IS THE TURKISH EQUITY MARKET COINTEGRATED WITH EUROPEAN NORTH AMERICAN AND EMERGING MARKETS?

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Approval of the Graduate School of Social Sciences

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ABSTRACT

IS THE TURKISH EQUITY MARKET COINTEGRATED WITH EUROPEAN NORTH AMERICAN AND EMERGING MARKETS?

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Modern portfolio theory stipulates that an investor can reduce systemic risk simply by diversifying its assets across national boundaries. Therefore, the issue of whether stock markets are cointegrated carries important implications for portfolio diversification. This study aims to identify and model a relationship between four equity markets namely, Turkish, European, North American and emerging markets using cointegration technique. We investigated the existence of cointegrating equation between four stock market indices and also the existence of a structural break. During our investigation, we constructed a vector error correction model (VECM) to observe short and long run relationships between the four markets. We used daily data from the October 23, 1995 until November 20, 2009 and relevant Morgan Stanley Capital International (MSCI) indices, namely MSCI Turkey, MSCI North America, MSCI Europe and MSCI Emerging Markets. Our first finding was that the Turkish equity markets are cointegrated with European, North American and emerging markets indicates that investing in the Turkish equity market does not provide an opportunity for risk diversification for international investors in the long run. It is only possible to benefit from the discrepancies which may occur in the short run. Furthermore, we identified a structural break contemporaneous with crisis of November 2000.

Keywords: Cointegration, Turkish equity market

ÖZET

Türk Hisse Senedi Piyasası Avrupa, Kuzey Amerika ve Gelişen Ülkeler Hisse Senedi Piyasalarıyla Eştümleşik mi?

Özberki, İzzet
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Modern portföy teorisi, yatırımcının sistematik riski sadece yurt dışı varlıklara yatırım yapmak suretiyle dağıtacağını öngörür. Dolayısıyla hisse senedi piyasalarının eştümleşik olup olmaması portföy riskinin dağıtımı açısından önem taşır. Çalışmamızın amacı Türk, Avrupa, Kuzey Amerika ve gelişen ülkeler hisse senedi piyasaları arasındaki ilişkiyi, eştümleşme tekniği kullanarak incelemek ve modellemektir. Dört pazar endeksi arasında mevcut eştümleşme denklemini ve yapısal kırılmayı inceledik. Bu inceleme sırasında yöney hata düzeltme modeli kurarak dört piyasanın birbirleriyle olan kısa ve uzun dönemli ilişkilerini ele aldık. 23 Ekim 1995 ile 20 Kasım 2009 tarihleri arasındaki dönem için Morgan Satnley Capital International (MSCI) endekslerini kullandık. Kullandığımız endeksler şunlar oldu: MSCI Turkey, MSCI North America, MSCI Europe ve MSCI Emerging Market. İlk bulgumuz, Türk, Avrupa, Kuzey Amerika ve gelişen ülkeler hisse senedi piyasalarının eştümleşik olması dolayısıyla, Türk piyasasının uluslararası yatırımcılara uzun donemde risk dağıtma imkânı sağlamadığıdır. Ancak kısa dönemde çıkan arbitraj imkânlarından yararlanmak mümkündür. Ayrıca, Kasım 2000 krizine denk gelen bir yapısal kırılma tespit ettik.

Anahtar kelimeler: Eştümleşme, Türk hisse senedi piyasası

To all those who have a place in my heart.

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CHAPTER I

Introduction

Modern portfolio theory stipulates that an investor can reduce systemic risk simply by diversifying its assets across national boundaries (provided that returns of the stocks in other markets are not perfectly correlated with the investor's home market). Diversification will allow for the same portfolio return with reduced risk if the markets do not move together. The concept of integration encompasses a wide range of topics including real integration, integration of financial markets and the analysis of linkages through which integration is materialized. Cointegration of stock markets implies the existence of a common force, such as arbitrage activity, which brings the stock markets in line together in the long run. Therefore, the issue of whether stock markets are cointegrated carries important implications for portfolio diversification. The practical implication of the fact that stock markets are cointegrated is that the potential for gaining abnormal profits through international diversification is limited in the long run. Whereas on the contrary, if markets are not cointegrated as there will be no arbitrage activity to bring the markets together in the long run, there is potential for investors to obtain long run gains through international portfolio diversification.

We believe that the fact that the Turkish equity market is integrated with international financial markets is important on two counts: first, for the international investors and second, for Turkish companies. It poses an importance for the international investors because if the Turkish equity market is integrated with the international equity markets, it does not provide any opportunity for portfolio diversification. If this is the case, it is not realistic to expect an increase in the amount of portfolio investment flowing into Turkey. The very same fact has a different implication from the companies' perspective. If the Turkish equity market is integrated with the

international markets, it is more likely that the Turkish companies may have wider access to direct foreign investment coming into Turkey rather than portfolio investments.
The result may also help Turkish firms considering going public to evaluate other possibilities in foreign stock exchanges. It may also provide the authorities with an indication on how to position Istanbul Stock Exchange (ISE) in their quest to market it to foreign companies.

Our research question is to investigate whether the Turkish equity market is integrated or not with international equity markets. In our thesis to denote the integration of different regional or national equity markets, we will adopt the concept of cointegration. To do so, we will test if the ISE is cointegrated with developed equity markets and developing equity markets. To investigate whether Turkish equity market is integrated with the international markets, we will adopt the Johansen methodology and use the relevant Morgan Stanley Capital International (MSCI) indices, namely MSCI Turkey, MSCI North America, MSCI Europe and MSCI Emerging Markets. An important feature of this study is the use of daily data. Although there are a number of studies tackling the issue of cointegration in the context of Turkish equity market, we did not come across any using daily data. The data we used covers the period between October 23rd, 1995 and November 20th, 2009

There are studies which previously investigated whether or not the Turkish equity market is integrated with international equity markets? Onay (2006) examines the long-term financial integration of second-round acceding and candidate countries with the European Union (EU) and the US stock markets during the accession process using weekly data. Another research on the Turkish equity markets was conducted by Citak et al. (2007). In their study, in which they compare the Turkish equity market with the American, German, English, Japanese, Indian and Malaysian markets for the 1986-2006 period using monthly data. Erbaykal et al (2008) study the relationships among Istanbul (Turkey), Merval (Argentina) and Bovespa (Brazil) stock exchange markets using monthly data covering the period 1997-2007. Korkmaz et al. (2009) investigate whether 16 developed and 21 emerging countries’ equity markets including Turkey are cointegrated or not by using monthly index values for the period of January 1995-December 2007.

