liberalization, but may actually suffer from greater autocorrelation, as the associated short-term costs and risks impede stock market efficiency.

Based on the presented results, a comparison of the short- and long-term estimates indicates that the liberalization-led-to-efficiency relationship is contingent on whether the deregulation is temporary or permanent (Kim, Lin and Suen, 2012). The temporary shocks do not provide sufficient time for the stock market to adjust to the new regulations; however, in the long-term, stock markets can adjust to the external shocks and can thus move to produce more disclosure and adhere more strongly to the international norms of corporate governance. Thus, these findings provide empirical support for applicability of the J-curve hypothesis on the effect of liberalization on the stock market efficiency. Moreover, this can be interpreted to implicitly align with the work by Baltagi, Demetriades and Law (2009), as the authors suggested that closed economies would take greater advantage of liberalization in the initial stage.

The current study does not find any statistical support for the hypothesis that efficiency leads to liberalization. More specifically, it cannot be statistically proven that more efficient markets are more eager to liberalize to raise more funds, whereas less efficient markets opt for more stringent capital controls. The possible justification for these findings can be the view that, when the stock market is efficient and capable of raising funds for projects, it does not require or seek any change and deregulation. Therefore, efficient markets are not a likely cause of change. Consequently, reverse causality from efficiency towards openness might not be the reason for the contradiction revealed in the review of the pertinent literature.

The empirical evidence presented in this work confirms the key role of the political and economic factors in the short-term risks and adverse outcomes of opening up the markets. Consequently, in terms of policy implications, countries should be equipped with adequate means to minimize the short-term costs of liberalization in order to reap the long-term benefits. In other words, they need to strengthen the prerequisite foundations of openness in order to avoid the potential initial crisis. Provided that countries can survive the initial stages of liberalization, they will enjoy the high level of informational efficiency, which is the main incentive to attract external investors. Therefore, financial liberalization that is interpreted by investors as a signal to provide better protection may increase cash inflow in the long term.

An extensive review of the extant literature revealed that the role of domestic institutions is the missing link in the theoretical prediction of the relationship between financial liberalization and stock market efficiency. Hence, this study has taken the task of examining this role by adding the institutional quality, as measured by WGI—a time-varying index.

The study findings lend empirical support to the existence of a significant link between financial openness and stock market efficiency. The findings presented in this thesis indicate that trade openness and financial openness *per se* do not induce efficiency in stock market, irrespective of the level of institutional development in a country. Nonetheless, when their interactive effects are examined, the results varied according to quality of institutions. In countries with high institutional quality, the interaction effect of financial liberalization with both trade openness and institutional development was found to be crucial for a country to benefit from financial liberalization. Conversely, in countries with low institutional quality, none of the interaction terms was meaningful.

Due to the time-varying nature of WGI, its effect can be distinguished from country-specific effects. The significance of this study thus lies in the evidence in support of the importance of the institutional quality for a country to reap the full benefits from financial liberalization.

Moreover, the GMM regression analysis has proven that there is a non-linear relationship between financial liberalization and stock market efficiency. In other words, there is a U-shape relationship between financial openness and efficiency of the stock market. An explanation for this U-shaped correlation might refer to the initial stage of institutional development in which neither domestic nor foreign investors find legal protection, and are thus not motivated to invest. This is the source for capital outflows and outgoing flight of capital, which leads to financial crisis.

Capital flight is encouraged by unstable property rights, and domestic economic and political conditions; in this condition, the stock market does not have the required efficiency to absorb the suspending capital, and domestic residents choose to invest their

wealth elsewhere, where they perceive the risk to be lower. When the economic and political structure of an economy is supporting the openness phenomenon, this leads to enhanced stock market efficiency; otherwise, the country may plunge into deep crisis.
As the economy continues to grow, the economic and political conditions improve and better institutions are established. The residents gain more confidence in the domestic economy and no longer need to send their assets abroad to avoid government control or political losses from expropriation. Consequently, financial liberalization in a flourishing economy attracts foreign investors, generating more income in return.

Therefore, financial liberalization may decrease capital flight and empower the stock market. This finding suggests that the positive effect of financial liberalization will increase as a country becomes more democratic and more politically open to the public. Dictatorship and autocracy not only encourage residents to place their wealth abroad to avoid control from their government, but also prohibit foreigners from investing due to high perceived risks. Therefore, the threshold levels of all dimensions of governance indicators play a significant role in confirming the theoretical hypothesis for the relationship between financial liberalization and stock market efficiency. The success and failure of financial liberalization is assumed to be dependent on country characteristics. Identifying the threshold level of institutions and comparing them with the existing situation prevalent in each country will provide guidance for policy makers whether to proceed for liberalization or not.

Employing the threshold panel estimation by Kremer, Bick and Nautz (2013) confirms the new idea of non-linear relationship between financial openness and stock market efficiency. This U-shaped relationship reveals that, before a certain level of institutional development, financial liberalization does not show the beneficiary role in stock market.

Conversely, once the threshold level is reached, financial liberalization has the ability to boost the stock market efficiency. Threshold panel estimation certifies the importance of institutional development for a country and exposes the exact critical level of institutions for emerging markets to reap the benefits of liberalization. The threshold level identification thus yielded a completely different country classification. Comparison of the GMM results presented in Chapter 5 and 6 explicitly points out that the inconsistencies between two aspects of institutions were due to the non-systematic arrangement of countries. While applying rule of thumb (Chapter 5) in country categorization, though, provided a clue for general conclusion, it failed to specify the critical level of each dimension of governance indicators.

The empirical results presented in this work suggest that all the components of the WGI explain the improvement in stock market efficiency through liberalization. Because of the time-varying nature of WGI, its effect can be distinguished from country-specific effects. The significance of this study lies in the evidence in support of the importance of the institutional quality for a country to reap the full benefits from financial liberalization. Moreover, while trade openness and financial openness, individually, do not contribute to the stock market efficiency, the effect of their interaction significantly enhances the stock market efficiency in countries with good structure. This interaction effect, however, is not meaningful in low-governance countries, indicating that, when the country is suffering from low-governance quality, trade openness, financial openness, governance indicator, or its interaction terms, do not lead to more efficiency of the stock market.

Based on the extensive literature review, the findings presented here constitute the only empirical work that supports Basu and Morey's (2005) theoretical framework for the existence of a significant link between financial openness and stock market efficiency.

Their model focuses on the role of technological returns to scale, whereas this study places more emphasis on the preconditions of domestic economies by categorizing the countries based on the level of institutional development. Therefore, the empirical findings reported in this thesis prove that *Governance Matters Indeed!*

7.2 Theoretical conclusion

As noted earlier, the emergence and importance of institutions refer back to Adam Smith. Smith (1976), who claimed that a certain degree of confidence in justice of government, rule of law, and property rights should exist in a country, in order for the manufacturing sector and commerce to flourish. Although neo-classical economics has ignored this intuition, the neoliberal ideology recognizes the governance as an inevitable part.

Based on the econometric results, the necessity of institutions has been approved in all parts of the analyses conducted as a part of this investigation. Therefore, it is reasonable to conclude that the empirical results are in line with neoliberalism definition. The econometric analysis could suggest that neoliberalism not only remains dominant, but also seems to continuously come up with new ideas on how to "save and revamp" (Aalbers , 2013) the system. As it has been discussed in the literature review, the governance concept is implicit in the definition of neoliberalism itself. Neoliberalism is not about total withdrawal of the state, but rather about its qualitative structuring. As Aalbers, 2012 pointed out, neoliberalism is not so much deregulation, but rather re-regulation. In that sense, the policies and practices of privatization are more central to neoliberalism than the ideology of free markets. States are not external, but central to neoliberalism, because the freedoms the neoliberal state embodies the premise that

"reflects the interest of private property owners, businesses, multinational corporations, and financial capital" (Peck, Theodore and Brenner, 2010).

The econometric results presented here focus on the role of governance, which is central to the neoliberalism ideology, where *state intervention* refers to the role of the governance, rules, and regulation to support free economic activities.

Seeking to answer the question if global financial crisis is the crisis of neoliberalism, it can be noted based on the current study findings that not only the financial global crises cannot be considered as neoliberalism crises, but most of the solutions to the crises can be found through more neoliberalism. Therefore, the solution is not new-Keynesianism or post-neoliberalism, but rather intensified neoliberalization because neoliberalism is just about market disciplines. Neoliberalism ideology is markedly different from neoliberalism practices. As Overbeek and van Apeldoorn (2012) discussed, it can be justified that existing neoliberalism was never really devoted to creating free market under proper governance. Its motivation was and is, rather, the dominance of public life by Giant Corporations. In neoliberal practices, state intervention has never been in the forms of regulations, but has always been overly severe.

Solving the problem of neoliberalism would require the agents of neoliberalism. The current crisis may not undermine the ideology of free market due to the adaptive capacity inherent in neoliberalism. The big crisis of our time did not become a crisis of the neoliberalism ideology. The challenges to neoliberalism ideology were easily turned into neoliberal solutions. Thus, the need for effective intervention as more regulation (defined as quality of institutions in this research) emerges as a key precondition for overcoming a major market failure in the system**.**

Linking the presented empirical findings with true definition of neoliberalism, it can be concluded that deregulation in general, and specifically liberalization, is the central point of neoliberalism. The element of state intervention in the form of more institutions and governance is the key factor in neoliberalism. The fundamental component to this effort towards liberalizing the market is a more authoritative state, which focuses on providing the conditions under which individual entrepreneurship, self-government, freedom, and responsibility can be possible.

Although the current financial crisis heralds the failure not only of an economic system, but also demise of neoliberalism ideology, the ideology of free markets neoliberalism is very much alive.

7.3 Contribution of the study

The impact of financial liberalization on stock markets has been one of the most debatable topics as previous studies have shown conflicting results. The consecutive recent crisis in 1990s and more importantly global financial crisis in 2009 has raised a serious doubt on the success of financial liberalization in developing countries. It has even challenged that if the neoliberalism era is going to end. Within the evolving scene in the liberalization field, the contribution of this study is multifaceted.

Firstly, this study takes the initiative to make a link between empirical aspect of an economy and theoretical part of it. Investigating econometric findings, the current study has taken advantages of profound analytical discussions to justify which school of thought describe liberalization phenomena and its relevant side effects. When econometric analysis shed more lights on the importance on institutions role, it has been linked to the

definition of neoliberalism theory by Adam Smith. Concluding that governance concept, emphasized in econometric findings, is implicit in the definition of neoliberalism can be considered as one of the contributions of the study.

Secondly, in literature sources focusing on *quantity* effect, either positive or negative effect of liberalization on growth is typically established; however, the success of liberalization cannot be evaluated by assessing whether it has positive or negative effect on growth. Merits of liberalization also need to be investigated by evaluating the *quality* effect, whereby it must be ascertained whether liberalization improves transparency and allocation of capital across firms. Therefore, salient shortage in *quality effect* of liberalization which specifically investigate about the effects of liberalization on efficiency has been covered in this work.

In line with this initiative, the present study provides a relatively detailed investigation of the liberalization-efficiency causality relationship. The interesting contribution of this work stems from the detailed investigation of the J-curve hypothesis in the context of financial liberalization, capitalizing on the recent advancements in the field of panel data econometrics. A positive long-term relationship between financial liberalization and stock market efficiency coexists with a negative short-term relationship between the two. The findings that financial liberalization, which has a deteriorated effect on stock market efficiency in the short-run, but positive impact in the long-run allow us to draw an analogy similar to the J - curve hypothesis.

Fourthly, applying time-variant version of institutional quality index enables its effect to be distinguished from country-specific effect. This will show the interaction effect of

financial liberalization and institutional development in clearer manner, and thus demonstrates the effect of informational efficiency. Additionally, considering the extent of trade openness as pre-requisite for financial liberalization, our result shows that the interaction of trade and financial liberalization leads to more efficient stock market.

Fifthly, the results of the study lend empirical support to the existence of a significant link between financial openness and stock market efficiency. This is the only study that is consistent with the theoretical framework that posits the existence of robust positive relation between financial openness and stock market efficiency only when the countries are enjoying the institutional level above threshold level.

Last but not least, the study has supported the U-shaped (non-linear) association between financial liberalization and stock market efficiency. This non-linear association reveals that countries with low level of institutions are in danger of entering into a crisis in case of sudden opening of stock market, while countries in which the institution level is above the threshold will reap the benefits of liberalization.

REFERENCES

Aalbers, M.B. (2012). Studies in urban and social change. In J. Robinson, N. Brenner, M. Gandy, P. L. Galès, C. Pickvance & A. Roy (Eds.), *Subprime cities: The political economy of mortgage markets*. Hoboken, NJ: Wiley.

Aalbers, M.B. (2013). Debate on neoliberalism in and after the neoliberal crisis. *International Journal of Urban and Regional Research, 37*(3), 1053-1057.

Aalbers, M.B. (2013). Neoliberalism is dead...long live neoliberalism! *International Journal of Urban and Regional Research, 37*(3), 1083-1090.

Abbott, P., Andersen, T.B., & Tarp, F. (2010). IMF and economic reform in developing countries. *The Quarterly Review of Economics and Finance, 50*(1), 17-26.

Abiad, A., Oomes, N., & Ueda, K. (2008). The quality effect: Does financial liberalization improve the allocation of capital? *Journal of Development Economics, 87*(2), 270-282.

Acemoglu, D. (2003). Why not a political coase theorem? Social conflict, commitment, and politics. *Journal of Comparative Economics, 31*(4), 620-652.

Acharya, R. (2010). Security speed of adjustment and market quality: A case of national stock exchange of India. *IUP Journal of Applied Finance, 16*(6), 54-65.

Allegret, J.P., Courbis, B., & Dulbecco, P. (2003). Financial liberalization and stability of the financial system in emerging markets: The institutional dimension of financial crises. *Review of International Political Economy, 10*(1), 73-92.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies, 58*(2), 277-297.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics, 68*(1), 29-51.

Axelrod, R. (1984). *The evolution of cooperation*. New York, NY: Basic Books.

Bae, K.H., Bailey, W., & Mao, C.X. (2006). Stock market liberalization and the information environment. *Journal of International Money and Finance, 25*(3), 404-428.

Bagehot, W. (1999). *Lombard street: A description of the money market*. New York, NY: Wiley.

Baltagi, B.H., Demetriades, P.O., & Law, S.H. (2009). Financial development and openness: Evidence from panel data. *Journal of Development Economics, 89*(2), 285-296.

Barberis, N., Shleifer, A., & Vishny, R. (1998). A model of investor sentiment. *Journal of Financial Economics, 49*(3), 307-343.

Bardhan, P.K. (1970). *Economic growth, development, and foreign trade: A study in pure theory*. New York, NY: Wiley-interscience.

Basu, P., & Morey, M.R. (2005). Trade opening and the behavior of emerging stock market prices. *Journal of Economic Integration, 20*(1), 68-92.

Baumol, W.J. (1965). *The stock market and economic efficiency*. New York, NY: Fordham University Press.

Beine, M., & Candelon, B. (2011). Liberalisation and stock market co-movement between emerging economies. *Quantitative Finance, 11*(2), 299-312.

Bekaert, G. (1995). Market integration and investment barriers in emerging equity markets *World Bank Economic Review, 9*(1), 75-107.

Bekaert, G., & Harvey, C.R. (2000). Foreign speculators and emerging equity markets. *The Journal of Finance, 55*(2), 565-613.

Bekaert, G., & Harvey, C.R. (2002). Research in emerging markets finance: Looking to the future. *Emerging Markets Review, 3*(4), 429-448.

Bekaert, G., Harvey, C.R., & Lundblad, C. (2001). Emerging equity markets and economic development. *Journal of Development Economics, 66*(2), 465-504.

Bekaert, G., Harvey, C.R., & Lundblad, C. (2005). Does financial liberalization spur growth? *Journal of Financial Economics, 77*(1), 3-55.

Bekaert, G., Harvey, C.R., & Lundblad, C. (2011). Financial openness and productivity. *World Development, 39*(1), 1-19.

Ben Naceur, S., Ghazouani, S., & Omran, M. (2008). Does stock market liberalization spur financial and economic development in the MENA region? *Journal of Comparative Economics, 36*(4), 673-693.

Bernard, V.L., & Thomas, J.K. (1990). Evidence that stock prices do not fully reflect the implications of current earnings for future earnings. *Journal of Accounting and Economics, 13*(4), 305-340.

Beveridge, W.H.B.B. (1955). *Power and influence*. New York, NY: Beechhurst Press.

Blackburne, E.F., & Frank, M.W. (2007). Estimation of nonstationary heterogeneous panels. *Stata Journal, 7*(2), 197-208.

Blundell, R., & Bonds, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics, 87*(1), 115-143.

Bond, S.R. (2002). Dynamic panel data models: A guide to micro data methods and practice. *Portuguese Economic Journal, 1*(2), 141-162.

Boudoukh, J., Richardson, M.P., & Whitelaw, R. (1994). A tale of three schools: Insights on autocorrelations of short-horizon stock returns. *Review of Financial Studies, 7*(3), 539-573.

Breusch, T.S., & Pagan, A.R. (1980). The lagrange multiplier test and its applications to model specification in econometrics. *The Review of Economic Studies, 47*(1), 239-253.

Brock, W.A. (1978). Asset prices in a production economy. In J. McCall (Ed.), *The Economics of Information and Uncertainty* (pp. 1-48): National Bureau of Economic Research.

Brown, D.P., & Jennings, R.H. (1989). On technical analysis. *The Review of Financial Studies, 2*(4), 527-551.

Bruno, M., & Sachs, J.D. (1985). *Economics of worldwide stagflation*. Cambridge, MA: Harward university press.

Buchanan, J.M., & Tullock, G. (1999). *The calculus of consent: Logical foundations of constitutional democracy*. Ann Arbor, MI: University of Michigan Press.

Cajueiro, D.O., Gogas, P., & Tabak, B.M. (2009). Does financial market liberalization increase the degree of market efficiency? The case of the Athens stock exchange. *International Review of Financial Analysis, 18*(1-2), 50-57.

Campbell, J.Y., Lo, A.W.-C., & MacKinlay, A.C. (1997). *The econometrics of financial markets*. Princeton, NJ: Princeton University press.

Campbell, J.Y., & Thompson, S.B. (2008). Predicting excess stock returns out of sample: Can anything beat the historical average? *Review of Financial Studies, 21*(4), 1509-1531.

Caprio, G. (1998). *Banking on crises: Expensive lessons from recent financial crises*. Washington, DC: World Bank Publications.

Carrieri, F., Chaieb, I., & Errunza, V. (2013). Do implicit barriers matter for globalization? *Review of Financial Studies, 26*(7), 1694-1739.

Caselli, F., Esquivel, G., & Lefort, F. (1996). Reopening the convergence debate: A new look at cross-country growth empirics. *Journal of Economic Growth, 1*(3), 363-389.

Chen, T. (2009). Informational efficiency: Which institutions matter? *Asia-Pacific Financial Markets, 16*(2), 141-168.

Chinn, M.D., & Ito, H. (2002). Capital account liberalization, institutions and financial development: Cross country evidence (No. w8967), National Bureau of Economic Research.

Chinn, M.D., & Ito, H. (2006). What matters for financial development? Capital controls, institutions, and interactions. *Journal of Development Economics, 81*(1), 163-192.

Choi, I. (1999). Testing the random walk hypothesis for real exchange rates. *Journal of Applied Econometrics, 14*(3), 293-308.

Chow, K.V., & Denning, K.C. (1993). A simple multiple variance ratio test. *Journal of Econometrics, 58*(3), 385-401.

Chudik, A., Pesaran, M.H., & Tosetti, E. (2011). Weak and strong cross-section dependence and estimation of large panels. *The Econometrics Journal, 14*(1), C45-C90.

Ciner, C., & Karagozoglu, A.K. (2008). Information asymmetry, speculation and foreign trading activity: Emerging market evidence. *International Review of Financial Analysis, 17*(4), 664-680.

Coase, R.H. (1937). The nature of the Firm. *Economica, 4*(16), 386-405.

Coase, R.H. (1992). The institutional structure of production. *The American Economic Review, 82*(4), 713-719.