We noticed the fact that all three studies which reached the conclusion that the Turkish equity market is cointegrated with international equity markets used monthly data. Whereas, the only study that used weekly data concluded that the Turkish equity market is not cointegrated with its international peers. Our motive is to find out the result of using daily data when checking the cointegration of the Turkish and international equity markets. In our thesis, we first checked the data for stationarity. To check the stationarity and establish the order of integration of the series, we applied the Augmented Dickey Fuller and Phillips-Perron unit root tests. As the Turkish economy underwent a major financial crisis at the turn of the century, we also used the Zivot Andrews test to allow for the effects of such structural breaks. Furthermore, we applied the Johansen test to check for the existence of a cointegrating vector and then we constructed the vector error correction model. We found that the Turkish equity market is cointegrated with European, North American and emerging markets

Organization of this thesis is as follows: Chapter II is on literature survey and Chapter III sets the background. Chapter IV is on econometric methodology and Chapter V is on econometric modelling. Finally in Chapter VI, we cover conclusions and policy implications.

CHAPTER II

Literature Survey

There is a wide range of studies that investigate the co-movement of the financial markets in different countries. Co-movement of the financial markets is partly explained by integration and partly by contagion (or inter-dependence) which is the transmission of crisis from one country to another. Financial integration may be defined as an increased correlation among different markets, over time. There are also a number of articles which undertake similar studies in industrial or regional level.

Although it is a well established fact that there have always been varying correlation structures in world equity markets for a period spanning over 150 years, these international equity correlations change dramatically through time (Goetzmann et al 2004). In this context, one can add that although there seems to be a general agreement on the fact that correlations between equity markets are not constant over time, it is less clear whether correlations actually tend upward (Berben et al 2005).

International market integration has been the subject of scrutiny from different perspectives. It is possible to divide the literature on integration in two sets as done by some researchers (Goldberg et al 2001). The first set consists of those that define integration as the convergence of asset returns. According to this approach, the more different markets converge; the more the assets with related risk characteristics would yield similar returns. The second set consists of empirical studies related to regime breaks. The existence of such breaks is verified through unit root tests or cointegration among different financial markets. The unit root test and cointegration will be explained later in more detail.

There are also studies embracing one of the above approaches but looking at it either at industrial or regional framework. Studies falling within the first set either test if there are deviations from Law of One Price (LOP) as do Korajczyk (1995) and Garcia-Herrero et al (2007) or check if there are any changes in the risk premia (Adjaoute et al 2002). There are others in a similar approach investigating the presence of common stochastic trends to identify whether the price of a security reflects all the available information about market fundamentals (Yuhn 1997). There are also studies investigating how strongly integrated European stock markets are, and if this has increased over time (Fratzscher 2001). These findings conclude that the European equity markets have become highly integrated merely since 1996 and that this integration is large part explained by the drive towards the European Monetary Union.

Baele et al. (2004) study if the frictions or barriers to the intermediation process in different areas have asymmetric effects on LOPs. Carrieri et al (2004) investigate the same problem but at the industrial level asking the following question: Can local industry risk being priced differently from a country as a whole, or may one consider it as any exposure to respective global industries?

On the other hand, Worthington et al. (2003) investigate if there is a change in the short and long run relationships between European markets before and after the Economic and Monetary Union (an example that falls within the second set). Their result indicates that there is a stationary long run relationship and significant short-run casual linkages between the equity markets of both the euro and non-euro areas. Another example which falls within this category is the work of Narayan et al (2003) which checks the existence of long term relationships between stock exchange markets. Their main finding is that there is a long run relationship among stock prices in Bangladesh, India, Sri Lanka and Pakistan. In a similar approach, Ammer et al (1996) investigate the covariance of the components of returns of national stock markets.

Some researchers looked at other markets. For example, Hassan (2003) investigates in his work whether the stock exchanges in the Gulf are becoming more integrated or not. Another work investigating the intra-regional form of financial integration is supplied by Herrmann et al (2008) where they develop their concept of the “convergence club”. Claessens et al (2007) look at the integration at the firm level. They establish attributes (like raising or getting cross listing in major world stock exchanges) of firms which make them become integrated.

There are also works on the long-run cointegration relationships between the Turkish equity market, developed and emerging equity markets on a single country basis. For example, Korkmaz et al. (2009) investigate this long term relationship by Johansen, Gregory-Hansen cointegration tests and Zivot Andrews structural break test by using monthly index values for the period of January 1995-December 2007. Their findings show that the Turkish equity market has a cointegration relationship with 16 developed and 21 emerging countries’ equity markets.

Onay (2006) examines the long-term financial integration of second-round acceding and candidate countries with the European Union (EU) and the US stock markets during the accession process. The long-term stock market interdependence is analyzed using the Johansen (1991) cointegration approach which indicates that no long term relationship exists among the second-round acceding countries, the EU and the US stock markets. Another example of a comparative research on the Turkish equity market is conducted by Citak et al. (2007). In their study, in which they compare the Turkish equity market with American, German, English, Japanese, Indian and Malaysian markets for the 1986-2006 period using monthly data, they identify long term relationships among Turkish, English, American, German and Indian markets. Erbaykal et al (2008) study the relationships among Istanbul (Turkey), Merval (Argentina) and Bovespa (Brazil) stock exchange markets using monthly data covering the period 1997– 2007. In this study, a long run relationship has been detected.

CHAPTER III

Background Setting

During the period covered, which is from October 23, 1995 until November 20, 2009 a number of crises took place. Among those one can mention the1996 Asian crisis, the 1998 Russian crisis or the 2001 Argentinean crisis as examples of crisis with a worldwide impact. We also have to mention the particular the 2000 and 2001 Turkish crises which were only on a national scale.