Combes, J.-L., Ebeke, C.H., Etoundi, S.M.N., & Yogo, T.U. (2014). Are Remittances and Foreign Aid a Hedge Against Food Price Shocks in Developing Countries? *World Development, 54*(0), 81-98.

Conley, T.G. (1999). GMM estimation with cross sectional dependence. *Journal of Econometrics, 92*(1), 1-45.

Constant, B. (1988). *The liberty of the ancients compared with that of the moderns*. Cambridge, England: Cambridge University Press.

Constant, B., & Fontana, B. (1988). *Constant: political writings*. Cambridge, England: Cambridge University Press.

Corley, R.N., Reed, O.L., Shedd, P.J., & Morehead, J.W. (1996). *The legal and regulatory environment of business*. Boston, MA: McGraw-Hill.

Daniel, K., Hirshleifer, D., & Subrahmanyam, A. (1998). Investor psychology and security market under- and overreactions. *The Journal of Finance, 53*(6), 1839-1885.

Daniel, K., & Titman, S. (1999). Market efficiency in an irrational world. *Financial Analysts Journal, 55*(6), 28-40.

Debondt, W.F.M., & Thaler, R. (1985). Does the stock market overreact? *The Journal of Finance, 40*(3), 793-805.

Debondt, W.F.M., & Thaler, R.H. (1987). Further evidence on investor overreaction and stock-market seasonality. *Journal of Finance, 42*(3), 557-581.

Dewey, J. (1916). *Democracy and education: An introduction to the philosophy of education*. New York, NY: Macmillan Company.

Dickey, D.A., & Fuller, W.A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association, 74*(366), 427-431.

Djankov, S., Glaeser, E., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2003). The new comparative economics. *Journal of Comparative Economics, 31*(4), 595-619.

Doran, J.S., Peterson, D.R., & Wright, C. (2010). Confidence, opinions of market efficiency, and investment behavior of finance professors. *Journal of Financial Markets, 13*(1), 174-195.

Edison, H.J., Levine, R., Ricci, L., & Sløk, T. (2002). International financial integration and economic growth. *Journal of International Money and Finance, 21*(6), 749-776.

Edison, H.J., & Warnock, F.E. (2003). A simple measure of the intensity of capital controls. *Journal of Empirical Finance, 10*(1), 81-103.

Edwards, S. (2001). Capital mobility and economic performance: Are emerging economies different? (No. w8076), National Bureau of Economic Research.

Efron, B., & Tibshirani, R.J. (1993). *An introduction to the bootstrap*. New York, NY: Chapman & Hall.

Eggoh, J.C., Bangake, C., & Rault, C. (2011). Energy consumption and economic growth revisited in African countries. *Energy Policy, 39*(11), 7408-7421.

Eichengreen, B., Arteta, C., & Wyplosz, C. (2003). When does capital account liberalization help more than it hurts? (No. w8414), National Bureau of Economic Research.

Eichengreen, B., Gullapalli, R., & Panizza, U. (2011). Capital account liberalization, financial development and industry growth: A synthetic view. *Journal of International Money and Finance, 30*(6), 1090-1106.

Engle, R.F., & Granger, C.W.J. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica, 55*(2), 251-276.

Erramilli, A., Narayan, O., & Willinger, W. (1996). Experimental queueing analysis with long-range dependent packet traffic. *IEEE/ACM Transactions on Networking (TON), 4*(2), 209-223.

Fama, E.F. (1965). The behavior of stock-market prices. *The Journal of Business, 38*(1), 34-105.

Fama, E.F. (1998). Market efficiency, long-term returns, and behavioral finance. *Journal of Financial Economics, 49*(3), 283-306.

Farmer, J.D. (2002). Market force, ecology and evolution. *Industrial & Corporate Change, 11*(5), 895-953.

Farmer, J.D., & Lo, A.W. (1999). Frontiers of finance: Evolution and efficient markets. *Proceedings of the National Academy of Sciences, 96*(18), 9991-9992.

Froot, K.A., & Perold, A.F. (1995). New trading practices and short-run market efficiency. *The Journal of Futures Markets, 15*(7), 731-765.

Fuchs-Schundeln, N., & Funke, N. (2003). Stock market liberalizations: Financial and macroeconomic implications. *Review of World Economics, 139*(4), 730-761.

Füss, R. (2005). Financial liberalization and stock price behaviour in Asian emerging markets. *Economic Change & Restructuring, 38*(1), 37-62.

Galindo, A., Schiantarelli, F., & Weiss, A. (2007). Does financial liberalization improve the allocation of investment?: Micro-evidence from developing countries. *Journal of Development Economics, 83*(2), 562-587.

Gay, R.D. (2008). *Effect of macroeconomic variables on stock market returns for four emerging economies: A vector regression model for Brazil, Russia, India, and China.* (D.B.A.), Nova Southeastern University, Retrieved from ProQuest Dissertations & Theses. (Order No. 3312013).

Gehring, K. (2013). Who benefits from economic freedom? Unraveling the effect of economic freedom on subjective well-being. *World Development, 50*, 74-90.

Goodin, R.E., & Pettit, P. (1995). *A companion to contemporary political philosophy*. Oxford, England: Wiley.

Gray, J. (1995). *Liberalism*. Minneapolis, MN: University of Minnesota Press.

Grilli, V., & Milesiferretti, G.M. (1995). Economic-effects and structural determinants of capital controls. *International Monetary Fund Staff Papers, 42*(3), 517-551.

Groen, J.J.J., & Kleibergen, F. (2003). Likelihood-based cointegration analysis in panels of vector error-correction models. *Journal of Business & Economic Statistics, 21*(2), 295-318.

Grossman, S., & Stiglitz, J. (1982). On the impossibility of informationally efficient markets: Reply. *The American Economic Review, 72*(4), 875-875.

Grundy, B.D., & McNichols, M. (1989). Trade and the revelation of Information through prices and direct disclosure. *The Review of Financial Studies, 2*(4), 495-526.

Hansen, B.E. (1999). Threshold effects in non-dynamic panels: Estimation, testing, and inference. *Journal of Econometrics, 93*(2), 345-368.

Harrison, H., & Stein, J.C. (1999). A unified theory of underreaction, momentum trading, and overreaction in asset markets. *The Journal of Finance, 54*(6), 2143-2184.

Hausman, J.A. (1978). Specification tests in econometrics. *Econometrica, 46*(6), 1251-1271.

Hayek, F.A. (1978). *The constitution of liberty*. Chicago, IL: University of Chicago Press.

Henry, P.B. (2000). Stock market liberalization, economic reform, and emerging market equity prices. *Journal of Finance, 55*(2), 529-564.

Henry, P.B. (2007). Capital account Liberalization: Theory, evidence, and speculation. *Journal of Economic Literature, 45*(4), 887-935.

Honig, A. (2008). Addressing causality in the effect of capital account liberalization on growth. *Journal of Macroeconomics, 30*(4), 1602-1616.

Hossain, M.S. (2012). Multivariate granger causality between economic growth, electricity consumption, exports and remittance for the panel of three SAARC countries. *Global Journal of Management and Business Research, 12*(4), 41-54.

Huang, D., & Huang, M. (2008). *Financial development and capital account openness. What links between them?* Paper presented at the Proceedings of 2008 Intenational conferance on Managemanet Science and Engineering Marrickville.

Hurst, H.E. (1950). *Long-term storage capacity of reservoirs*. Lancaster, CA: American Society of Civil Engineers.

Im, K., & Pesaran, M.H. (2003). On the panel unit root tests using nonlinear instrumental variables. *Working paper series, Available at SSRN 482463*.

Im, K.S., Pesaran, M.H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics, 115*(1), 53-74.

Ito, M., & Sugiyama, S. (2009). Measuring the degree of time varying market inefficiency. *Economics Letters, 103*(1), 62-64.

Jae , K.H. (2006). Wild bootstrapping variance ratio tests. *Economics Letters, 92*(1), 38-43.

Jae , K.H. (2009). Automatic variance ratio test under conditional heteroskedasticity. *Finance Research Letters, 6*(3), 179-185.

Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *The Journal of Finance, 48*(1), 65-91.

Jegadeesh, N., & Titman, S. (2001). Profitability of momentum strategies: An evaluation of alternative explanations. *The Journal of Finance, 56*(2), 699-720.

Jensen, M.C. (1978). Some anomalous evidence regarding market efficiency. *Journal of Financial Economics, 6*(2), 95-101.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control, 12*(2), 231-254.

Jolliffe, I. (2004). *Principal component analysis*. New York, NY: Springer.

Joreskog, K.G., & Goldberger, A.S. (1975). Estimation of a model with multiple indicators and multiple causes of a single latent variable. *Journal of the American Statistical Association, 70*(351), 631-639.

Jui-Cheng, H. (2009). Deregulation and liberalization of the Chinese stock market and the improvement of market efficiency. *The Quarterly Review of Economics and Finance, 49*(3), 843-857.

Kaminsky, G.L., & Schmukler, S.L. (2008). Short-run pain, long-run gain: Financial liberalization and stock market cycles. *Review of Finance, 12*(2), 253-292.

Kanu, T.S. (2011). *The relationship among stock market development, macroeconomic variables, and institutional factors in sub-Sahara Africa.* (Ph.D. Dissertation), Walden University, Retrieved from ProQuest Dissertations & Theses. (Order No. 3474022).

Kao, C., Chiang, M.H., & Chen, B. (1999). International R&D spillovers: An application of estimation and inference in panel cointegration. *Oxford Bulletin of economics and Statistics, 61*(S1), 691-709.

Kasper, W. (2004). *Economic freedom and development: An essay about property rights, competition and prosperity*. Lagos State, Nigeria: Dat & Partners Logistics.

Kaufmann, D., & Kraay, A. (2008). Governance indicators: where are we, Where should we be going? *The World Bank Research Observer, 23*(1), 1-30.

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2005). Governance matters IV: Governance indicators for 1996-2004. *World Bank Policy Research Working Paper*(3630).

Kawakatsu, H., & Morey, M.R. (1999). Financial liberalization and stock market efficiency: An empirical examination of nine emerging market countries. *Journal of Multinational Financial Management, 9*(3), 353-371.

Kearney, C., & Lucey, B.M. (2004). International equity market integration: Theory, evidence and implications. *International Review of Financial Analysis, 13*(5), 571-583.

Kendall, G.P. (2003). *From liberalism to neoliberalism*. Paper presented at the Social Change in the 21st Century, Queensland University of Technology.

Kendall, M.G., & Hill, A.B. (1953). The analysis of economic time-series-part I: Prices. *Journal of the Royal Statistical Society. Series A (General), 116*(1), 11-34.

Kil, J.S. (2004). *Korea, Taiwan, and the Asian financial crisis: Domestic institutional differences and impact of external pressure for liberalization.* (Ph.D. Dissertation), University of Pennsylvania, Retrieved from ProQuest Dissertations & Theses. (Order No. 3152067).

Kim, D.H., Lin, S.C., & Suen, Y.B. (2012). Dynamic effects of financial openness on economic growth and macroeconomic uncertainty. *Emerging Markets Finance and Trade, 48*(1), 25-54.

Kim, E.H., & Singal, V. (2000). Stock market openings: Experience of emerging economies. *Journal of Business, 73*(1), 25-66.

Kim, J.H., Shamsuddin, A., & Lim, K.-P. (2011). Stock return predictability and the adaptive markets hypothesis: Evidence from century-long U.S. data. *Journal of Empirical Finance, 18*(5), 868-879.

Klein, M.W. (2005). Capital account liberalization, institutional quality and economic growth: Theory and evidence (No. w11112), National Bureau of Economic Research.

Kose, A.M., Prasad, E.S., & Taylor, A.D. (2011). Thresholds in the process of international financial integration. *Journal of International Money and Finance, 30*(1), 147-179.

Kose, M.A., Prasad, E., Rogoff, K., & Wei, S.J. (2009). Financial globalization: A reappraisal. *Imf Staff Papers, 56*(1), 8-62.

Kremer, S., Bick, A., & Nautz, D. (2013). Inflation and growth: New evidence from a dynamic panel threshold analysis. *Empirical Economics, 44*(2), 861-878.

Lane, P.R., & Milesi-Ferretti, G.M. (2007). The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities. *Journal of International Economics, 73*(2), 223-250.

Langbein, L., & Knack, S. (2009). The Worldwide Governance Indicators: Six, One, or None? *Journal of Development Studies, 46*(2), 350-370.

Larsson, R., Lyhagen, J., & Löthgren, M. (2001). Likelihood-based cointegration tests in heterogeneous panels. *The Econometrics Journal, 4*(1), 109-142.

Levin, A., Lin, C.F., & Chu, C.S.J. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics, 108*(1), 1-24.

Levine, R. (1997). Financial development and economic growth: Views and agenda. *Journal of Economic Literature, 35*(2), 688-726.

Li, K., Morck, R., Yang, F., & Yeung, B. (2004). Firm-specific variation and openness in emerging markets. *The Review of Economics and Statistics, 86*(3), 658-669.

Lim, K.-P., & Kim, J.H. (2011). Trade openness and the informational efficiency of emerging stock markets. *Economic Modelling, 28*(5), 2228-2238.

Lim, K.-P., Luo, W., & Kim, J.H. (2011). Are US stock index returns predictable? Evidence from automatic autocorrelation-based tests. *Applied Economics, 45*(8), 953-962.

Lim, K., & Brooks, R. (2006). The evolving and relative efficiencies of stock markets: Empirical evidence from rolling bicorrelation test statistics (931071), SSRN Working Paper, available at http://ssrn.com/abstract=931071.

Lim, K.P., & Brooks, R. (2011). The evolution of stock market efficiency over time : A survey of the empirical literature. *Journal of Economic Surveys, 25*(1), 69-108.

Lo, A.W. (1999). The three P's of total risk management. *Financial Analysts Journal, 55*(1), 13-26.

Lo, A.W. (2002). Bubble, rubble, finance in trouble? *Journal of Psychology and Financial Markets, 3*(2), 76-86.

Lo, A.W. (2004). The adaptive markets hypothesis. *The Journal of Portfolio Management, 30*(5), 15-29.

Lo, A.W. (2005). Reconciling efficient markets with behavioral finance: The adaptive markets hypothesis. *Journal of Investment Consulting, 7*(2), 21-44.

Lo, A.W., & MacKinlay, A.C. (1988). Stock market prices do not follow random walks: Evidence from a simple specification test. *The Review of Financial Studies, 1*(1), 41-66.

Lo, A.W., & MacKinlay, A.C. (2001). *A non-random walk down Wall Street*. Princeton, NJ: Princeton University Press.

Locke, J., & Wootton, D. (1993). *Political writings*. New York, NY: Mentor.

Low, S.-W., Kew, S.-R., & Tee, L.-T. (2011). International evidence on the link between quality of governance and stock market performance. *Global Economic Review, 40*(3), 361-384.

Lucas, R.E., Jr. (1978). Asset prices in an exchange economy. *Econometrica, 46*(6), 1429-1445.

Lütkepohl, H., & Krätzig, M. (2004). *Applied time series econometrics*. Cambridge, England: Cambridge University Press.

Magee, S.P. (1973). Currency contracts, pass-through, and devaluation. *Brookings Papers on Economic Activity, 1973*(1), 303-325.

Malkiel, B., Mullainathan, S., & Stangle, B. (2005). Market efficiency versus behavioral finance. *Journal of Applied Corporate Finance, 17*(3), 124-136.

Malkiel, B.G., & Fama, E.F. (1970). Efficient capital markets: A review of the theory and empirical work. *The journal of Finance, 25*(2), 383-417.

Mandelbrot, B. (1963). The variation of certain speculative prices. *The Journal of Business, 36*(4), 394-419.

Marx, K. (1987). *Das kapital*. London, England: Dietz.

McCoskey, S., & Kao, C. (1998). A residual-based test of the null of cointegration in panel data. *Econometric reviews, 17*(1), 57-84.

McKinnon, R.I. (1973). *Money and capital in economic development*. Washington, DC: Brookings Institution Press.

Mehrez, G., & Kaufmann, D. (2000). Transparency, liberalization, and financial crisis. *World Bank Policy Research Working Paper*(No. 2286).

Michaely, R., Thaler, R.H., & Womack, K.L. (1995). Price reactions to dividend initiations and omissions: Overreaction or drift? *The Journal of Finance, 50*(2), 573-608.

Mill, J.S. (1863). *On liberty*. Oxford, England: Oxford University Press.

Modigliani, F., & Miller, M.H. (1958). The cost of capital, corporation finance and the theory of investment. *The American Economic Review, 48*(3), 261-297.

Montesquieu, C., Nugent, T., & Alembert, J.L.R. (1900). *The Spirit of Laws*. New York, NY: Colonial Press.

Naghavi, N., & Lau, W.-Y. (2014). Exploring the nexus between financial openness and informational efficiency , Does the quality of institution matter? *Applied Economics, 46*(7), 674-685.

Narayan, P.K., Narayan, S., & Popp, S. (2010). Does electricity consumption panel Granger cause GDP? A new global evidence. *Applied Energy, 87*(10), 3294-3298.

Nelson, R.R., & Winter, S.G. (1982). *An evolutionary theory of economic change*. Cambridge, MA: The Belknap Press of Harvard Univ. Press.

Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica, 49*(6), 1417-1426.

Nikiforos , L. (2004). Financial market liberalization and stock market efficiency: Evidence from the Athens Stock Exchange. *Global Finance Journal, 15*(2), 103-123.

North, D.C. (1990). *Institutions, institutional change and economic performance*. Cambridge, England: Cambridge university press.

North, D.C. (1994). Economic performance through time. *The American Economic Review, 84*(3), 359-368.

O'Mahony, M., & Vecchi, M. (2005). Quantifying the impact of ICT capital on output growth: A heterogeneous dynamic panel approach. *Economica, 72*(288), 615-633.

Olson, M. (1982). *The rise and decline of nations: economic growth, stagflation, and social rigidities*. London, England: Yale University Press.

Olson, M. (2009). *The logic of collective action: Public goods and the theory of groups* (Vol. 124). Cambridge, MA: Harvard University Press.

Orok-Duke, O.E., Akpan Ekott, G., & Edu Enya, B. (2009). Critical review of financial sector reforms and financial liberalization in developing countries (1483477), SSRN Working Paper, available at http://ssrn.com/abstract=1483477.

Overbeek, H., & van Apeldoorn, B. (2012). *Neoliberalism in crisis*. Great Britain: Palgrave Macmillan.

Patomäki, H. (2009). Neoliberalism and the global financial crisis. *New Political Science, 31*(4), 431-442.

Peck, J., Theodore, N., & Brenner, N. (2010). Postneoliberalism and its malcontents. *Antipode, 41*(s1), 94-116.

Pedroni, P. (1999). Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of economics and Statistics, 61*(4), 653-670.

Pedroni, P. (2004). Panel cointegration: Asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Econometric Theory, 20*(3), 597-625.

Pesaran, M.H. (2004). *General diagnostic tests for cross section dependence in panels*. Munich, Germany: Center for Economic Studies and Ifo Institute for Economic Research.

Pesaran, M.H. (2006). Estimation and inference in large heterogeneous Panels with a multifactor error structure. *Econometrica, 74*(4), 967-1012.

Pesaran, M.H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics, 22*(2), 265-312.

Pesaran, M.H., Shin, Y., & Smith, R.P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association, 94*(446), 621-634.

Pesaran, M.H., & Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics, 68*(1), 79-113.

Pesaran, M.H., & Tosetti, E. (2011). Large panels with common factors and spatial correlation. *Journal of Econometrics, 161*(2), 182-202.

Phillips, P.C.B., & Ouliaris, S. (1990). Asymptotic properties of residual based tests for cointegration. *Econometrica, 58*(1), 165-193.

Rawls, J. (1999). *A theory of justice*. New York, NY: Oxford University Press.

Reed, O.L., Shedd, P.J., Morehead, J.W., & Pagnattaro, M.A. (2006). *The legal and regulatory environment of business*. New York, NY: McGraw-Hill.

Rodrik, D. (1999). *The new global economy and developing countries: Making openness work* (Vol. 24). Baltimore, MD: Johns Hopkins University Press.

Rogoff, K. (1999). International institutions for reducing global financial instability. *The Journal of Economic Perspectives, 13*(4), 21-42.

Roodman, D. (2006). How to do xtabond2: An introduction to difference and system GMM in Stata. *Center for Global Development working paper*(103).

Roodman, D. (2009). A note on the theme of too many instruments. *Oxford Bulletin of economics and Statistics, 71*(1), 135-158.

Rousseau, P.L., & Sylla, R. (2003). Financial systems, economic growth, and globalization. In M. D. Bordo, A. M. Taylor & J. G. E. Williamson (Eds.), *Globalization in historical perspective* (pp. 373-416). Chicago, IL: University of Chicago Press.

Rubinstein, M. (2001). Rational markets: Yes or no? The affirmative case. *Financial Analysts Journal, 57*(3), 15-29.

Ryan, A. (1993). Liberalism. In R. E. Goodin, P. Pettit & T. Pogge, W (Eds.), *A Companion to Contemporary Political Philosophy* (Vol. 2): Wiley-Blackwell.

Saad-Filho, A., & Johnston, D. (2005). *Neoliberalism: A critical reader*. London, England: Pluto Press.

Sakalauskas, V., & Kriksciuniene, D. (2007). Analysis of the day-of-the-week anomaly for the case of emerging stock market. In J. Neves, M. Santos & J. Machado (Eds.), *Progress in Artificial Intelligence* (Vol. 4874, pp. 371-382). Heidelberg, Germany: Springer.

Sakalauskas, V., & Kriksciuniene, D. (2013). Tracing of stock market long term trend by information efficiency measures. *Neurocomputing, 109*, 105-113.

Self, J.K., & Mathur, I. (2006). Asymmetric stationarity in national stock market indices: An MTAR analysis. *Journal of Business, 79*(6), 3153-3174.

Shaw, E. (1973). *Financial deepening in economic development* New York, NY: Oxford University Press.

Shin, H.Y. (2012). *Essays on the causes and consequences of the Asian financial crisis-Financialization, stagnant corporate investment, and alternative measures of the Asian labor markets.* (Ph.D. dissertation No, 3511343), New School University, Retrieved from ProQuest Dissertations & Theses. (Order No. 3312013).

Singal, V. (2003). *Beyond the random walk: A guide to stock market anomalies and low-risk investing*. New York, NY: Oxford University Press.

Smith, A., & Skinner, A. (1986). *The wealth of nations*. New York, NY: Penguin Adult group.

Smith, G. (2011). The changing and relative efficiency of European emerging stock markets. *The European Journal of Finance, 18*(8), 689-708.

Solow, R.M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics, 70*(1), 65-94.

Squidoo, J. (2008, 16 October). Capitalism is at bay. *The Economist,* p.12.

Stigler, G.J. (1971). The theory of economic regulation. *The Bell journal of economics and management science, 2*(1), 3-21.

Stock, J.H., & Watson, M.W. (2003). Forecasting output and inflation: The role of asset prices. *Journal of Economic Literature, 41*(3), 788-829.

Theobald, M., & Yallup, P. (2004). Determining security speed of adjustment coefficients. *Journal of Financial Markets, 7*(1), 75-96.

Tocqueville, A. (1954). *Democracy in America*. New York, NY: Knopf.

Toda, H.Y., & Phillips, P.C.B. (1993). Vector autoregressions and causality. *Econometrica, 61*(6), 1367-1393.

Velenchik, A. (2001). The new global economy and developing countries: Making openness work. *Journal of International Economics, 55*(1), 235-237.

Viner, J. (1947). International finance in the postwar world. *Journal of Political Economy, 55*(2), 97-107.

Vishwanath, T., & Kaufmann, D. (2001). Toward transparency: New approaches and their application to financial markets. *The World Bank Research Observer, 16*(1), 41-57.

Von , M.L. (1998). *Human action: A treatise on economics.* Auburn, AL: Ludwig Von Mises Institute.

Westerlund, J., & Breitung, J. (2013). Lessons from a decade of IPS and LLC. *Econometric reviews, 32*(5-6), 547-591.

Westerlund, J., & Edgerton, D.L. (2007). A panel bootstrap cointegration test. *Economics Letters, 97*(3), 185-190.

White, H. (2001). The new global economy and developing countries: Making openness work. *Development and Change, 32*(2), 386-387.

Williamson, O.E. (1983). *Markets and hierarchies, analysis and antitrust implications: A study in the economics of internal organization*. New York, NY: Free Press.

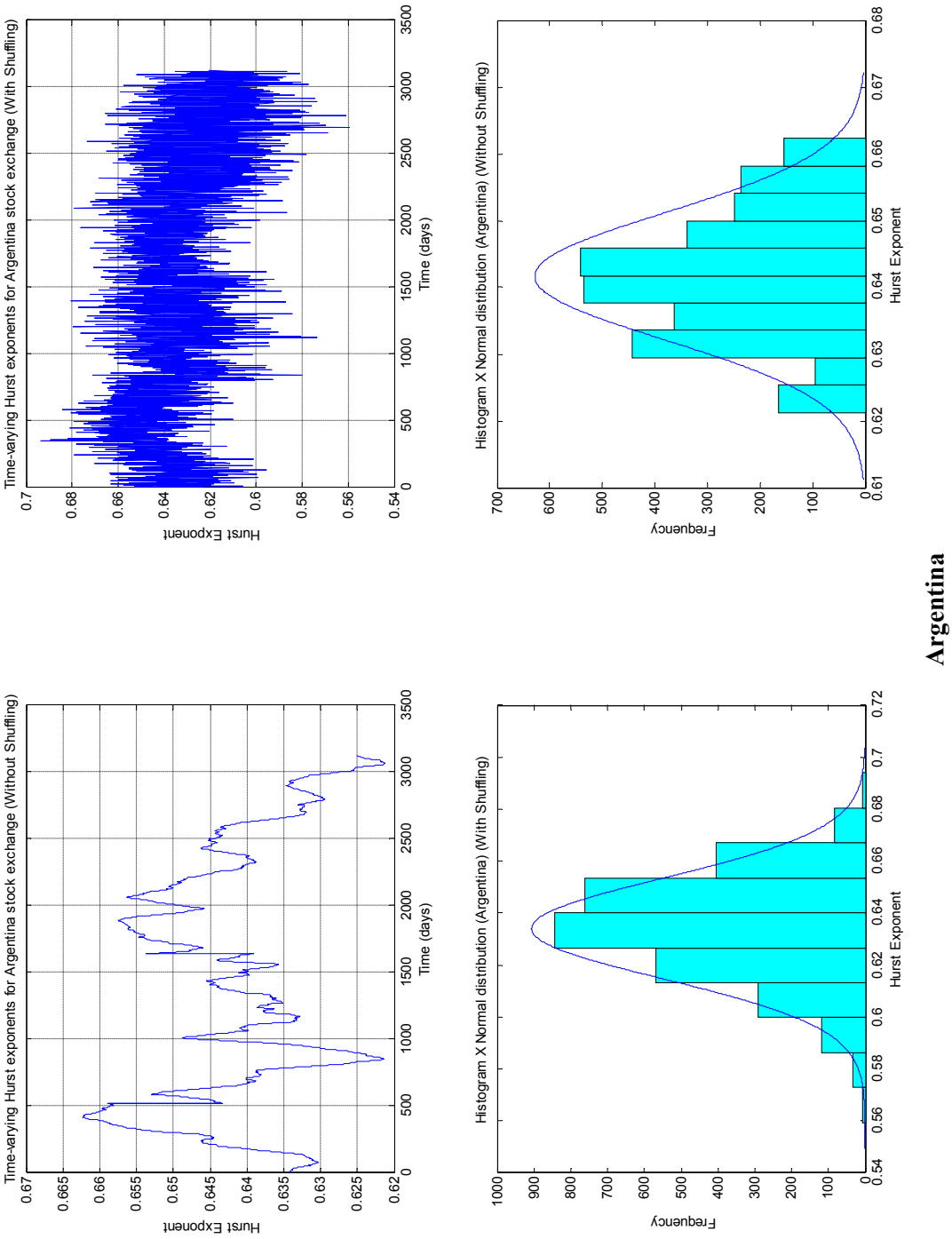
Williamson, O.E. (1985). *The economic intstitutions of capitalism: Firms, markets, relational contracting*. New York, NY: Free Press.

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics, 126*(1), 25-51.

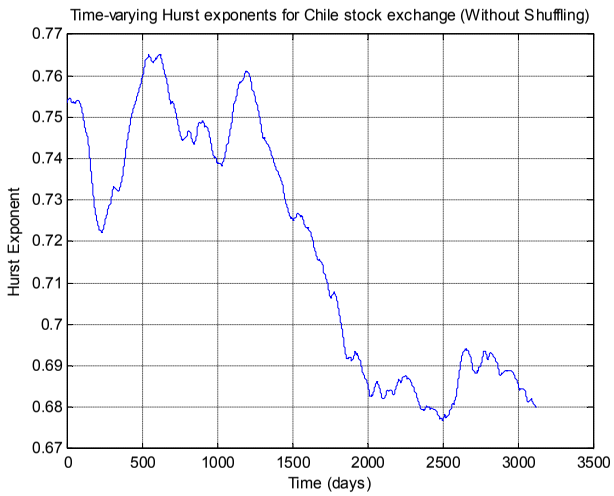
Yoo, S.H. (2006). The causal relationship between electricity consumption and economic growth in the ASEAN countries. *Energy Policy, 34*(18), 3573-3582.

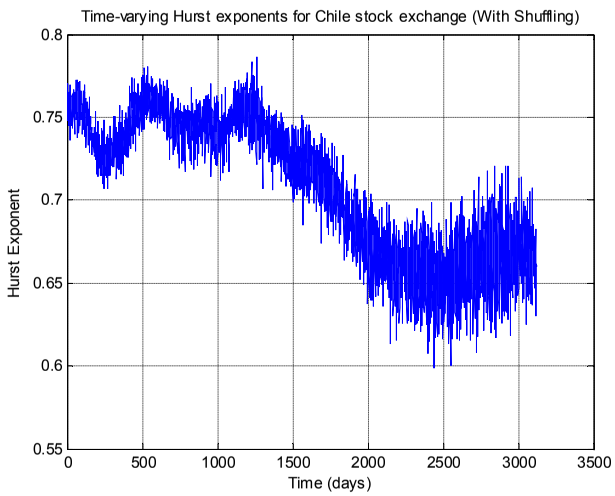
APPENDICES

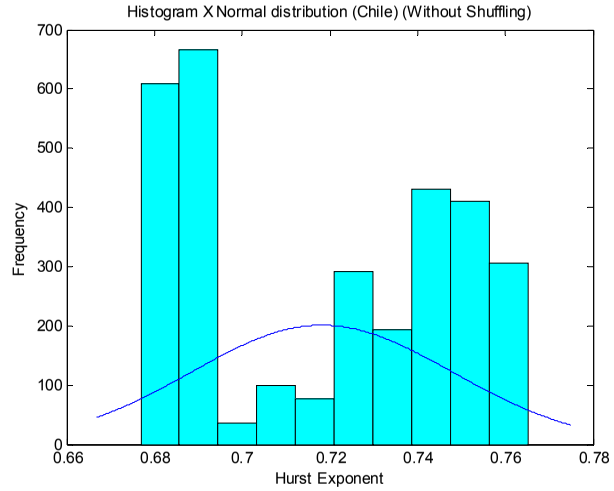
Appendix A: Figures of time-varying efficiency (Hurst exponent)

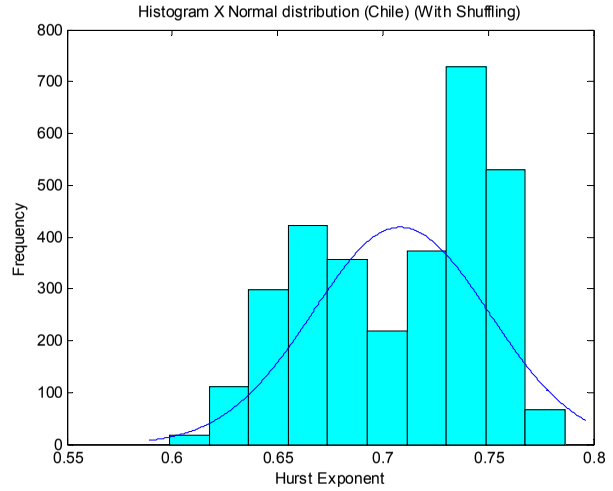


Argentina

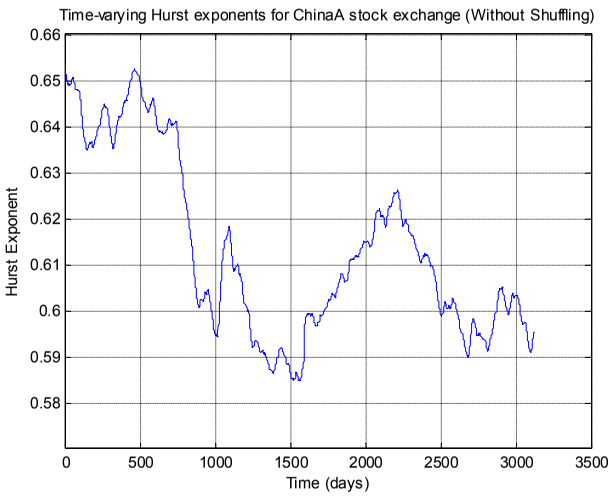

Time-varying Hurst exponents for Chile stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.77
0.76
0.75
0.74
0.73
0.72
0.71
0.7
0.69
0.68
0.67
0
500
1000
1500
2000
2500
3000
3500

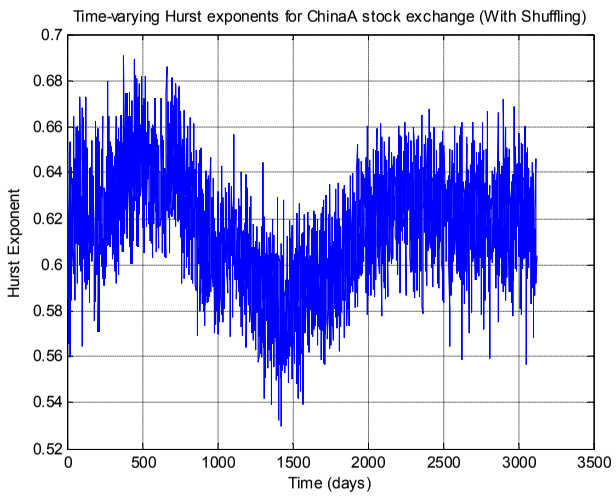

Time-varying Hurst exponents for Chile stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.8
0.75
0.7
0.65
0.6
0.55
0
500
1000
1500
2000
2500
3000
3500

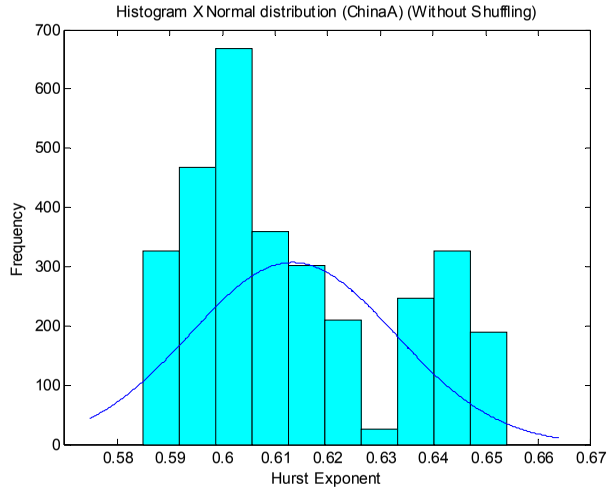

Histogram X Normal distribution (Chile) (Without Shuffling)
Frequency
Hurst Exponent
700
600
500
400
300
200
100
0
0.66
0.68
0.7
0.72
0.74
0.76
0.78

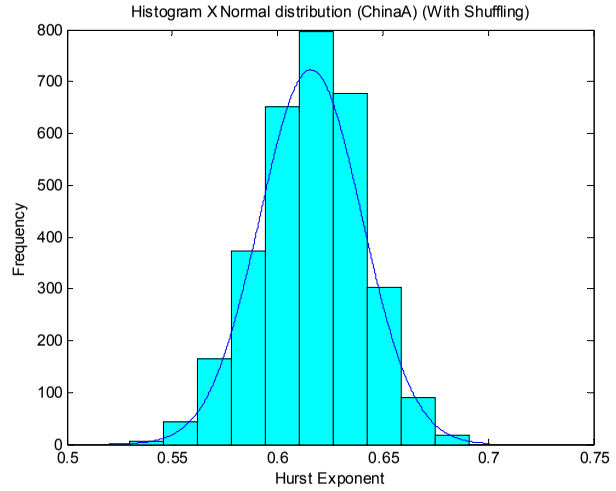

Histogram X Normal distribution (Chile) (With Shuffling)
Frequency
Hurst Exponent
800
700
600
500
400
300
200
100
0
0.55
0.6
0.65
0.7
0.75
0.8

Chile

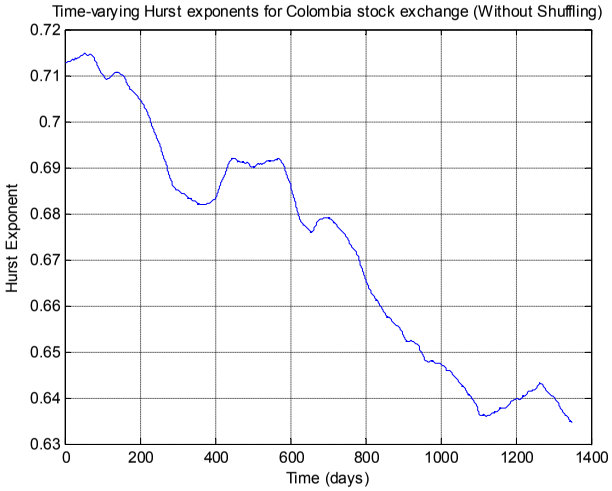

Time-varying Hurst exponents for ChinaA stock exchange (Without Shuffling)
Hurst Exponent
Time (days)

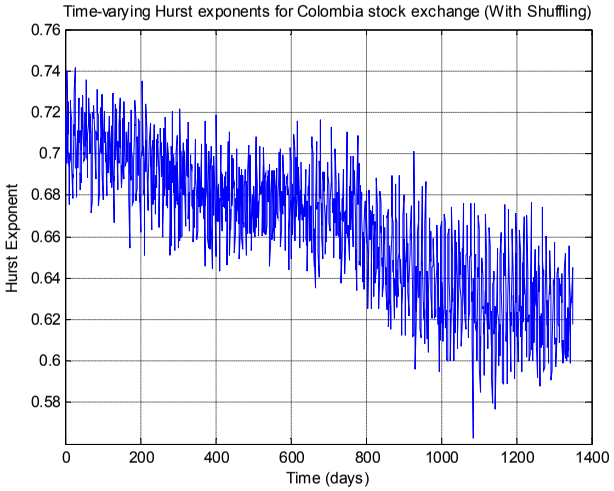

Time-varying Hurst exponents for ChinaA stock exchange (With Shuffling)
Hurst Exponent
Time (days)

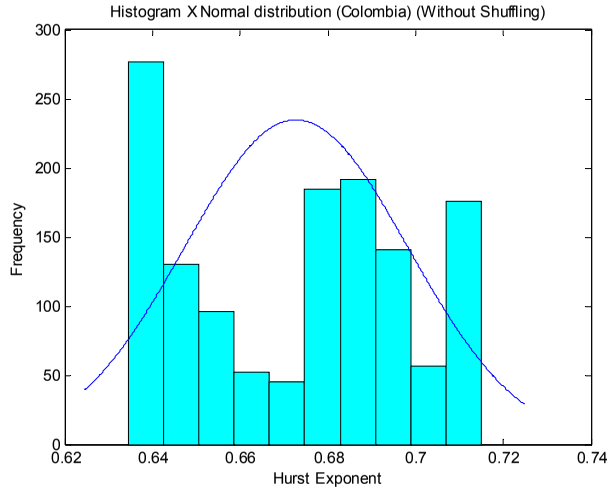

Histogram X Normal distribution (ChinaA) (Without Shuffling)
Frequency
Hurst Exponent