In this chapter we will investigate the historical development of the ISE. We also will scrutinize the dynamics of the 2000 crisis to understand its relevance for integration of the ISE.

Then we will give a brief overview about the development of the indices we used over the period under investigation and spot the effects of the crises over the indices.

III.1. ISE

The origin of stock exchange activities can be traced back to the 1854 Crimean War. Bonds issued to finance the Ottoman debt incurred during the war started to be traded in Istanbul. In 1866, Dersaadet (another name for Istanbul) Bonds Exchange was established with the support of creditor states. The Exchange was moved to Komisyon Han in 1866. The first exchange regulation was introduced in 1871. In 1875, it was decided that half of the interests and principals of the government debts that were due would be paid in cash and the remainder would be paid in exchange for bonds. The Exchange was moved to 4.Vakifhan in Bahcekapi on April 1st, 1926. Following the foundation of the Republic of Turkey, certain arrangements were introduced in 1929 including the enactment of the law on securities and foreign exchange markets. The

Exchange began to operate under the name Istanbul Securities Exchange. İş Bankası and Central Bank were founded as publicly-traded companies.(ISE)

In 1938, the Exchange was moved to Ankara as a result of which the intermediary activities almost ceased. In April 1941, the exchange was moved back to Istanbul. In 1958, the authority of the Exchange to carry out foreign exchange activities was cancelled and assigned to the Central Bank. The bankers' crisis was one of the most important reasons triggering the inception of the modern era of exchange operations. Several savers' incurring great losses led to a quest for a new system. The Capital Markets Board was set up to inspect all capital market institutions. On December 26th, 1985, ISE was founded. Whereby, a 120-year era came to an end and a new era started.

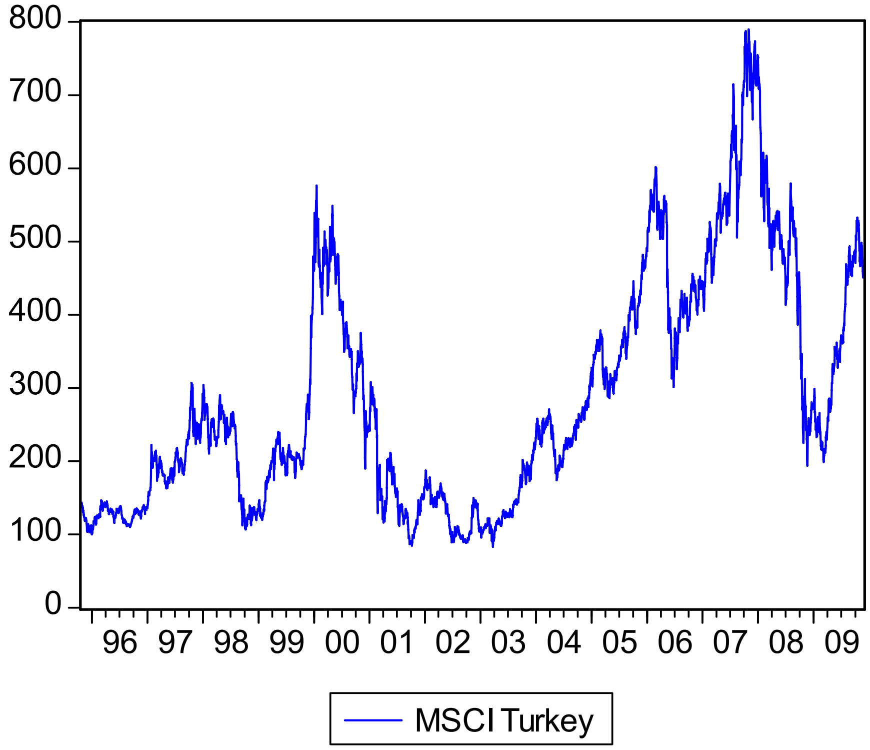
The Exchange started its operations on the 2nd and 3rd floors of Ziraat Bankasi in Cagaloglu then subsequently moved to Erenhan in Karakoy where the new trading started with the sale of the income sharing certificate for the Bosporus Bridge. Later, quests for a new system began. The ticker symbol system was adopted using the ticker symbol system of Jordan as a model which was at the time very flexible.

In 1989, two key decisions about the exchange were taken: First, the establishment of the Turkish Fund amounting to 104 million USD, second the Decree No 32 that enabled foreigners to invest in all types of securities in Turkey and transfer their returns.

Quests for a new system for the settlement and custody of securities commenced. The exchange was moved to its present premises in 1995. Activities like the development of new products, upgrade of the trading system gained speed. Recent developments include the introduction of new national and international indices, establishment of the Emerging Companies Market and the Corporate Products Market.

The ISE stock market indices are designed to measure the price and return performances of the stocks traded on the Exchange on an aggregate and sector basis. ISE price indices are calculated and announced throughout the entire sessions and return indices only at the end of the session. ISE 100 Index is the benchmark index for the national market.

ISE 100 Index consists of 100 stocks which are selected amongst the companies, except investment trusts, traded on the National Market in accordance with the criteria set by the ISE. ISE 100 Index automatically covers ISE 30 and ISE 50 stocks.
The other indices are: ISE National-All Shares Index, ISE National-30, ISE National-50, ISE National-100, Sector and sub-sector indices, ISE Second National Market Index, ISE New Economy Market Index and ISE Investment Trusts Index.



Turkey changed its import substitution strategy it adopted in the early 1960's after 20 years. In the early 1980's, the main issue in the economy was inflation. These 20 years period was marked by several International Monetary Fund supported disinflation programs' implementations with little or no success. The end of this period was marked by the effects of the financial crisis which had begun in South East Asia in the middle of 1996 and then spread further in some developing countries such as Russia and Brazil. Russia devalued the ruble by 33% against the dollar and declared a moratorium (Chambers 2006).