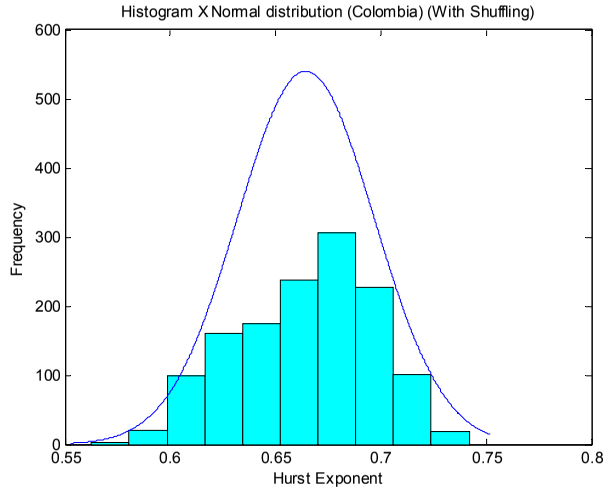

Histogram X Normal distribution (ChinaA) (With Shuffling)
Frequency
Hurst Exponent

China A

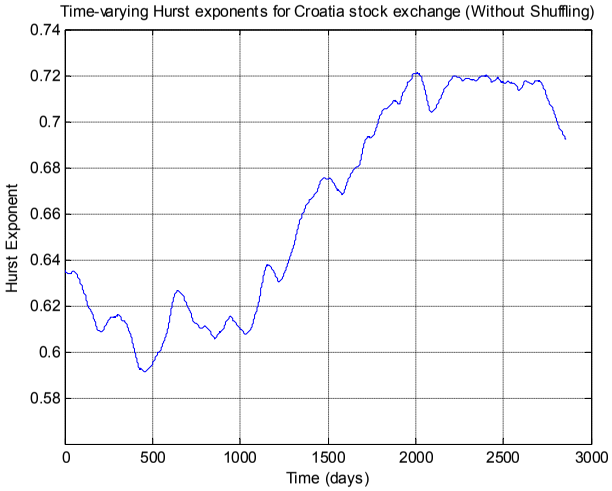

Time-varying Hurst exponents for Colombia stock exchange (Without Shuffling)
Hurst Exponent
Time (days)

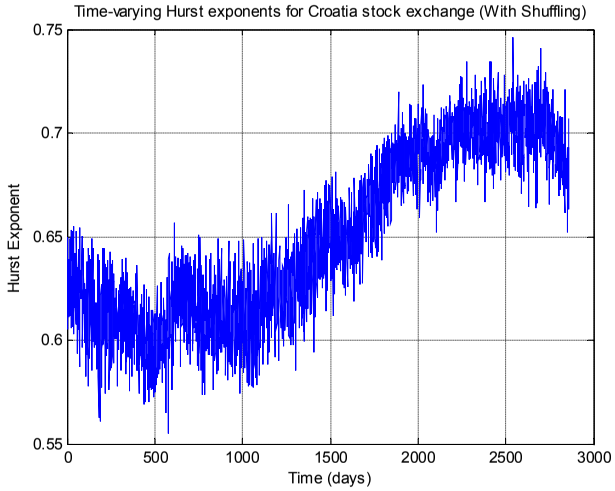

Time-varying Hurst exponents for Colombia stock exchange (With Shuffling)
Hurst Exponent
Time (days)

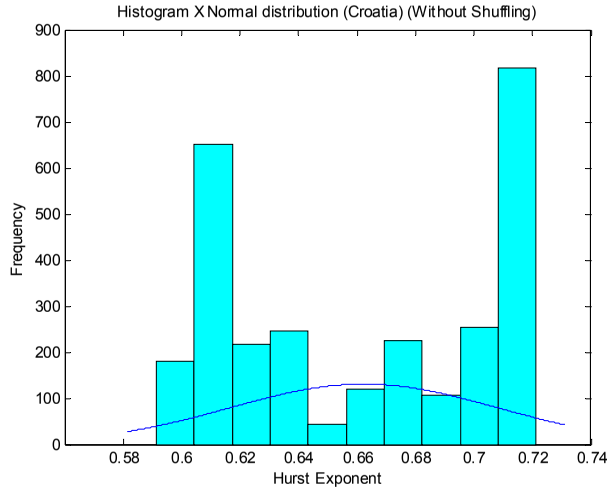

Histogram X Normal distribution (Colombia) (Without Shuffling)
Frequency
Hurst Exponent

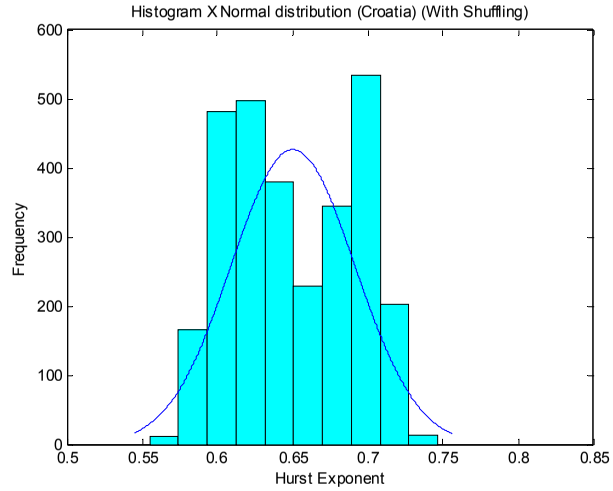

Histogram X Normal distribution (Colombia) (With Shuffling)
Frequency
Hurst Exponent

Colombia

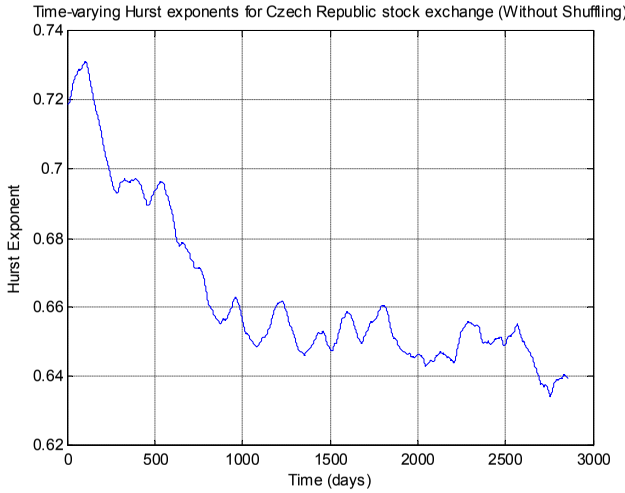

Time-varying Hurst exponents for Croatia stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0
500
1000
1500
2000
2500
3000

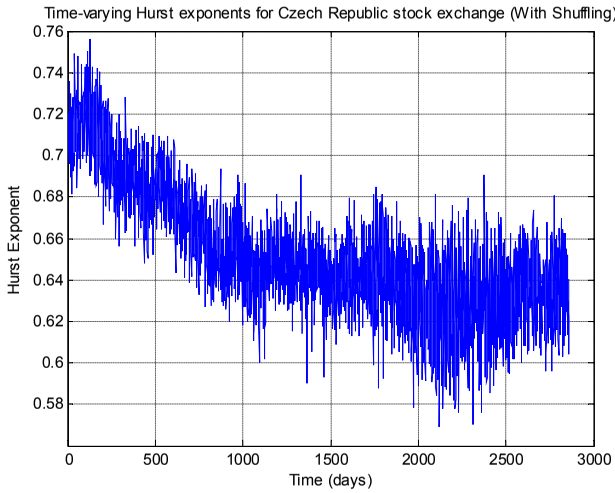

Time-varying Hurst exponents for Croatia stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.75
0.7
0.65
0.6
0.55
0
500
1000
1500
2000
2500
3000

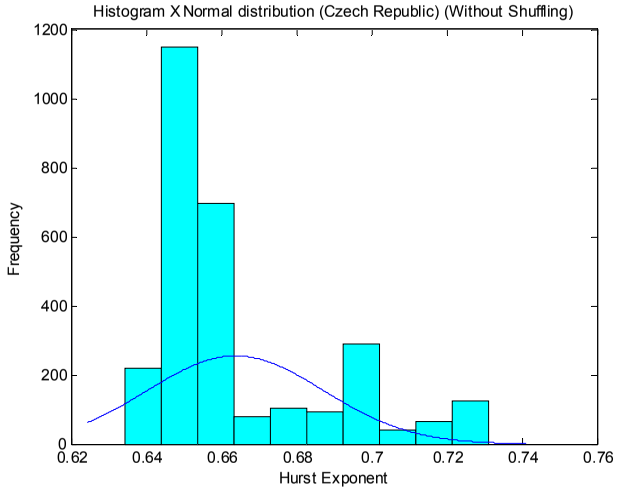

Histogram X Normal distribution (Croatia) (Without Shuffling)
Frequency
Hurst Exponent
900
800
700
600
500
400
300
200
100
0
0.58
0.6
0.62
0.64
0.66
0.68
0.7
0.72
0.74

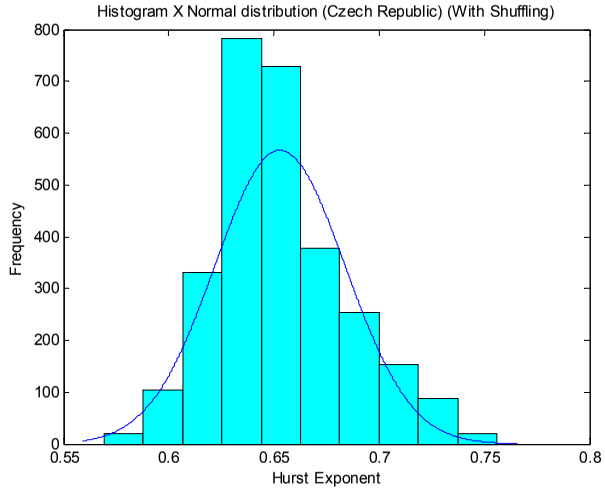

Histogram X Normal distribution (Croatia) (With Shuffling)
Frequency
Hurst Exponent
600
500
400
300
200
100
0
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85

Croatia

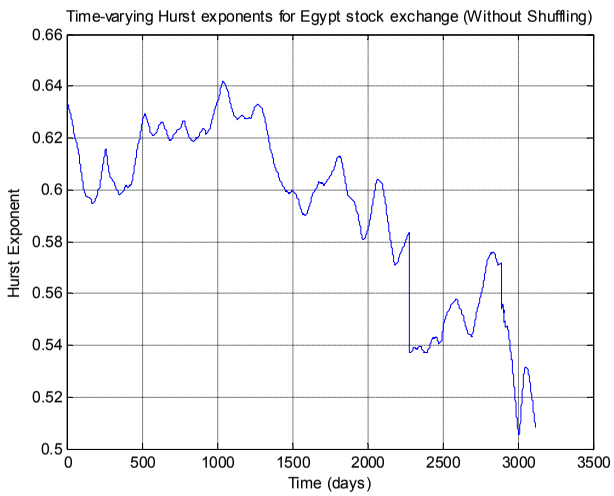


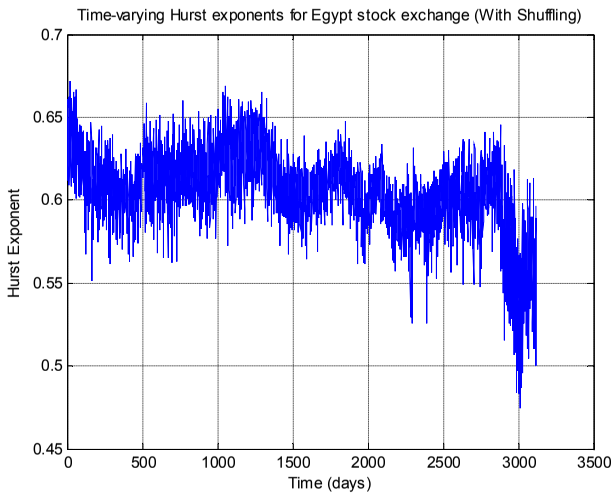


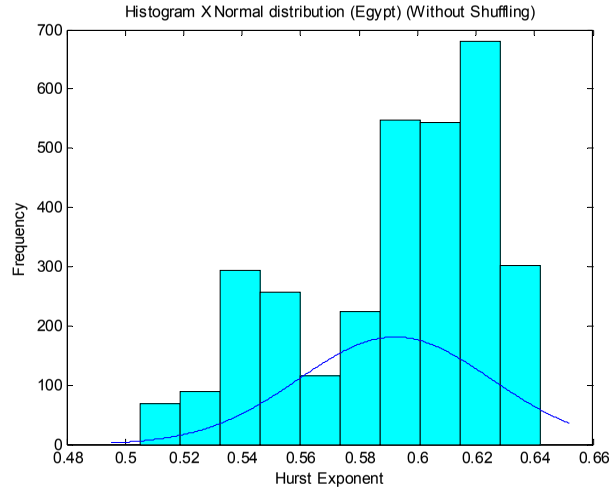


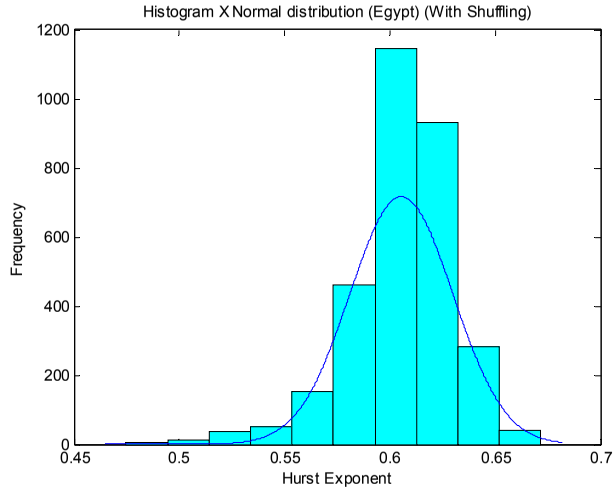


Czech Republic

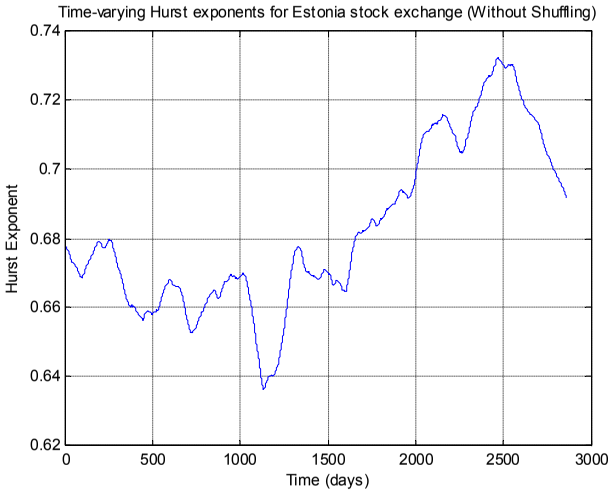

Time-varying Hurst exponents for Egypt stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.66
0.64
0.62
0.6
0.58
0.56
0.54
0.52
0.5
0
500
1000
1500
2000
2500
3000
3500

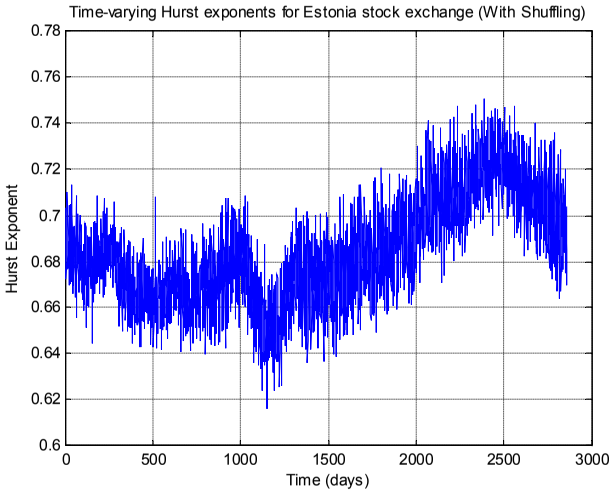

Time-varying Hurst exponents for Egypt stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.7
0.65
0.6
0.55
0.5
0.45
0
500
1000
1500
2000
2500
3000
3500

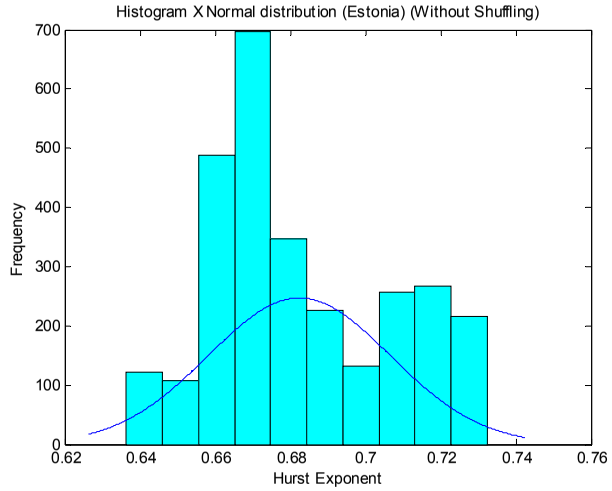

Histogram X Normal distribution (Egypt) (Without Shuffling)
Frequency
Hurst Exponent
700
600
500
400
300
200
100
0
0.48
0.5
0.52
0.54
0.56
0.58
0.6
0.62
0.64
0.66

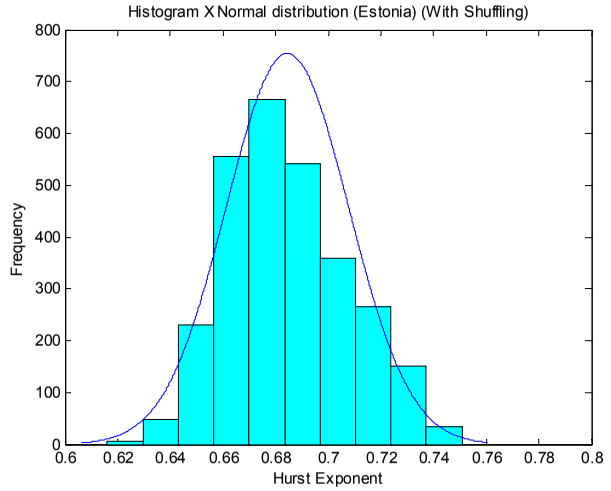

Histogram X Normal distribution (Egypt) (With Shuffling)
Frequency
Hurst Exponent
1200
1000
800
600
400
200
0
0.45
0.5
0.55
0.6
0.65
0.7

Egypt

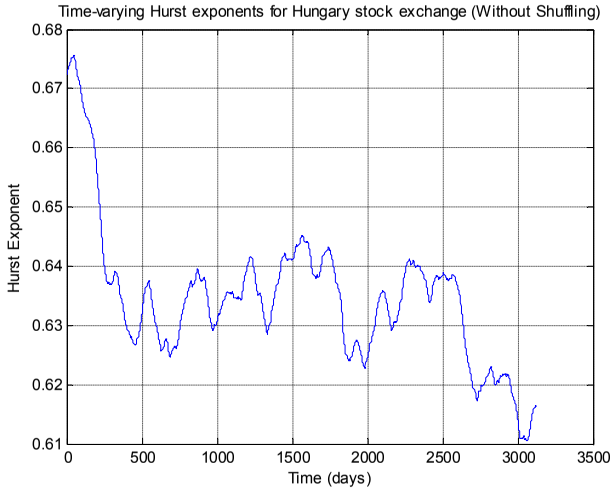

Time-varying Hurst exponents for Estonia stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0
500
1000
1500
2000
2500
3000

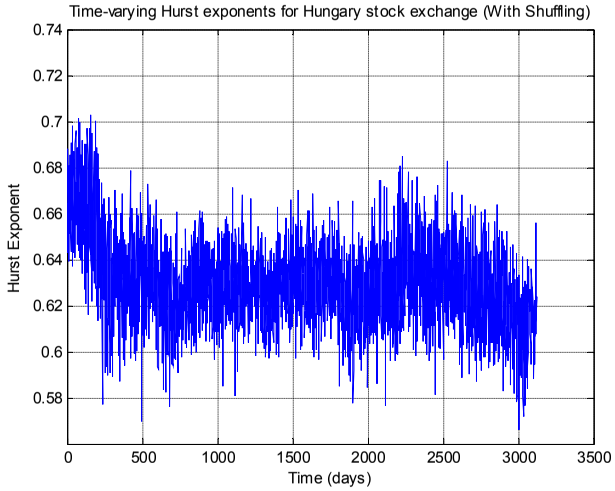

Time-varying Hurst exponents for Estonia stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.78
0.76
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0
500
1000
1500
2000
2500
3000

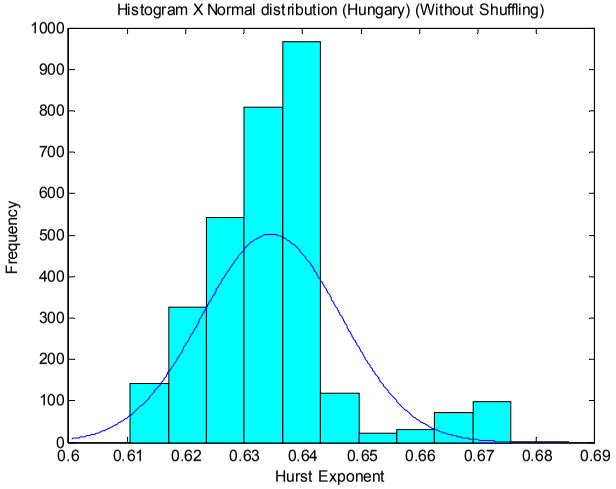

Histogram X Normal distribution (Estonia) (Without Shuffling)
Frequency
Hurst Exponent
700
600
500
400
300
200
100
0
0.62
0.64
0.66
0.68
0.7
0.72
0.74
0.76

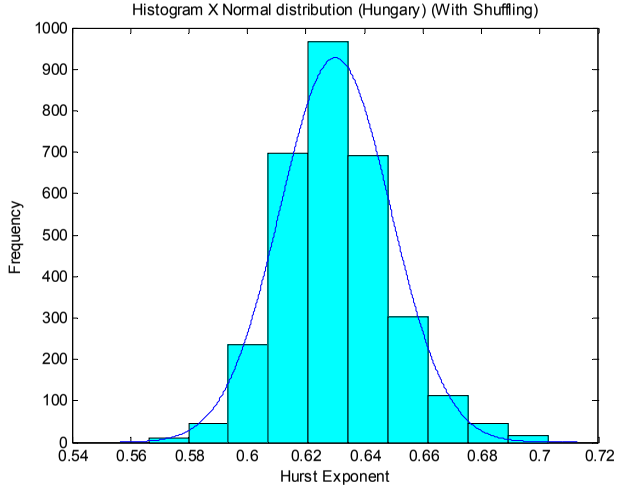

Histogram X Normal distribution (Estonia) (With Shuffling)
Frequency
Hurst Exponent
800
700
600
500
400
300
200
100
0
0.6
0.62
0.64
0.66
0.68
0.7
0.72
0.74
0.76
0.78
0.8

Estonia

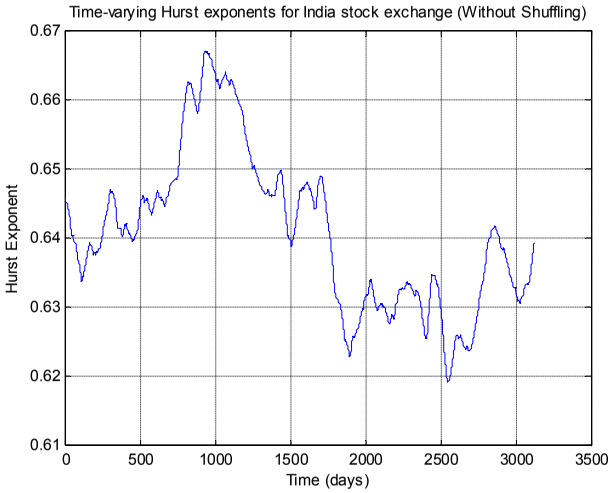

Time-varying Hurst exponents for Hungary stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.68
0.67
0.66
0.65
0.64
0.63
0.62
0.61
0
500
1000
1500
2000
2500
3000
3500

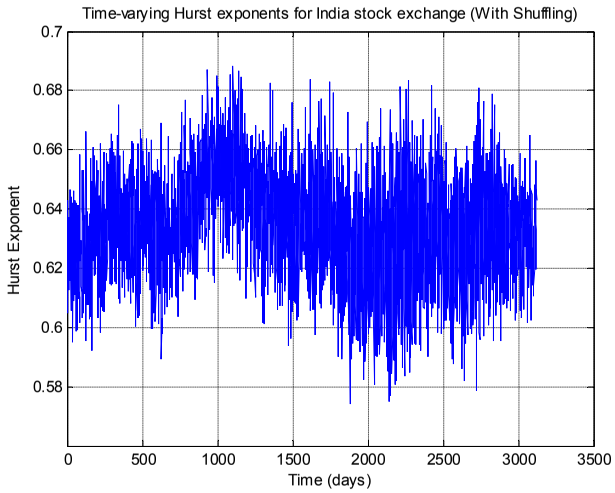

Time-varying Hurst exponents for Hungary stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0
500
1000
1500
2000
2500
3000
3500

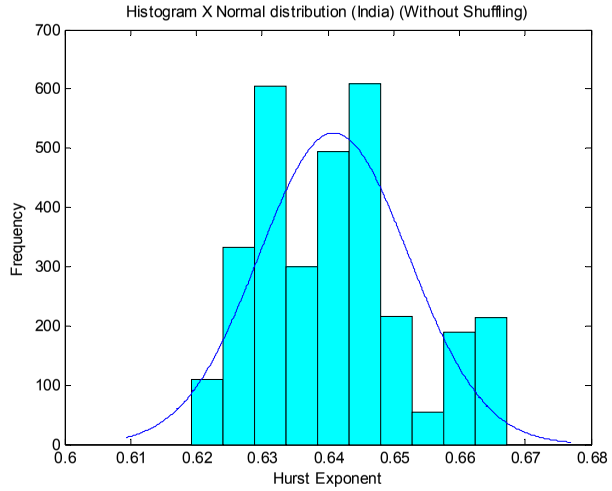

Histogram X Normal distribution (Hungary) (Without Shuffling)
Frequency
Hurst Exponent
1000
900
800
700
600
500
400
300
200
100
0
0.6
0.61
0.62
0.63
0.64
0.65
0.66
0.67
0.68
0.69

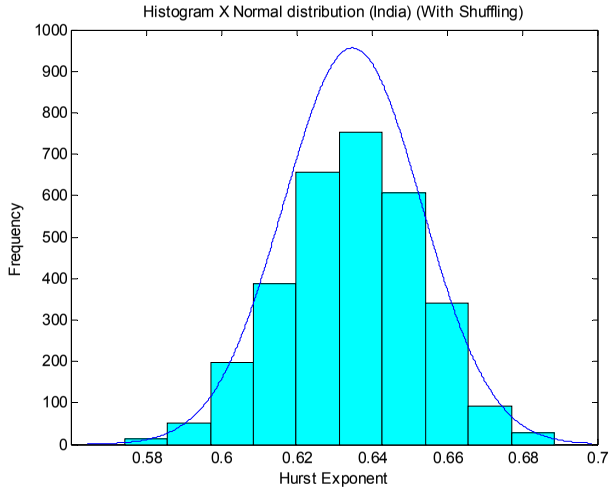

Histogram X Normal distribution (Hungary) (With Shuffling)
Frequency
Hurst Exponent
1000
900
800
700
600
500
400
300
200
100
0
0.54
0.56
0.58
0.6
0.62
0.64
0.66
0.68
0.7
0.72

Hungary

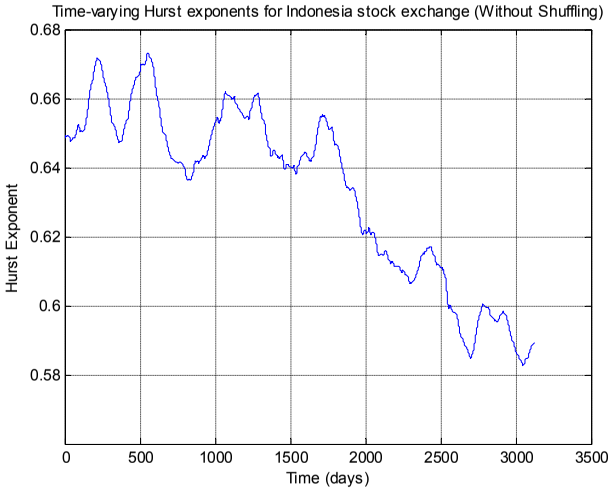

Time-varying Hurst exponents for India stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.67
0.66
0.65
0.64
0.63
0.62
0.61
0
500
1000
1500
2000
2500
3000
3500

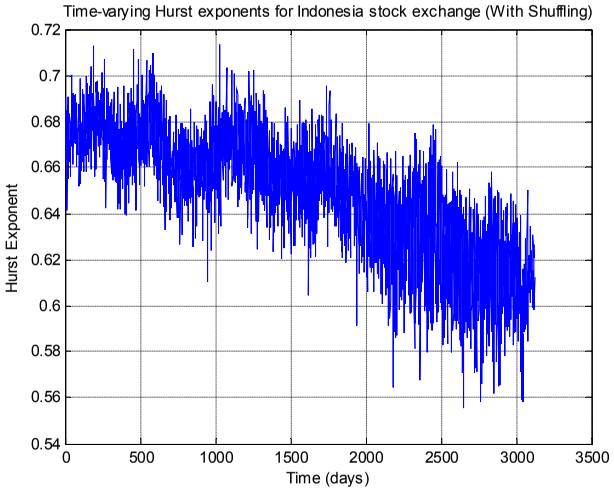

Time-varying Hurst exponents for India stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0
500
1000
1500
2000
2500
3000
3500

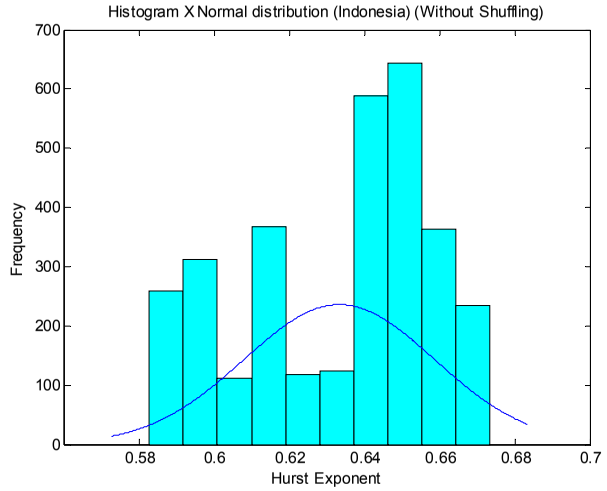

Histogram X Normal distribution (India) (Without Shuffling)
Frequency
Hurst Exponent
700
600
500
400
300
200
100
0
0.6
0.61
0.62
0.63
0.64
0.65
0.66
0.67
0.68

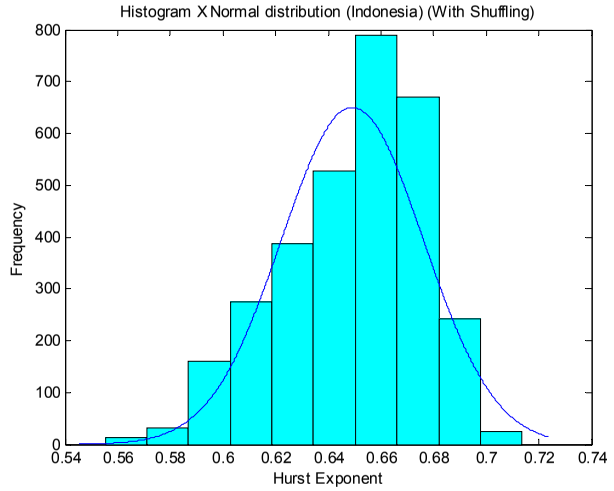

Histogram X Normal distribution (India) (With Shuffling)
Frequency
Hurst Exponent
1000
900
800
700
600
500
400
300
200
100
0
0.58
0.6
0.62
0.64
0.66
0.68
0.7

India

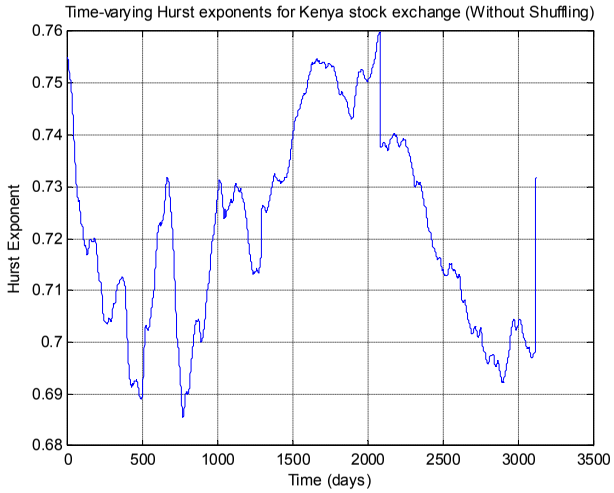

Time-varying Hurst exponents for Indonesia stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.68
0.66
0.64
0.62
0.6
0.58
0
500
1000
1500
2000
2500
3000
3500

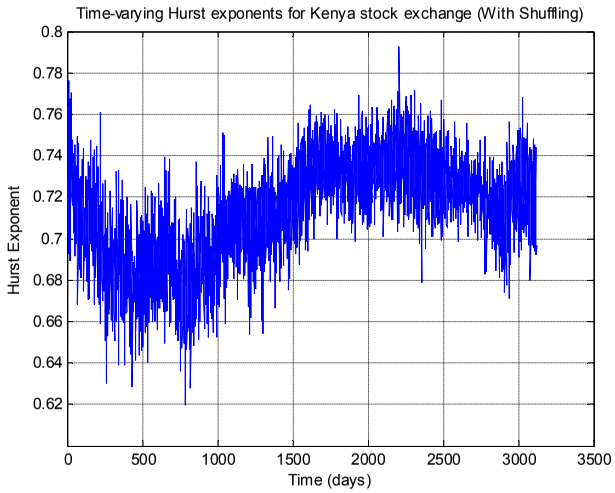

Time-varying Hurst exponents for Indonesia stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0.56
0.54
0
500
1000
1500
2000
2500
3000
3500

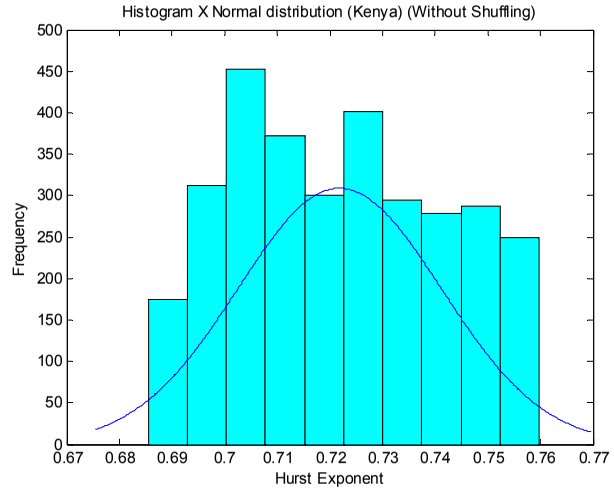

Histogram X Normal distribution (Indonesia) (Without Shuffling)
Frequency
Hurst Exponent
700
600
500
400
300
200
100
0
0.58
0.6
0.62
0.64
0.66
0.68
0.7

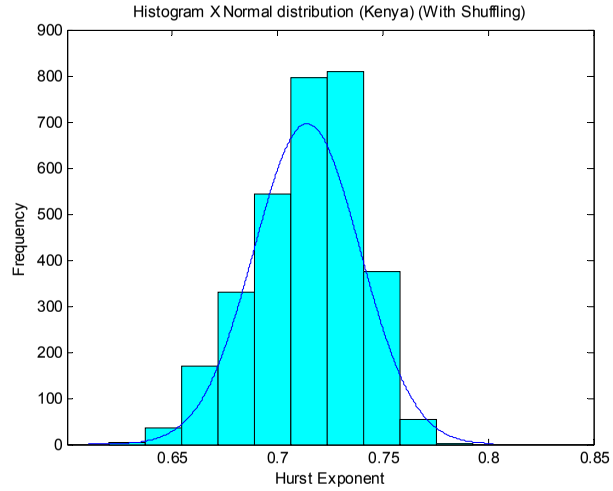

Histogram X Normal distribution (Indonesia) (With Shuffling)
Frequency
Hurst Exponent
800
700
600
500
400
300
200
100
0
0.54
0.56
0.58
0.6
0.62
0.64
0.66
0.68
0.7
0.72
0.74

Indonesia

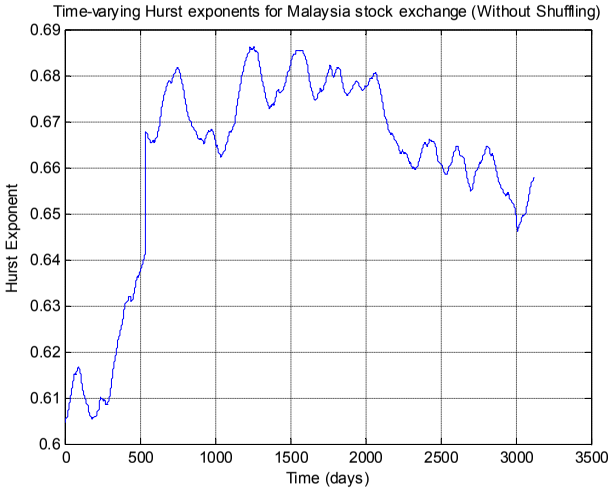

Time-varying Hurst exponents for Kenya stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.76
0.75
0.74
0.73
0.72
0.71
0.7
0.69
0.68
0
500
1000
1500
2000
2500
3000
3500

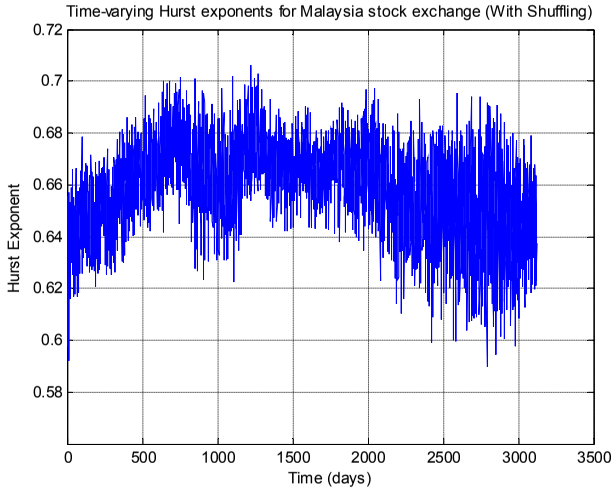

Time-varying Hurst exponents for Kenya stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.8
0.78
0.76
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0
500
1000
1500
2000
2500
3000
3500

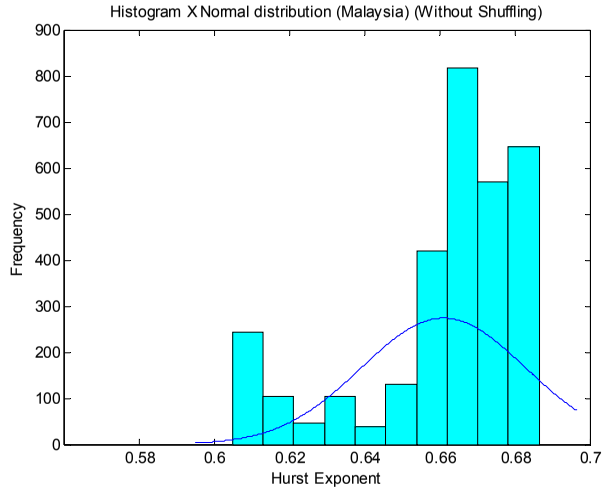

Histogram X Normal distribution (Kenya) (Without Shuffling)
Frequency
Hurst Exponent
500
450
400
350
300
250
200
150
100
50
0
0.67
0.68
0.69
0.7
0.71
0.72
0.73
0.74
0.75
0.76
0.77