The next period started with a major banking crisis that took place in November 2000 which was due to a sudden increase in the demand for USD. This caused a rapid depletion of foreign exchange reserves of the country. The crisis started with a threefold increase in the overnight rates in the interbank market. The increase in the volatility of interest rates actually predated this development by a few months. Thus, the increase in the rates, coupled with an increase in its volatility was indeed a harbinger of the coming crisis. As summarized by Uygur 2001, the crisis staved of by the Central Bank at the cost of (a) high interest rates, (b) loss of sizable foreign exchange reserves and (c) Supplemental Reserve Facility extended by IMF, a short term facility with a high cost involved.

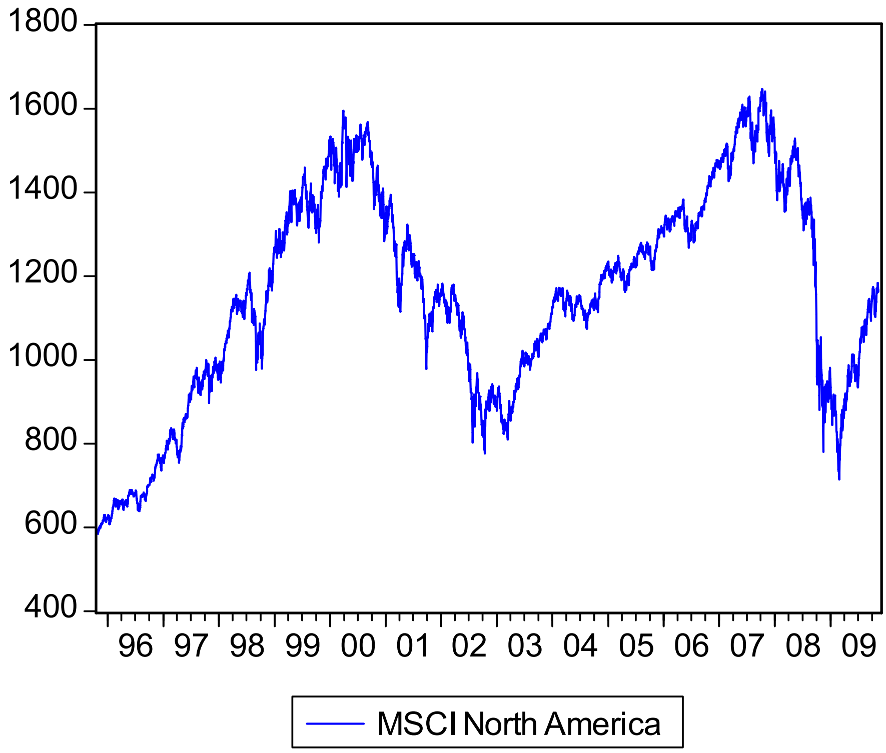
"So, the government had to abandon the fixed exchange rate regime and began to conduct a floating exchange rate regime. After this critical decision, the Turkish lira continued to devaluate against the USD. After some time, the Turkish economy became dependent on the capital inflows." (Yilmazkuday 2008)

Thus, the November 2000 crisis is of greater significance from the capital inflows point of view when compared to other several crises experienced throughout recent Turkish economic history. It is worthwhile to mention that there are also studies pointing out the fact that national stock markets become more interrelated after a crash and strengthening comovement among national stock markets (Metin et al 2001).

III.2. Other markets

The biggest constituents of the North American Markets are The New York Stock Exchange (NYSE) and The National Association of Securities Dealers Automated Quotations (NASDAQ). The NYSE is located in New York City, USA. It is the world's largest stock exchange by market capitalization of its listed companies at USD 28.5 trillion as of May 2008. The origin of the NYSE can be traced to May 17th, 1792, when the Buttonwood Agreement was signed by 24 stock brokers outside of 68 Wall Street in New York under a buttonwood tree on Wall Street. On March 8, 1817, the organization drafted a constitution and renamed itself the "New York Stock & Exchange Board".(NYSE)

The National Association of Securities Dealers Automated Quotations (NASDAQ) is an electronic stock exchange with more than 3,300 company listings. The NASDAQ is located in New York's Times Square. It was founded in 1971 by the National Association of Securities Dealers (NASD). It is owned and operated by the NASDAQ OMX Group, the stock of which was listed on its own stock exchange beginning July 2, 2002, under the ticker symbol NASDAQ: NDAQ. It is regulated by the Securities and Exchange Commission.(NASDAQ)

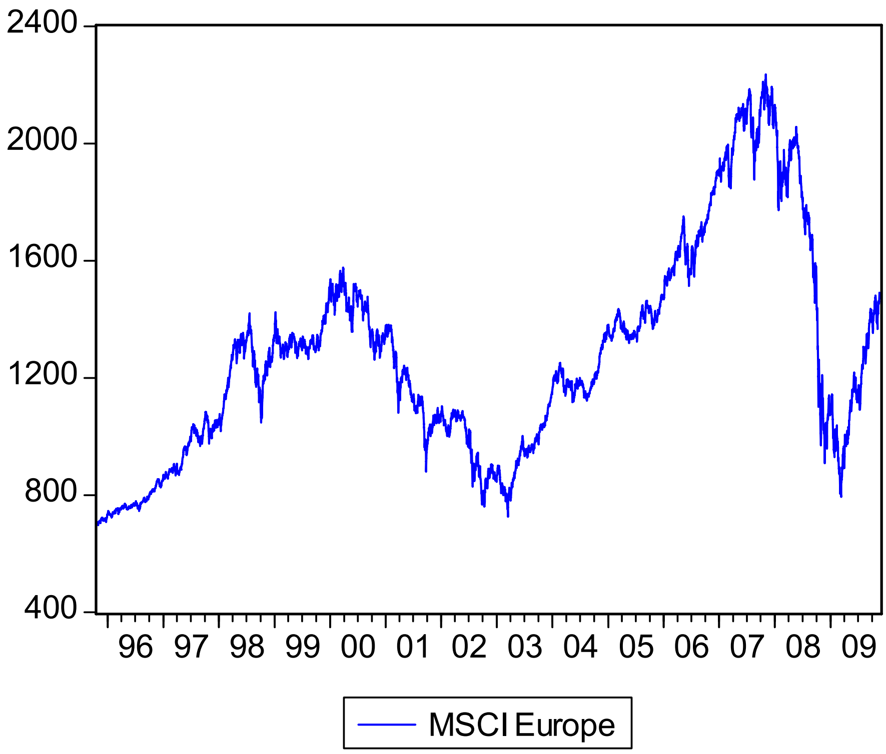


The stock market downturn of 2002 is the sharp drop in stock prices during that year in stock exchanges across the United States, Canada, Asia, and Europe. After recovering from lows reached following the September 11 attacks, indices slid steadily starting in March 2002, with dramatic declines in July and September leading to lows last reached in 1997 and 1998.