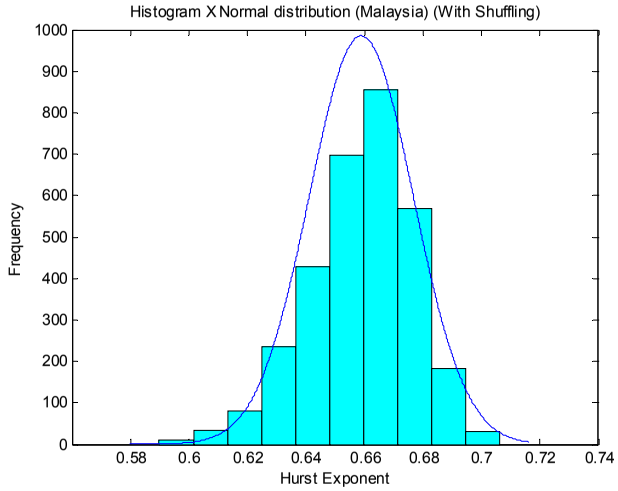

Histogram X Normal distribution (Kenya) (With Shuffling)
Frequency
Hurst Exponent
900
800
700
600
500
400
300
200
100
0
0.65
0.7
0.75
0.8
0.85

Kenya

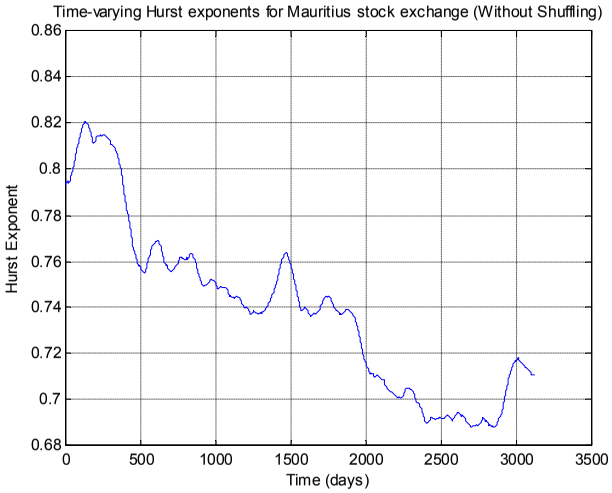

Time-varying Hurst exponents for Malaysia stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.69
0.68
0.67
0.66
0.65
0.64
0.63
0.62
0.61
0.6
0
500
1000
1500
2000
2500
3000
3500

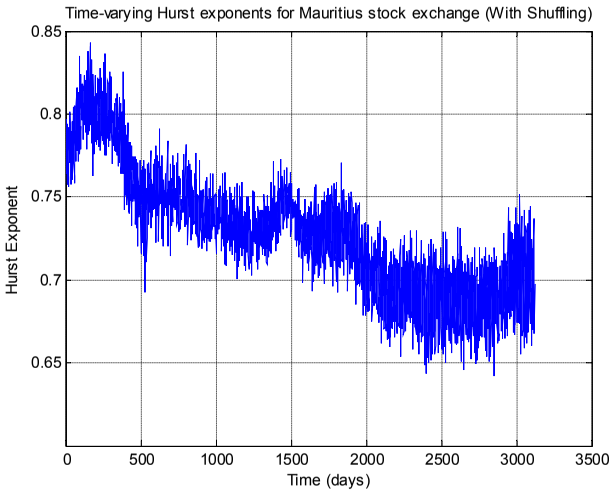

Time-varying Hurst exponents for Malaysia stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0
500
1000
1500
2000
2500
3000
3500

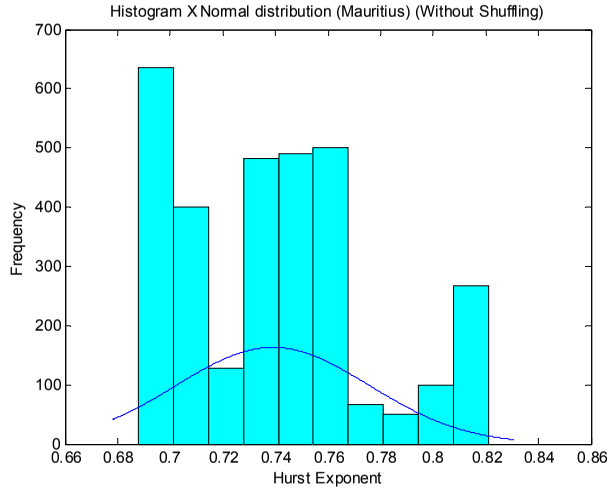

Histogram X Normal distribution (Malaysia) (Without Shuffling)
Frequency
Hurst Exponent
900
800
700
600
500
400
300
200
100
0
0.58
0.6
0.62
0.64
0.66
0.68
0.7

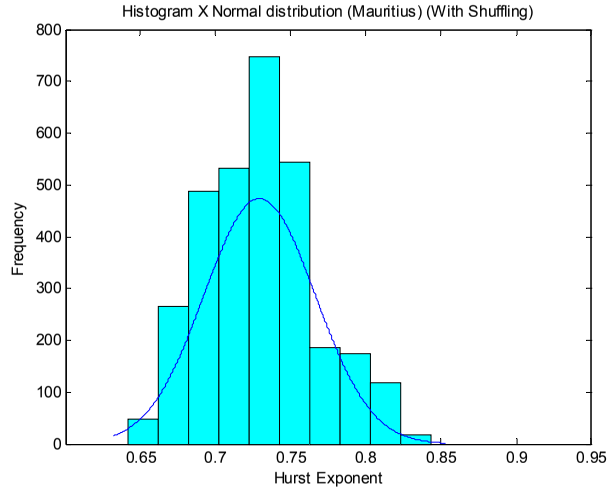

Histogram X Normal distribution (Malaysia) (With Shuffling)
Frequency
Hurst Exponent
1000
900
800
700
600
500
400
300
200
100
0
0.58
0.6
0.62
0.64
0.66
0.68
0.7
0.72
0.74

Malaysia

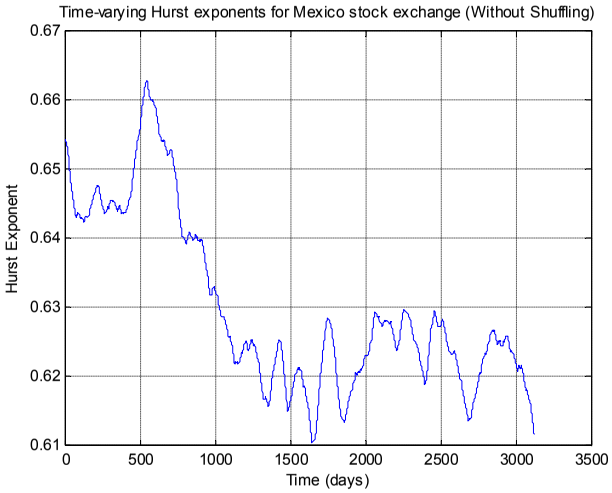

Time-varying Hurst exponents for Mauritius stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.86
0.84
0.82
0.8
0.78
0.76
0.74
0.72
0.7
0.68
0
500
1000
1500
2000
2500
3000
3500

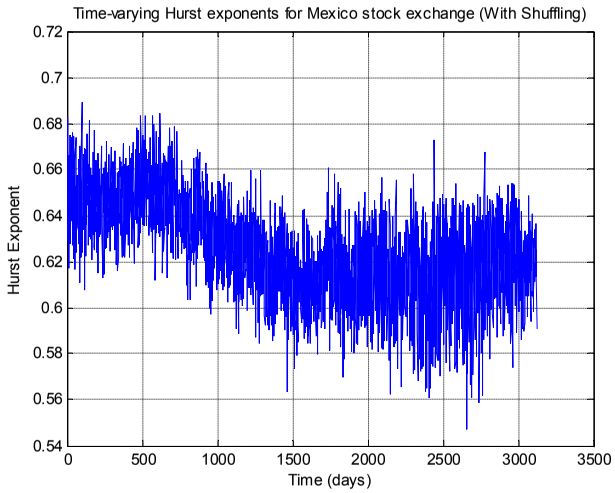

Time-varying Hurst exponents for Mauritius stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.85
0.8
0.75
0.7
0.65
0
500
1000
1500
2000
2500
3000
3500

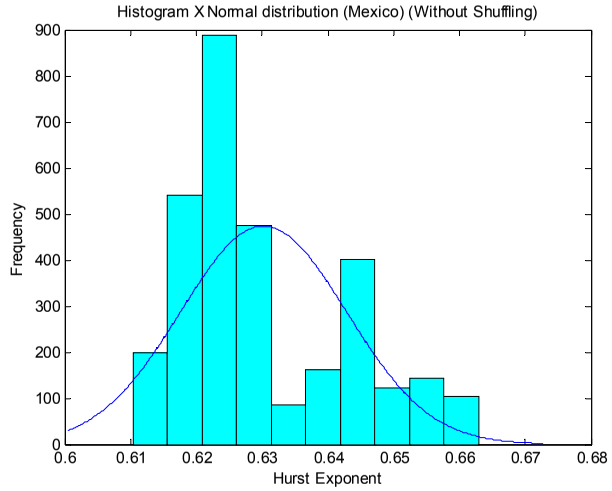

Histogram X Normal distribution (Mauritius) (Without Shuffling)
Frequency
Hurst Exponent
700
600
500
400
300
200
100
0
0.66
0.68
0.7
0.72
0.74
0.76
0.78
0.8
0.82
0.84
0.86

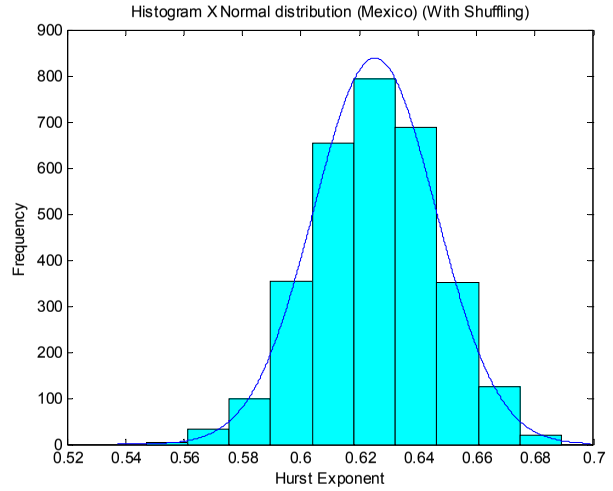

Histogram X Normal distribution (Mauritius) (With Shuffling)
Frequency
Hurst Exponent
800
700
600
500
400
300
200
100
0
0.65
0.7
0.75
0.8
0.85
0.9
0.95

Mauritius

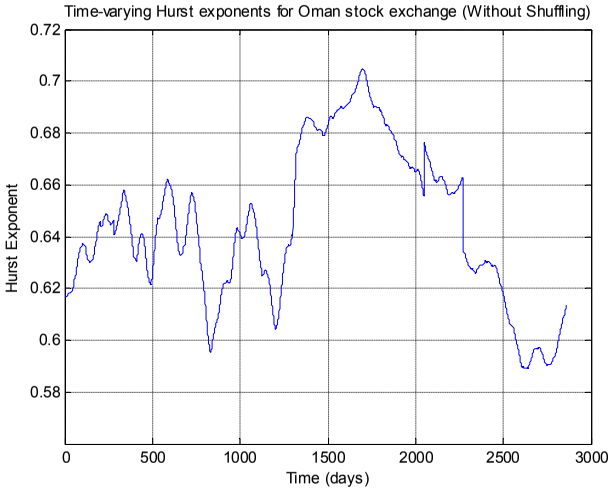

Time-varying Hurst exponents for Mexico stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.67
0.66
0.65
0.64
0.63
0.62
0.61
0
500
1000
1500
2000
2500
3000
3500

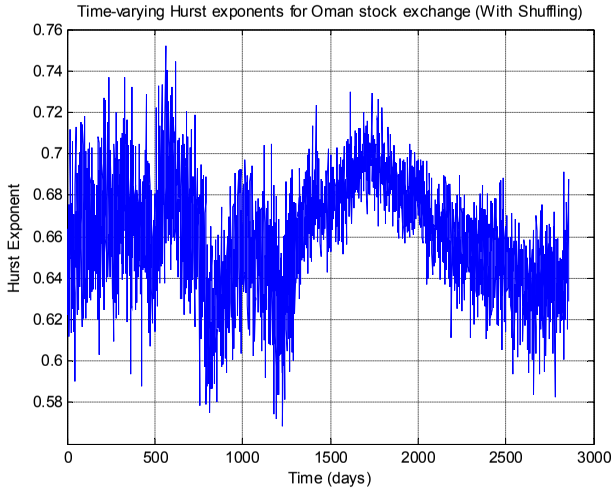

Time-varying Hurst exponents for Mexico stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0.56
0.54
0
500
1000
1500
2000
2500
3000
3500

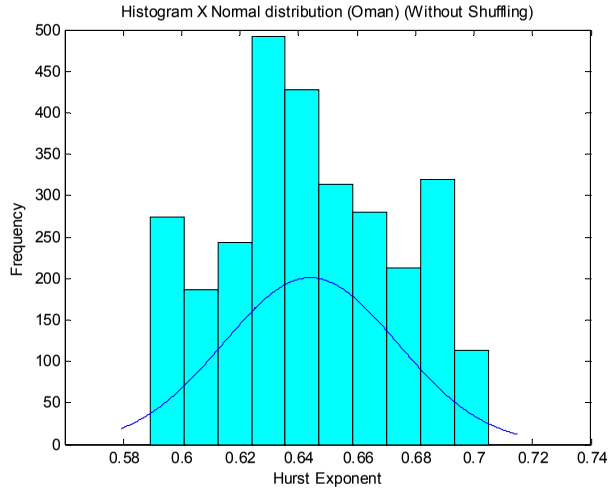

Histogram X Normal distribution (Mexico) (Without Shuffling)
Frequency
Hurst Exponent
900
800
700
600
500
400
300
200
100
0
0.6
0.61
0.62
0.63
0.64
0.65
0.66
0.67
0.68

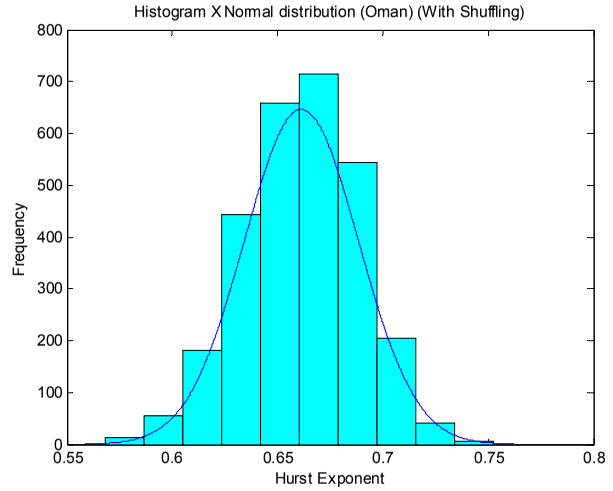

Histogram X Normal distribution (Mexico) (With Shuffling)
Frequency
Hurst Exponent
900
800
700
600
500
400
300
200
100
0
0.52
0.54
0.56
0.58
0.6
0.62
0.64
0.66
0.68
0.7

Mexico

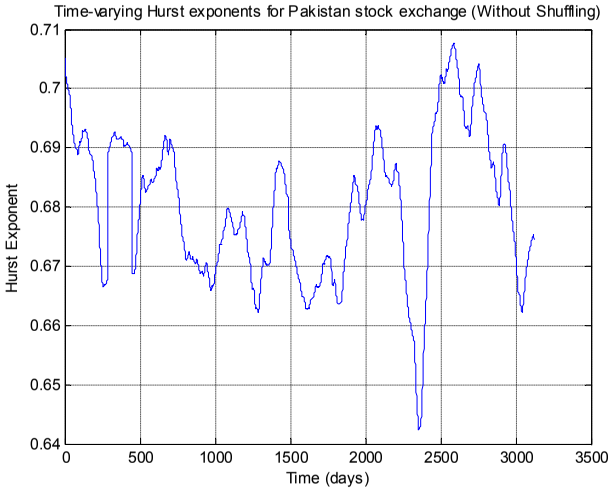

Time-varying Hurst exponents for Oman stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0
500
1000
1500
2000
2500
3000

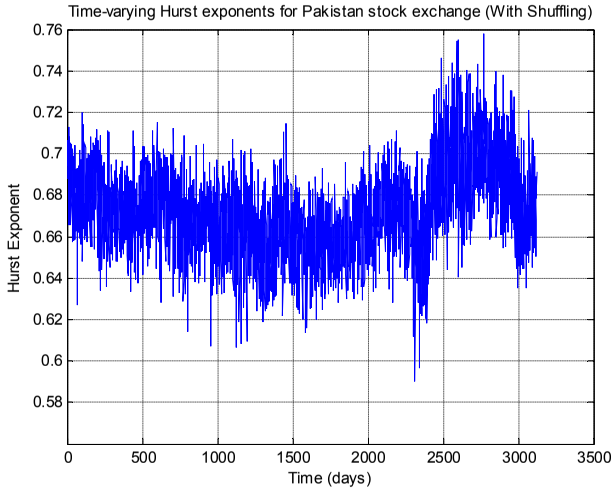

Time-varying Hurst exponents for Oman stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.76
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0
500
1000
1500
2000
2500
3000

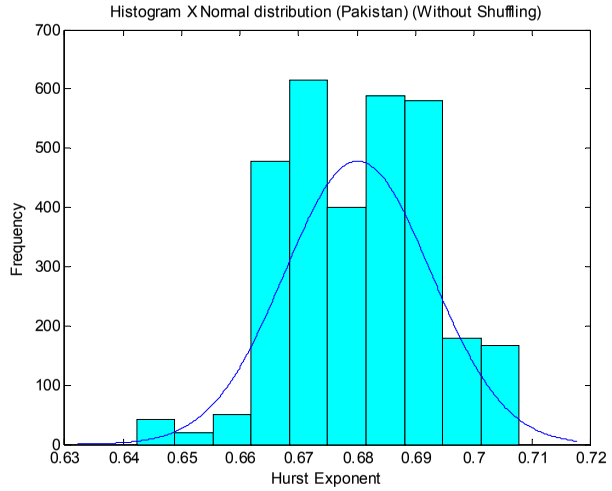

Histogram X Normal distribution (Oman) (Without Shuffling)
Frequency
Hurst Exponent
500
450
400
350
300
250
200
150
100
50
0
0.58
0.6
0.62
0.64
0.66
0.68
0.7
0.72
0.74

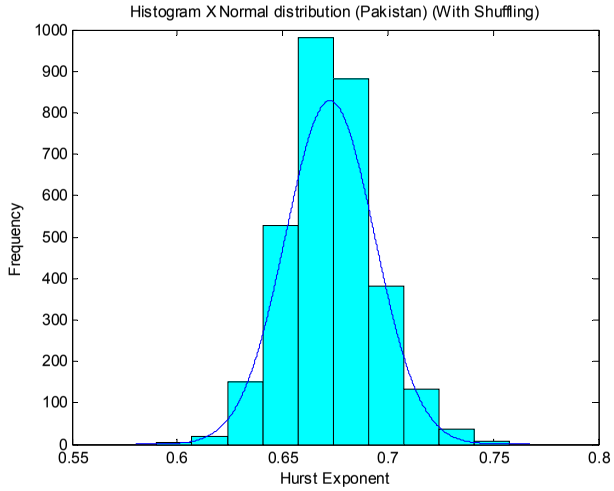

Histogram X Normal distribution (Oman) (With Shuffling)
Frequency
Hurst Exponent
800
700
600
500
400
300
200
100
0
0.55
0.6
0.65
0.7
0.75
0.8