This downturn can be viewed as part of a larger bear market or correction, after a decade-long bull market had led to unusually high stock valuations. In fact, some Internet companies (Webvan, Exodus Communications, and Pets.com) went bankrupt. Others (Amazon.com, eBay, and Yahoo!) went down dramatically in value, but still are in business to this day and have generally good long term growth prospects.

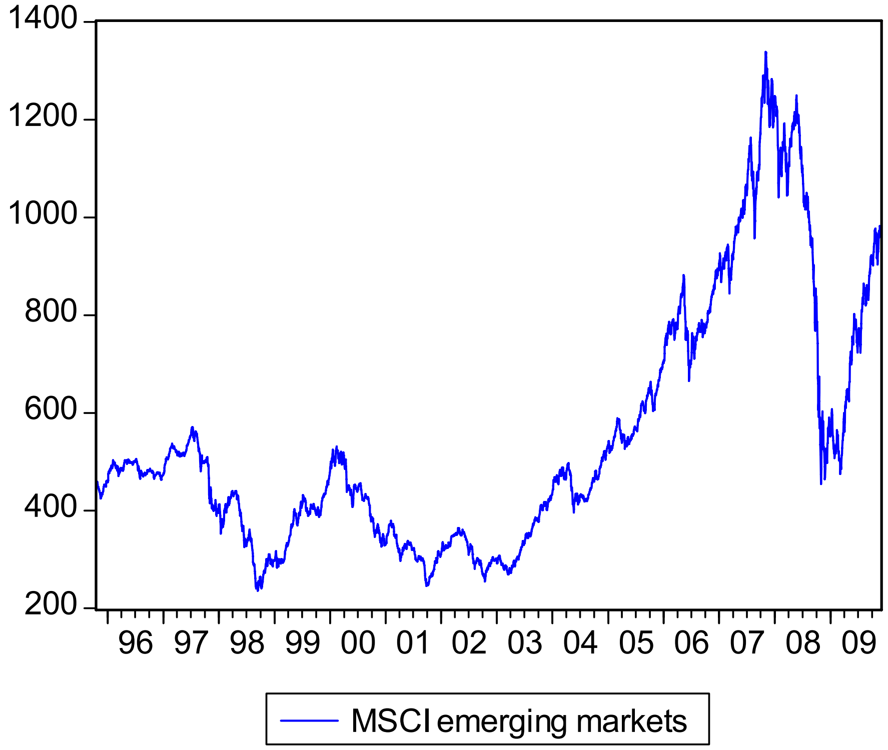
An outbreak of accounting scandals (Enron, Arthur Andersen, Adelphia, and WorldCom) was also a factor in the speed of the fall, as numerous large corporations were forced to restate earnings (or lack thereof) and investor confidence suffered. The September 11 attacks also contributed heavily to the stock market downturn, as investors became unsure about the prospect of terrorism affecting the United States economy.

Major constituents of European equity market include the London Stock Exchange, Bourse de Paris, and the Deutsche Börse. The London Stock Exchange is located in London, United Kingdom. Founded in 1801, it is one of the largest stock exchanges in the world, with many overseas listings as well as British companies. The exchange is part of the London Stock Exchange Group and sometimes referred to by the ticker symbol for the group, LSE. The history of Bourse de Paris goes back to the 19th century. The Deutsche Börse traces back its roots as early as the 16th century.



In mid-1997 the Asian financial crisis that erupted in Thailand with a series of speculative attacks on the Thai baht led to sharp declines in the currencies, stock markets, and other asset prices of a number of Asian countries. As the contagion spread to Korea, the world's eleventh largest economy, the possibility of a default by

Korea raised a potential threat to the international monetary system. In addition to its severe effects in Asia, the crisis has put pressure on emerging markets outside the region; contributed to virulent contagion and volatility in international financial markets. Subsequent crises originated from the developed countries took also their toll on the emerging markets.



We did not go into details or causes of the latest crisis of 2008 and 2009 on two accounts. First, labelled as the biggest crisis in the living memory it affected all the markets. Second although there are signs of recovery, as of the time of study we were in the crisis we deemed it more appropriate to leave the analysis of this for a later time.

CHAPTER IV

Econometric Methodology

In this section we will investigate the general model of cointegration and the related concept of stationarity.

IV.1. Unit root tests and cointegration

If two series are cointegrated, it can be said they share a common trend. As mentioned by Verbeek (2004), the assumption that two (or more) time series are stationary is crucial for the properties of standard estimation and testing procedures. To show consistency of the ordinary least squares (OLS) estimator for example, we typically use the result that when the sample size increases, sample (co)variances converge to population (co)variances. When the series are nonstationary the latter (co)variances are ill-defined because the series are not fluctuating around a constant mean. The correlations between financial quantities are notoriously unstable. An alternative statistical measure to correlation is cointegration. It is probably a more robust measure of the linkage between two financial quantities according to Wilmott (2007).

As described by Moroza (2008), if a linear combination of investigating non-stationary variables is stationary then the variables are said to be cointegrated. Many financial time series are non-stationary and some may move similarly over time. In other words, the two series never stray too far from one other (Wilmott 2007). This implies that these time series are bound by some relationship in the long run. Therefore, “in order to perform the cointegration test, the investigating time series should firstly be tested for the presence of a unit root” (Moroza 2008).