Oman

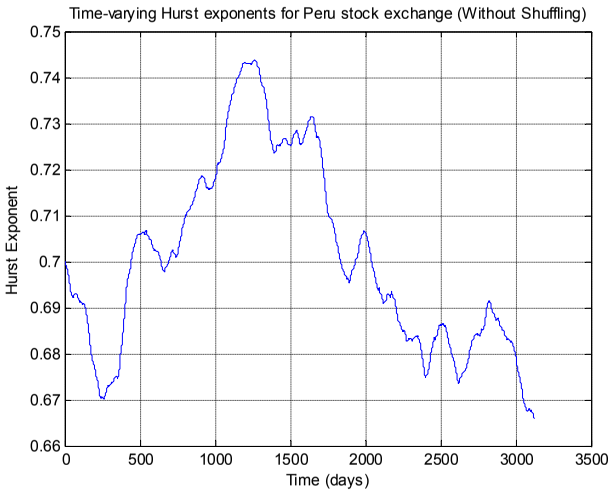

Time-varying Hurst exponents for Pakistan stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.71
0.7
0.69
0.68
0.67
0.66
0.65
0.64
0
500
1000
1500
2000
2500
3000
3500

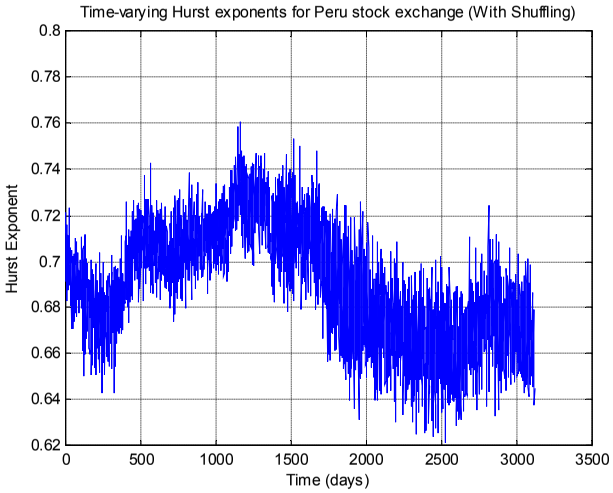

Time-varying Hurst exponents for Pakistan stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.76
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0
500
1000
1500
2000
2500
3000
3500

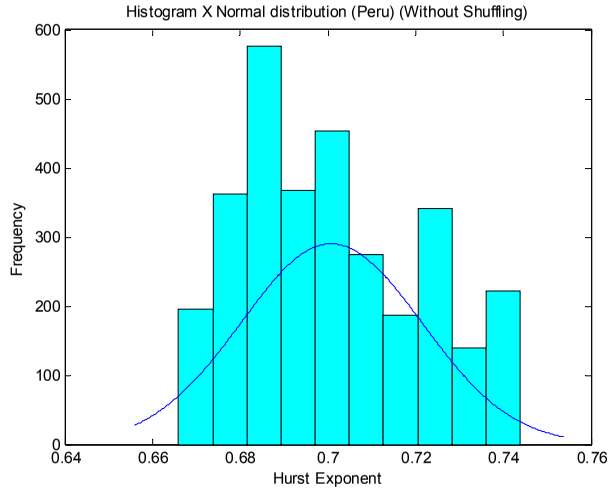

Histogram X Normal distribution (Pakistan) (Without Shuffling)
Frequency
Hurst Exponent
700
600
500
400
300
200
100
0
0.63
0.64
0.65
0.66
0.67
0.68
0.69
0.7
0.71
0.72

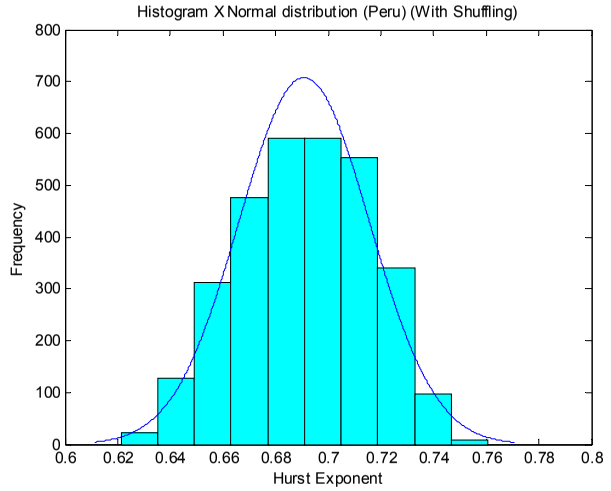

Histogram X Normal distribution (Pakistan) (With Shuffling)
Frequency
Hurst Exponent
1000
900
800
700
600
500
400
300
200
100
0
0.55
0.6
0.65
0.7
0.75
0.8

Pakistan

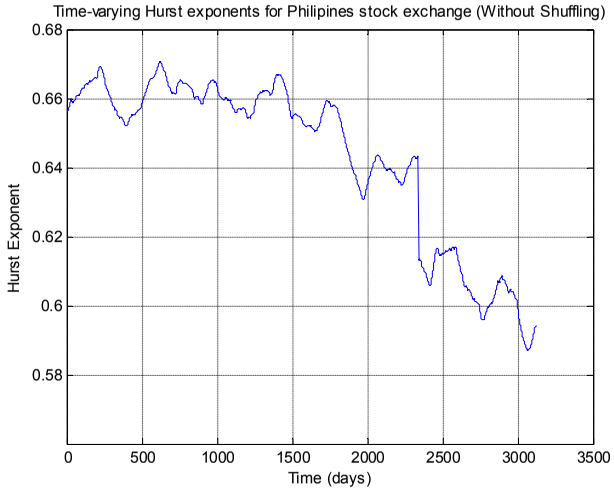

Time-varying Hurst exponents for Peru stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.75
0.74
0.73
0.72
0.71
0.7
0.69
0.68
0.67
0.66
0
500
1000
1500
2000
2500
3000
3500

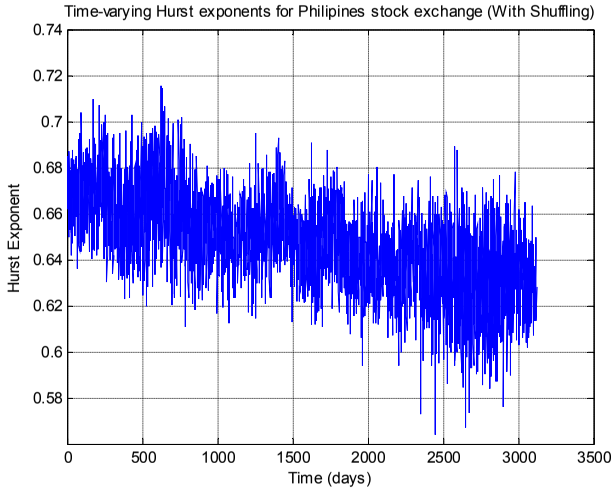

Time-varying Hurst exponents for Peru stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.8
0.78
0.76
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0
500
1000
1500
2000
2500
3000
3500

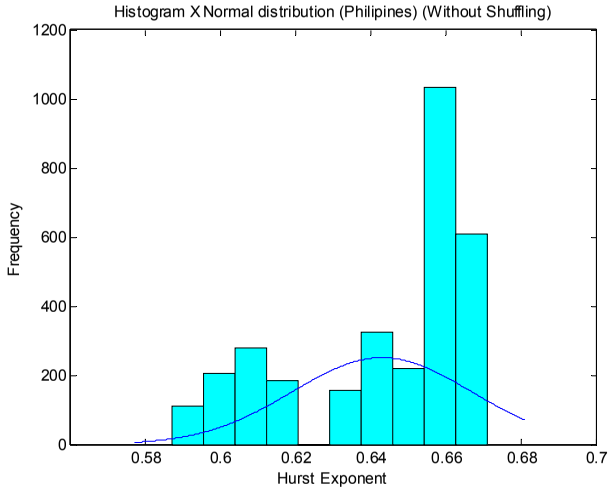

Histogram X Normal distribution (Peru) (Without Shuffling)
Frequency
Hurst Exponent
600
500
400
300
200
100
0
0.64
0.66
0.68
0.7
0.72
0.74
0.76

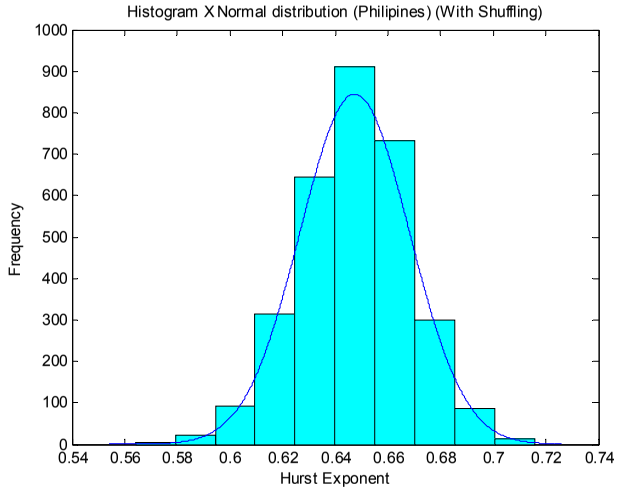

Histogram X Normal distribution (Peru) (With Shuffling)
Frequency
Hurst Exponent
800
700
600
500
400
300
200
100
0
0.6
0.62
0.64
0.66
0.68
0.7
0.72
0.74
0.76
0.78
0.8

Peru

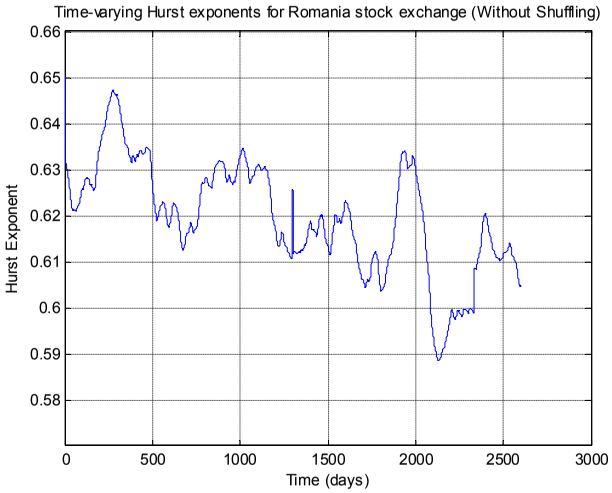

Time-varying Hurst exponents for Philipines stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.68
0.66
0.64
0.62
0.6
0.58
0
500
1000
1500
2000
2500
3000
3500

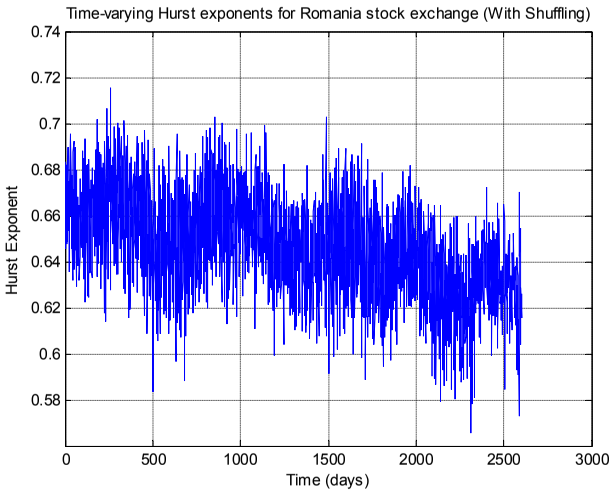

Time-varying Hurst exponents for Philipines stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0
500
1000
1500
2000
2500
3000
3500

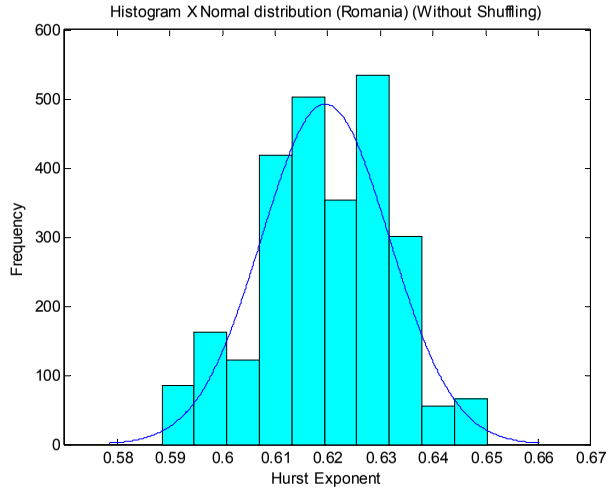

Histogram X Normal distribution (Philipines) (Without Shuffling)
Frequency
Hurst Exponent
1200
1000
800
600
400
200
0
0.58
0.6
0.62
0.64
0.66
0.68
0.7

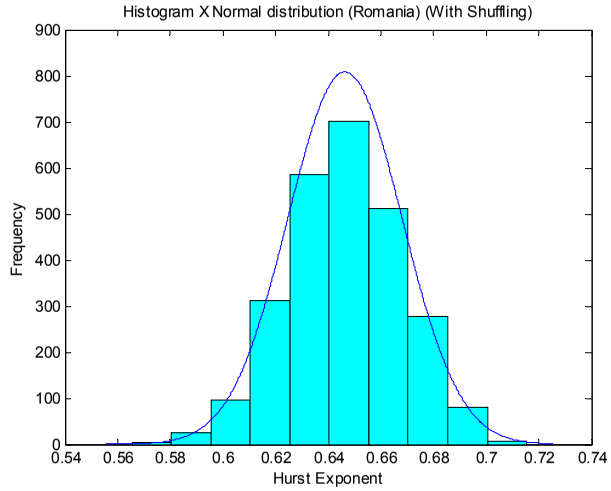

Histogram X Normal distribution (Philipines) (With Shuffling)
Frequency
Hurst Exponent
1000
900
800
700
600
500
400
300
200
100
0
0.54
0.56
0.58
0.6
0.62
0.64
0.66
0.68
0.7
0.72
0.74

Philipines


Time-varying Hurst exponents for Romania stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.66
0.65
0.64
0.63
0.62
0.61
0.6
0.59
0.58
0
500
1000
1500
2000
2500
3000

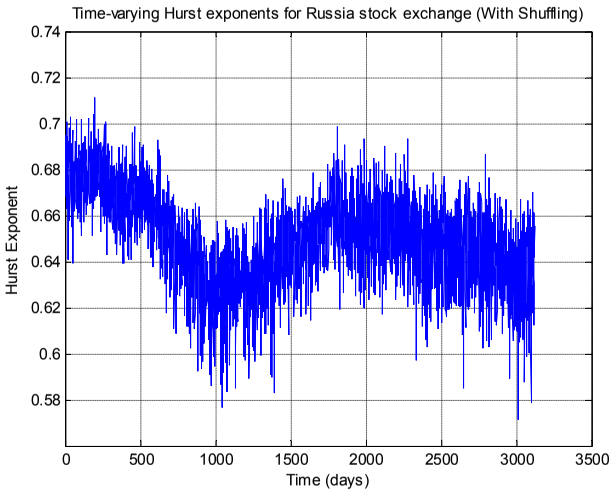

Time-varying Hurst exponents for Romania stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.74
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0
500
1000
1500
2000
2500
3000

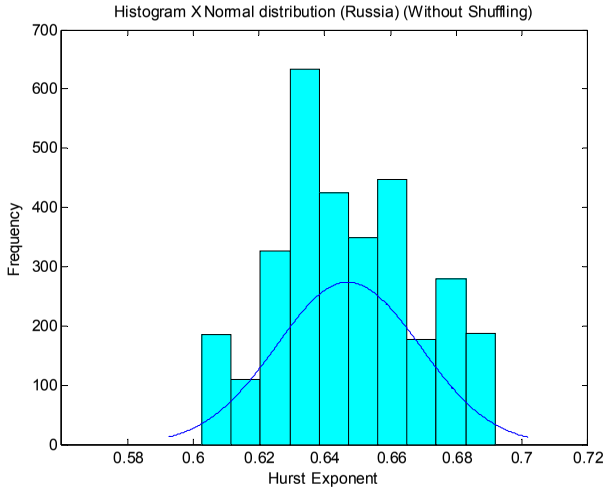

Histogram X Normal distribution (Romania) (Without Shuffling)
Frequency
Hurst Exponent
600
500
400
300
200
100
0
0.58
0.59
0.6
0.61
0.62
0.63
0.64
0.65
0.66
0.67

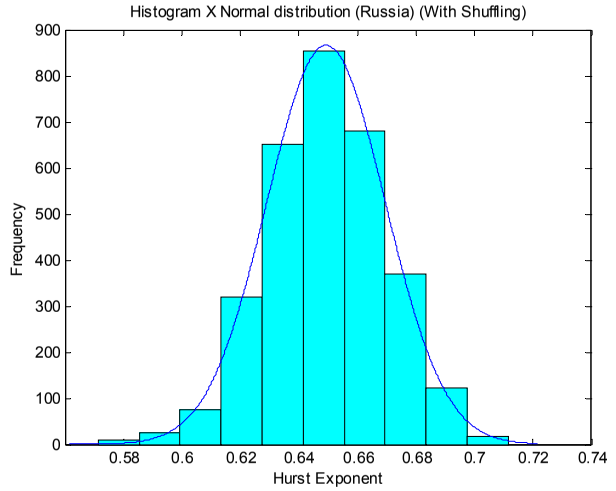

Histogram X Normal distribution (Romania) (With Shuffling)
Frequency
Hurst Exponent
900
800
700
600
500
400
300
200
100
0
0.54
0.56
0.58
0.6
0.62
0.64
0.66
0.68
0.7
0.72
0.74

Romania

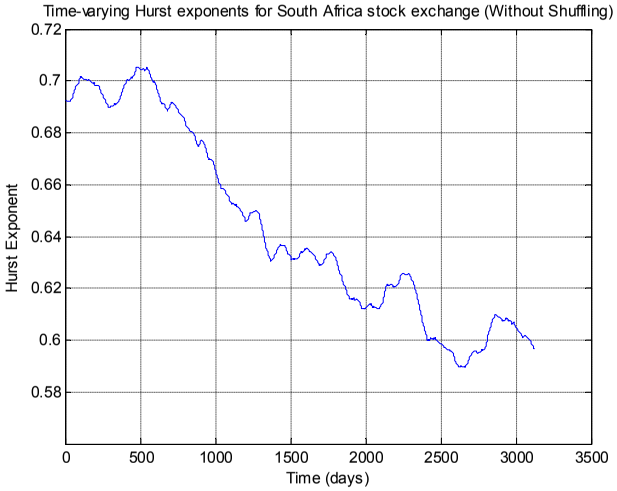

Time-varying Hurst exponents for Russia stock exchange (Without Shuffling)
Hurst Exponent
Time (days)

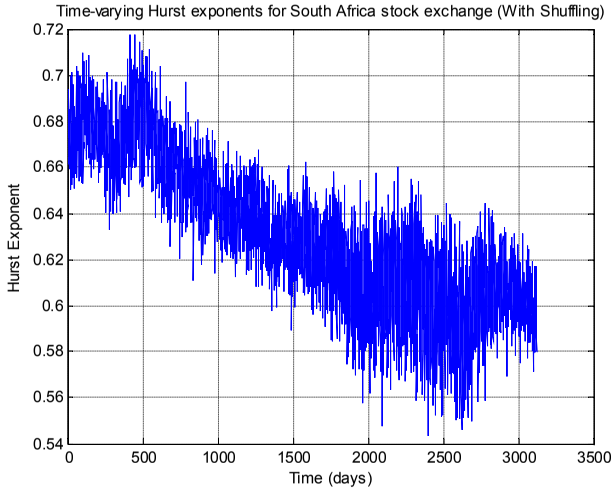

Time-varying Hurst exponents for Russia stock exchange (With Shuffling)
Hurst Exponent
Time (days)