The existence of a unit root or structural break implies the existence of changing relationship in the long run, whereas the opposite implies a trend-stationary relationship. Thus, a time series integrated of order zero i.e. **I**(0) is stationary in levels, while for a time series integrated of orders one i.e. **I**(1)., the first difference is stationary while the levels are not.

As explained by Verbeek (2004), in the longer run, it can make a surprising amount of difference whether the series has an exact unit root or whether the root is slightly greater than one. It is the difference between being **I**(0) and **I**(1). In general, the main differences between processes that are **I**(0) and **I**(1) can be summarized as follows: An **I**(0) series fluctuates around its mean with a finite variance that does not depend on time, while an **I**(1) wanders widely. Typically, it is said that an **I**(0) series is mean reverting, as there is a tendency in the long run to return to its mean. Furthermore, an **I**(0) series has a limited memory of its past behaviour (implying that the effects of a particular random innovation are only transitory) while an **I**(1) process has an indefinitely long memory (implying that an innovation will permanently affect the process). This last aspect becomes clear from the lag increases, while for the **I**(1) process the estimated autocorrelation coefficients decay to zero very slowly. Stationarity of a stochastic process requires that the variances and autocovariances are finite and independent of time (Brooks 2008).

For the purpose of our analysis in this study series with constant mean, constant variance and constant autocovariance is defined for each given lag as being stationary. This is also defined as weak stationarity. There are two types of non-stationarity: stochastic: difference stationary series (random walk model with drift) and deterministic: trend stationary series.

Our interest will be limited to stochastic stationarity which has been found to best describe most non-stationary financial and economic data.

In its simpler form, a stochastic trend model may be written as follows:

$$y_t = y_{t-1} + u_t$$

or

$$\Delta y_t = u_t$$

Stationarity is achieved by differencing once. Therefore, there is one unit root. If more differentiation were needed to achieve differencing then there would have been more unit roots. Existence of a unit root shows stationarity. Furthermore, if two variables with differing orders of integration are combined, the combination will have an order of integration equal to the largest. If a linear combination of a set of variables is stationary, then this set of variables are said to be cointegrated.

Cointegration implies the very existence of a long term relationship binding the series together. If they are cointegrated they can not wander apart without boundries. Therefore, it is important to check the stationarity of the series under examination and this is done through unit root tests.

IV.2. Testing the data for stationarity and the existence of a unit root

As explained by Brooks (2008), the early pioneering work on testing for a unit root in time series was conducted by Dickey and Fuller (DF). Their hypothesis of interest is

H_0: Series contains unit root versus H_1: Series is stationary.

The basic objective of the test is to test the null hypothesis that $\phi = 1$ in:

$$y_t = \phi y_{t-1} + u_t$$

against the one-sided alternative $\phi < 1$.

Usually the following regression is used:

$$\Delta y_t = \psi y_{t-1} + u_t$$

so that a test of $\phi=1$ is equivalent to a test of $\psi=0$ (since $\phi-1=\psi$).

We can write

$$\Delta y_t = u_t$$

where $\Delta y_t = y_t - y_{t-1}$, and the alternatives may be expressed as

$$\Delta y_t = \psi y_{t-1} + \mu + \lambda_t + u_t$$

with

i) $\mu = \lambda = 0$ in case, and
ii) $\lambda = 0$ in case and
iii) $\psi = \phi - 1$.

In each case, the tests are based on the t-ratio on the y_{t-1} term in the estimated regression of Δy_t on y_{t-1}, plus a constant in case ii) and a constant and trend in case iii).

The tests above are only valid if u_t is white noise. In particular, u_t will be autocorrelated if there was autocorrelation in the dependent variable of the regression (Δy_t) which we have not modelled. The solution is to "augment" the test using p lags of the dependent variable. Hence, the test is named the Augmented Dickey Fuller (ADF) test.

Phillips and Perron (PP) have developed a more comprehensive theory of unit root nonstationarity. The tests are similar to ADF tests but incorporate an automatic correction to the DF procedure to allow for autocorrelated residuals. The tests usually give the same conclusions as the ADF tests and the calculation of the test statistics is complex.

IV.3. Method of parameter estimation in cointegrated systems: The Engle Granger 2 Step Method (Engle et al.1987)

This is a single equation technique to estimate parameters which is conducted as follows:

Step 1:

- Ensure all the individual variables are **I**(1)
- Estimate the cointegrating regression using OLS
- Save the residuals of the cointegrating regression
- Test these residuals to ensure they are **I**(0).

Step 2:

- Use step 1 residuals as one variable in the error correction model e.g.

$$\Delta y_t = \beta_1 \Delta x_t + \beta_2 (\hat{u}_{t-1}) + u_t$$

where $\hat{u}_{t-1} = y_{t-1} - \tau x_{t-1}$

The stationary and linear combination of nonstationary variables is also known as the cointegrating vector. Additionally, any linear transformation of the cointegrating vector will also be a cointegrating vector.

IV.4. Testing for and estimating cointegrating systems using the Johansen Technique based on VARs

To use Johansen's method, we need to turn the Vector autoregression (VAR) of the form

$$\underset{g\times 1}{y_t} = \underset{g\times g}{\beta_1}\ \underset{g\times 1}{y_{t-1}} + \underset{g\times g}{\beta_2}\ \underset{g\times 1}{y_{t-2}} + \ldots + \underset{g\times g}{\beta_k}\ \underset{g\times 1}{y_{t-k}} + \underset{g\times 1}{u_t}$$

into a VECM, which can be written as

$$\Delta y_t = \Pi\, y_{t-k} + \Gamma_1\, \Delta y_{t-1} + \Gamma_2\, \Delta y_{t-2} + \ldots + \Gamma_{k-1}\, \Delta y_{t-(k-1)} + u_t$$

where $\Pi = (\sum_{j=1}^{k} \beta_i) - I_g$ and $\Gamma_i = (\sum_{j=1}^{i} \beta_j) - I_g$

Π is a long run coefficient matrix since all the $\Delta y_{t-i} = 0$.

The test for cointegration between the y's is calculated by looking at the rank of the Π matrix via its eigenvalues. The rank of a matrix is equal to the number of its characteristic roots (eigenvalues) that are different from zero.

The eigenvalues denoted λ_i are put in order:

$$\lambda_1 \geq \lambda_2 \geq \dots \geq \lambda_g$$

If the variables are not cointegrated, the rank of Π will not be significantly different from zero, so $\lambda_i = 0 \ \forall \ i$.

Then if $\lambda_i = 0$, ln $(1-\lambda_i) = 0$

If the λ's are roots, they must be less than 1 in absolute value.

Say, rank (Π) = 1, then ln $(1-\lambda_1)$ will be negative and ln $(1-\lambda_i) = 0$

If the eigenvalue i is non-zero, then ln $(1-\lambda_i) < 0 \ \forall \ i > 1$.

The test statistics for cointegration are formulated as:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{g} \ln(1-\hat{\lambda}_i)$$

and

$$\lambda_{\max}(r, r+1) = -T \ln(1-\hat{\lambda}_{r+1})$$

where $\hat{\lambda}_i$ is the estimated value for the ith ordered eigenvalue from the Π matrix.

λ_{trace} tests the null that the number of cointegrating vectors is less than equal to r against an unspecified alternative.

$\lambda_{trace} = 0$ when all the $\lambda_i = 0$, so it is a joint test.

λ_{max} tests the null that the number of cointegrating vectors is r against an alternative of r+1.

Johansen et al. (1990) provide critical values for the statistics. The distribution of the test statistics is non-standard and, the critical values depend on the value g-r : the number of non-stationary components and whether constants are included in each of the equations. Intercepts can be included either in the cointegrating vectors themselves or as additional terms in the VAR. The latter is equivalent to including a trend in the data generating process for the levels of the series.

If the test statistic is greater than the critical value from Johansen's tables, reject the null hypothesis that there are r cointegrating vectors in favour of the alternative that there are $r + 1$ (for λ_{trace}) or more than (for λ_{max}). The testing is conducted in a sequence and under the null hypothesis, $r = 0,1,...,g - 1$ so that the hypothesis for λ_{max} is:

$H_0 : r = 0$ versus $H_1 : 0 < r \leq g$

$H_0 : r = 1$ versus $H_1 : 1 < r \leq g$

$H_0 : r = 2$ versus $H_1 : 2 < r \leq g$

.

.

$H_0 : r = g - 1$ versus $H_1 : r = g$

The first test involves a null hypothesis of no cointegration vectors (corresponding to Π having 0 rank). If this null hypothesis is not rejected, it would be concluded that there are no cointegrating vectors and the testing would be completed. However, if $H_0 : r = 0$ is rejected, the null hypothesis that there is one cointegrating vector (i.e. $H_0 : r = 1$) would be tested and so on. Thus, the value of r is continually increased until the null hypothesis is no longer rejected.

But how does this correspond to a test of the rank of Π matrix? r is the rank of Π. Π can not be of full rank (g) since this would correspond to univariate case, Δy_t depends only on Δy_{t-j} and not y_{t-1}, so there is no long run relationship between the elements of y_{t-1}. Hence there is no cointegration. For $1 <$ rank $(\Pi) < g$, there are r cointegrating vectors. Π is then defined as the product of two matrices, α and β', of dimension (g x r) and (r x g), respectively, i.e.

$$\Pi = \alpha \beta'$$

The matrix β gives the cointegrating vectors, while α gives the amount of each cointegrating vector entering each equation of the VECM, also known as the 'adjustment parameters'.

IV.5.The Zivot and Andrews test:

As mentioned by Narayan et al (2004), one of the models proposed by Zivot and Andrews to allow the effects of structural brakes is the crash-cum-growth model which allows for a structural break in intercept and slope.

The model has the following form:

$$\Delta y_t = \kappa + \Phi y_{t-1} + \beta_t + \Phi_1 DU_t + \gamma_1 DT_t + \sum_{j=1}^{k} d_j \Delta y_{t-j} + \varepsilon_t$$

Here is Δ is the first difference operator, ε_t is a white noise disturbance term with variance σ^2, and $t = 1,\ldots..,T$ is an index of time. The Δy_{t-j} term on the right-hand side of the equation allow for serial correlation and ensure that the disturbance term is white noise. DU_t is an indicator dummy variable for a mean shift occurring at time TB and DT_t is the corresponding trend shift variable, where

$$DU_t = \begin{cases} 1 \text{ } if\ t > TB \\ 0 \text{ } otherwise \end{cases}$$

and

$$DT_t = \begin{cases} t - TB & if\ t > TB \\ 0 & otherwise \end{cases}$$

The breakpoint is searched for over the range of the sample (0.15T, 0.85T). The null hypothesis is that $\Phi = 0$ in the above equation, which implies that the series $\{ y_t \}$ is an integrated process without a structural break. The alternative hypothesis is that $\Phi < 0$, which implies that { y_t } is breakpoint stationary. The breakpoint is selected by choosing the value of *TB* for which the *t*-statistic for Φ is minimized.