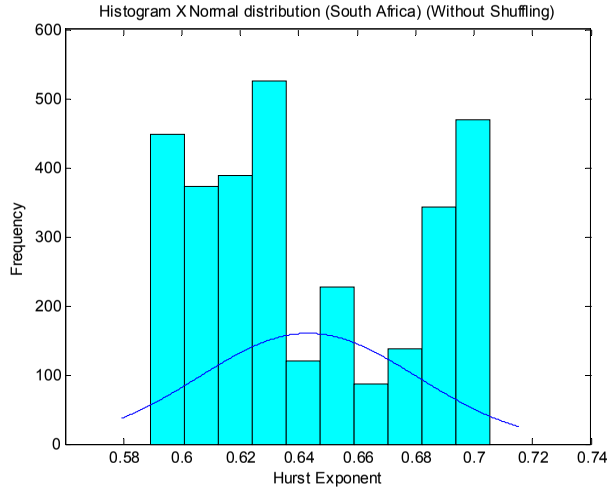

Histogram X Normal distribution (Russia) (Without Shuffling)
Frequency
Hurst Exponent

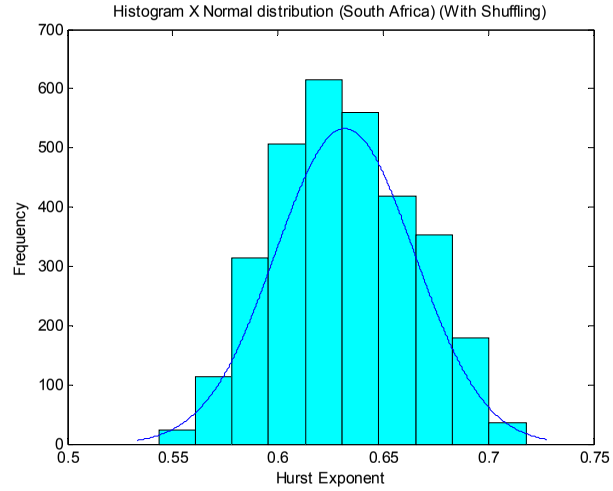

Histogram X Normal distribution (Russia) (With Shuffling)
Frequency
Hurst Exponent

Russia

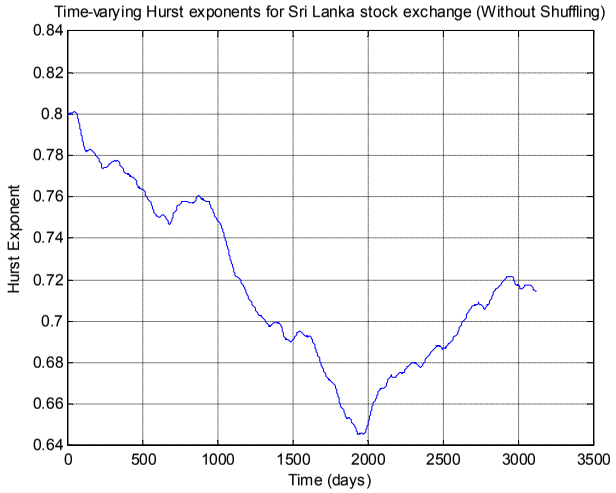


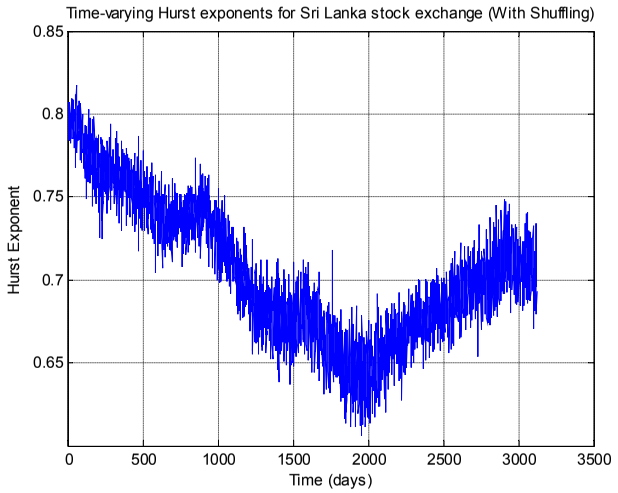


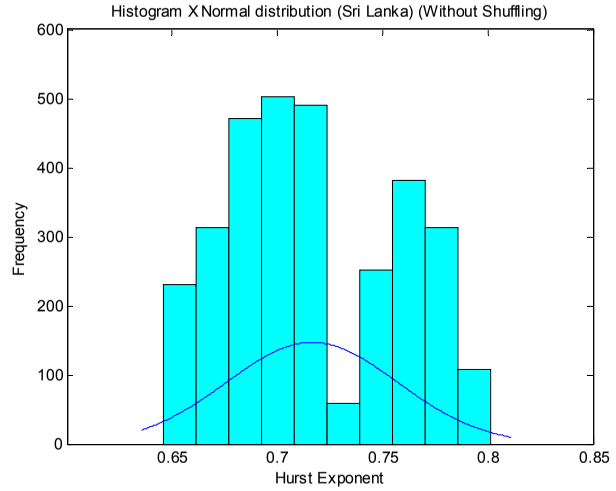


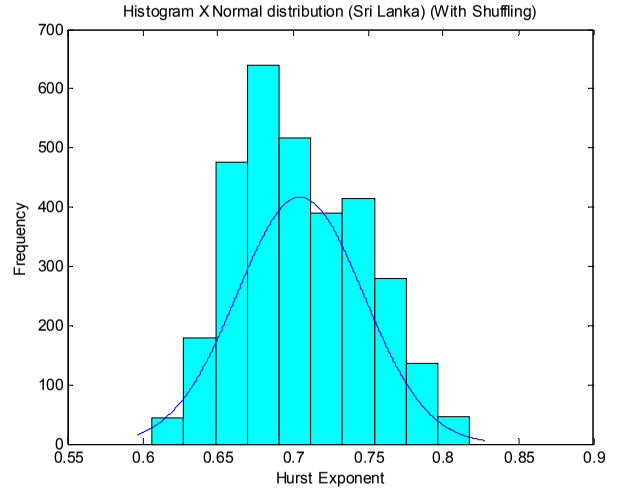


South Africa

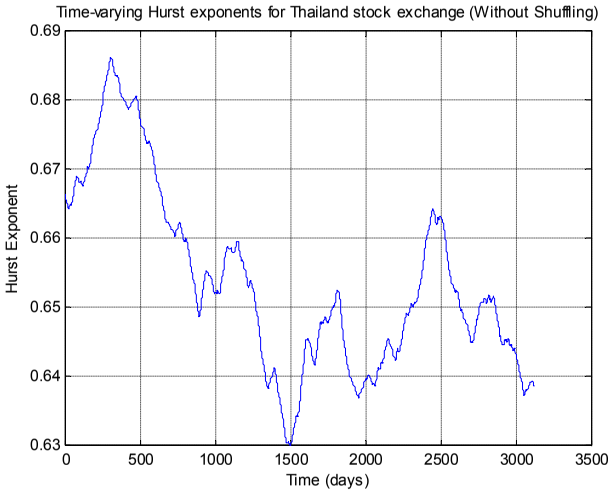

Time-varying Hurst exponents for Sri Lanka stock exchange (Without Shuffling)
Hurst Exponent
Time (days)

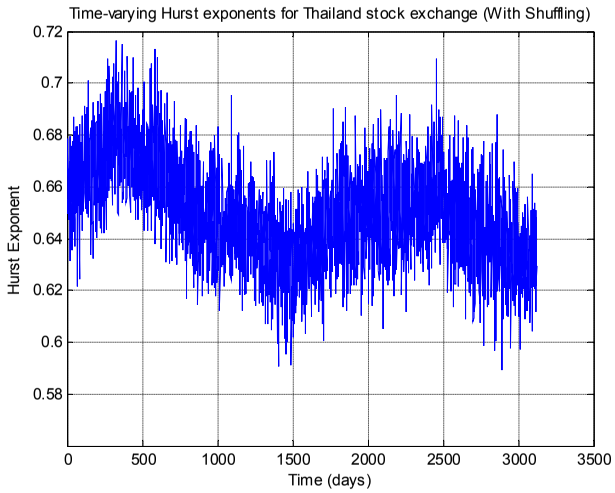

Time-varying Hurst exponents for Sri Lanka stock exchange (With Shuffling)
Hurst Exponent
Time (days)

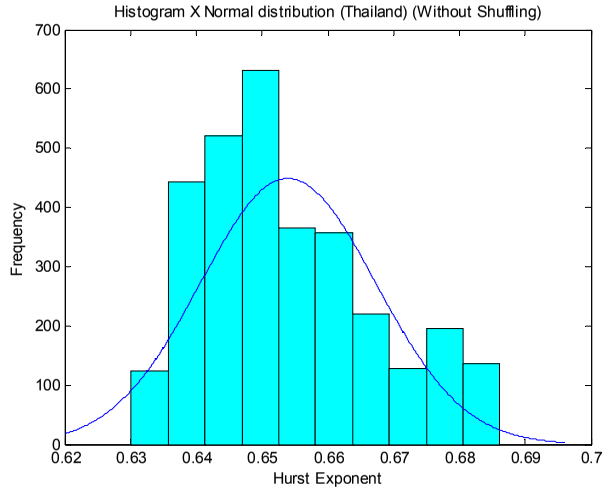

Histogram X Normal distribution (Sri Lanka) (Without Shuffling)
Frequency
Hurst Exponent

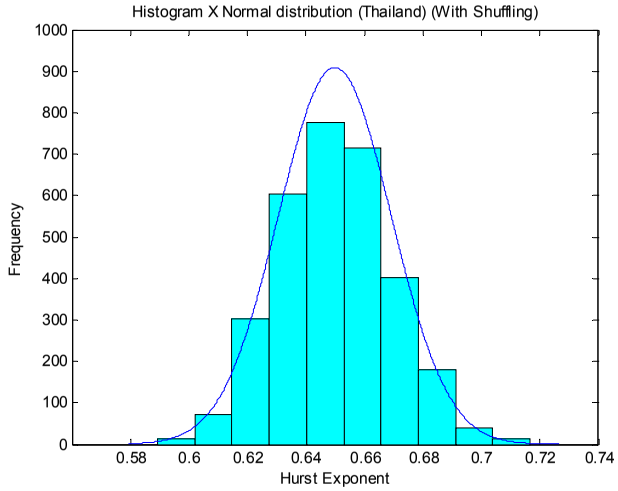

Histogram X Normal distribution (Sri Lanka) (With Shuffling)
Frequency
Hurst Exponent

Sri Lanka

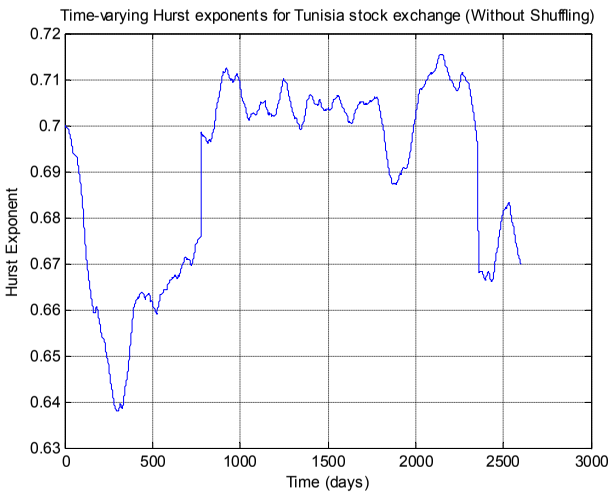

Time-varying Hurst exponents for Thailand stock exchange (Without Shuffling)
Hurst Exponent
Time (days)
0.69
0.68
0.67
0.66
0.65
0.64
0.63
0
500
1000
1500
2000
2500
3000
3500

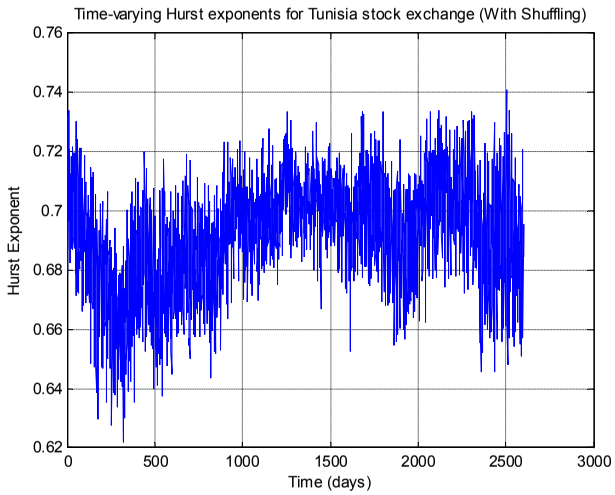

Time-varying Hurst exponents for Thailand stock exchange (With Shuffling)
Hurst Exponent
Time (days)
0.72
0.7
0.68
0.66
0.64
0.62
0.6
0.58
0
500
1000
1500
2000
2500
3000
3500

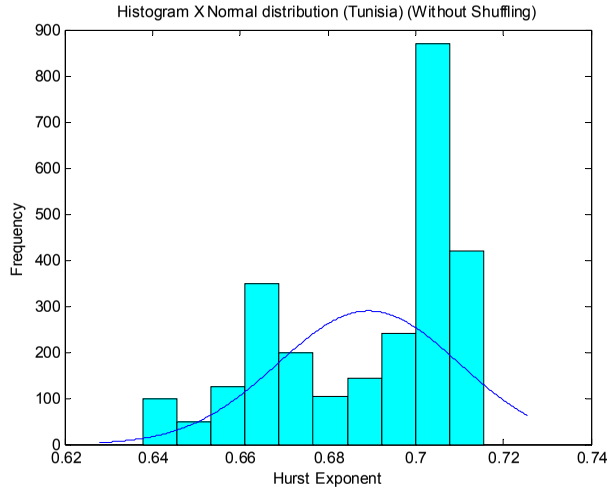

Histogram X Normal distribution (Thailand) (Without Shuffling)
Frequency
Hurst Exponent
700
600
500
400
300
200
100
0
0.62
0.63
0.64
0.65
0.66
0.67
0.68
0.69
0.7

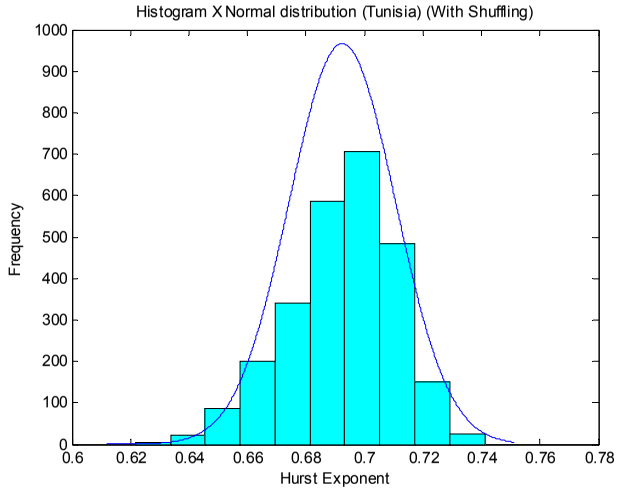

Histogram X Normal distribution (Thailand) (With Shuffling)
Frequency
Hurst Exponent
1000
900
800
700
600
500
400
300
200
100
0
0.58
0.6
0.62
0.64
0.66
0.68
0.7
0.72
0.74

Thailand

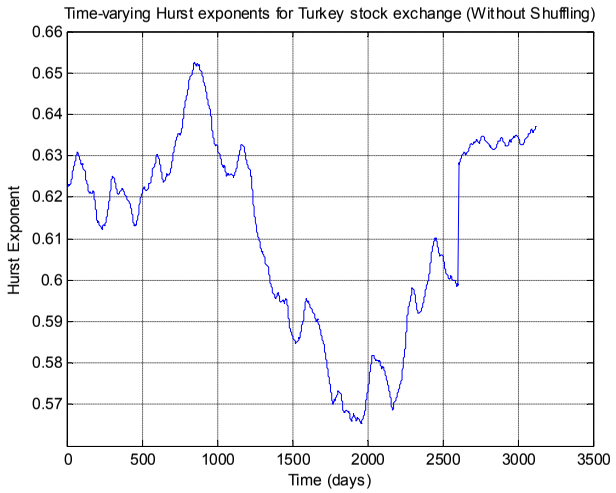

Time-varying Hurst exponents for Tunisia stock exchange (Without Shuffling)
Hurst Exponent
Time (days)

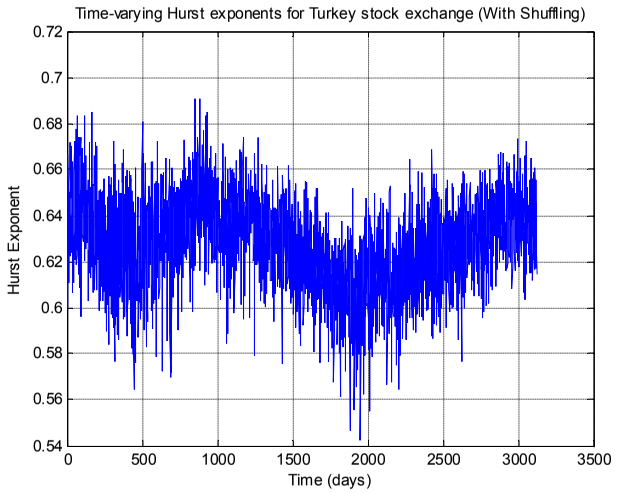

Time-varying Hurst exponents for Tunisia stock exchange (With Shuffling)
Hurst Exponent
Time (days)

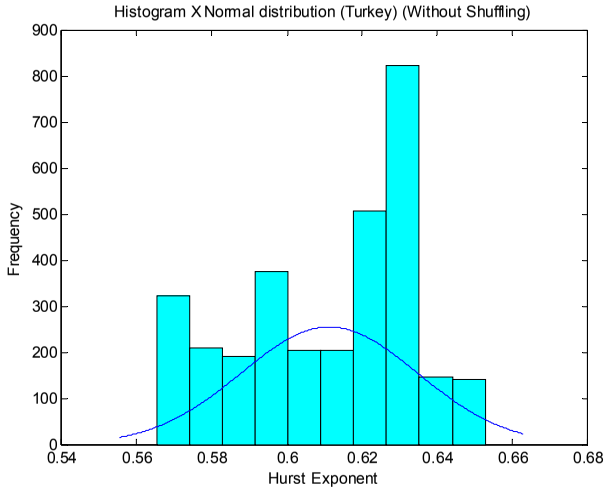

Histogram X Normal distribution (Tunisia) (Without Shuffling)
Frequency
Hurst Exponent

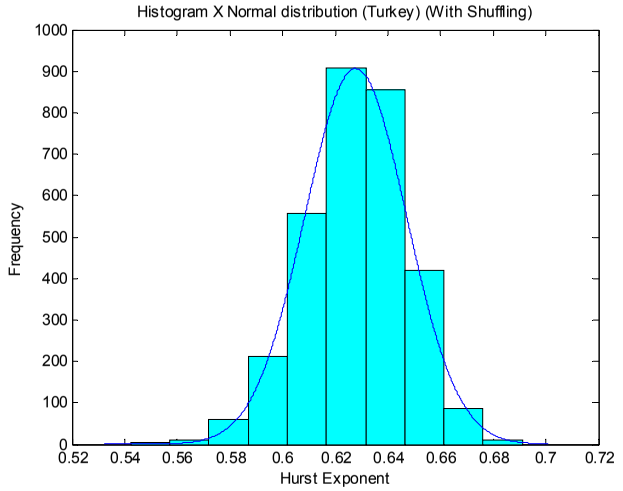

Histogram X Normal distribution (Tunisia) (With Shuffling)
Frequency
Hurst Exponent

Tunisia


Time-varying Hurst exponents for Turkey stock exchange (Without Shuffling)
Hurst Exponent
Time (days)


Time-varying Hurst exponents for Turkey stock exchange (With Shuffling)
Hurst Exponent
Time (days)


Histogram X Normal distribution (Turkey) (Without Shuffling)
Frequency
Hurst Exponent


Histogram X Normal distribution (Turkey) (With Shuffling)
Frequency
Hurst Exponent

Turkey