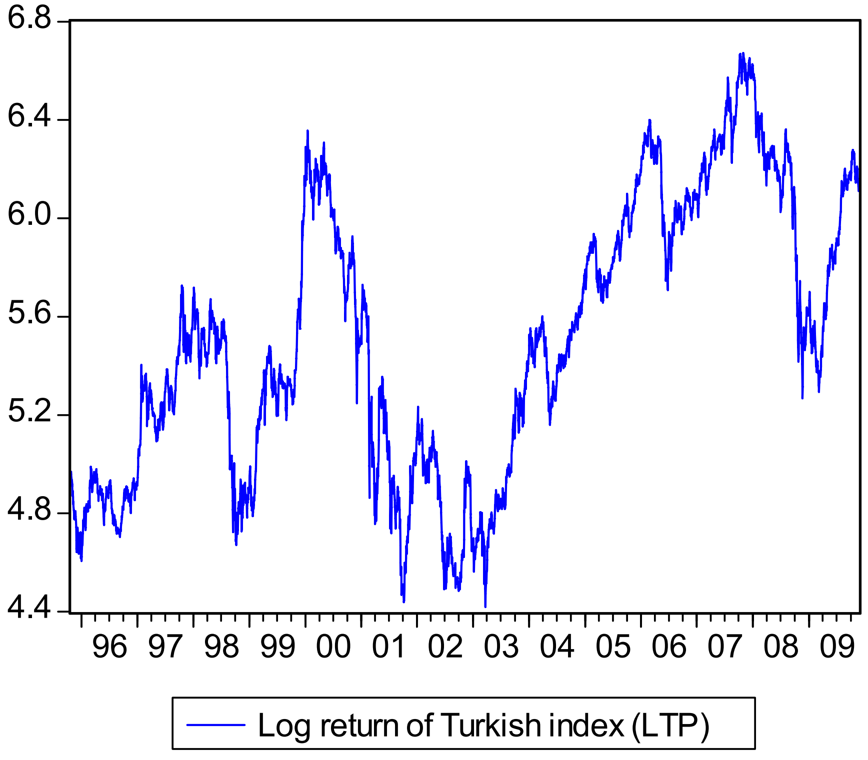
CHAPTER V

Econometric Modelling

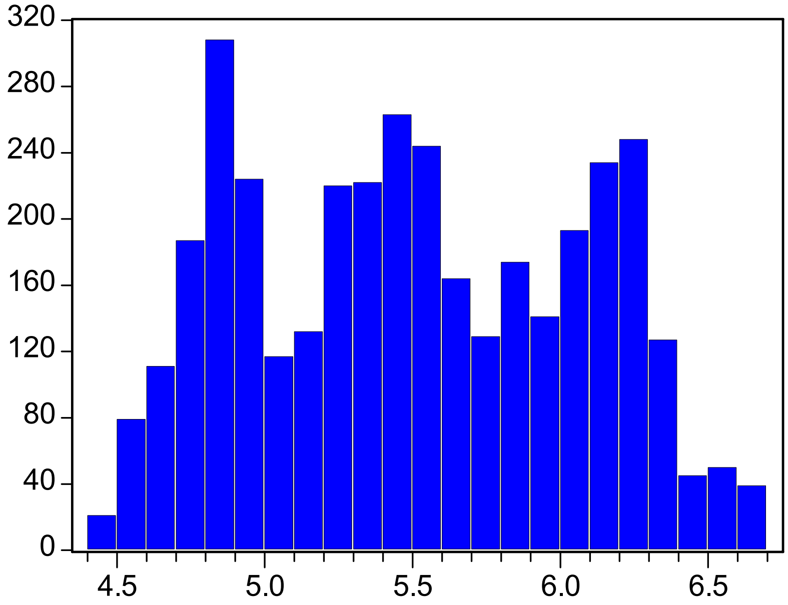
V.1. Data description

We used daily data from the October 23, 1995 until November 20, 2009. In our study, we used the relevant Morgan Stanley Capital International (MSCI) indices, namely MSCI Turkey, MSCI North America, MSCI Europe and MSCI Emerging Markets. All these indices are denominated in USD. We used Bloomberg information system to access and extract the data. We start our analysis by describing the data visually and giving their descriptive statistics.

Log return of Turkish index (LTP)



Log return of Turkish Index (LTP) has the following descriptive statistical data distribution properties:



Series: LTP
Sample 10/23/1995 11/20/2009
Observations 3672

Mean	5.508041
Median	5.485162
Maximum	6.671805
Minimum	4.418817
Std. Dev.	0.556240
Skewness	0.080435
Kurtosis	1.894432
Jarque-Bera	190.9686
Probability	0.000000

Empirical Distribution Test for LTP
Hypothesis: Normal

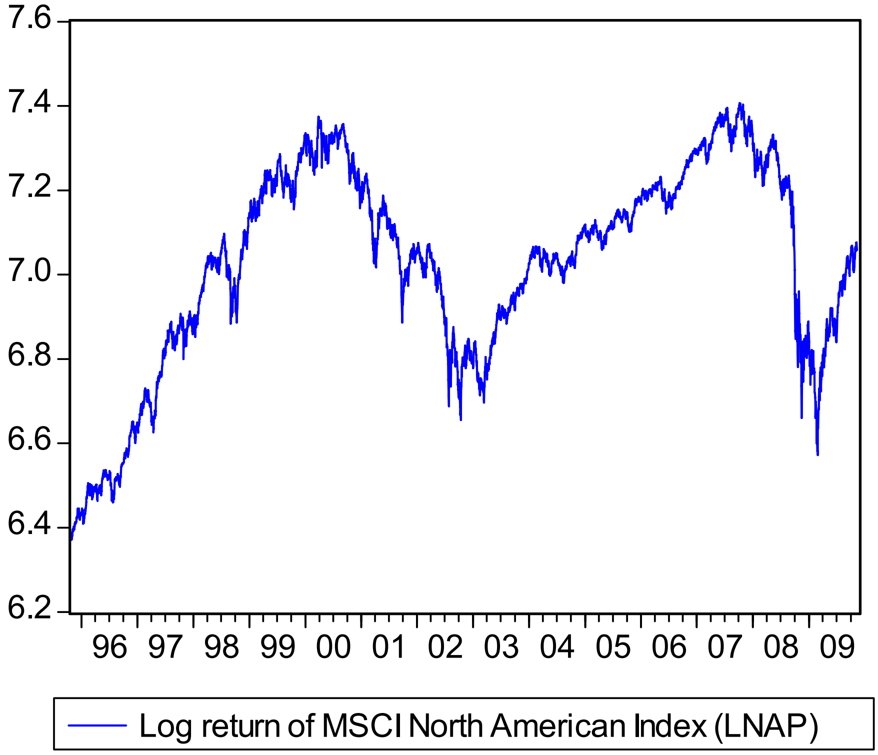
Method	Value	Adj. Value	Probability
Lilliefors (D)	0.075201	NA	0.0000
Cramer-von Mises (W2)	5.266034	5.266751	0.0000
Watson (U2)	5.235926	5.236639	0.0000
Anderson-Darling (A2)	38.08403	38.09181	0.0000

Method: Maximum Likelihood - d.f. corrected (Exact Solution)

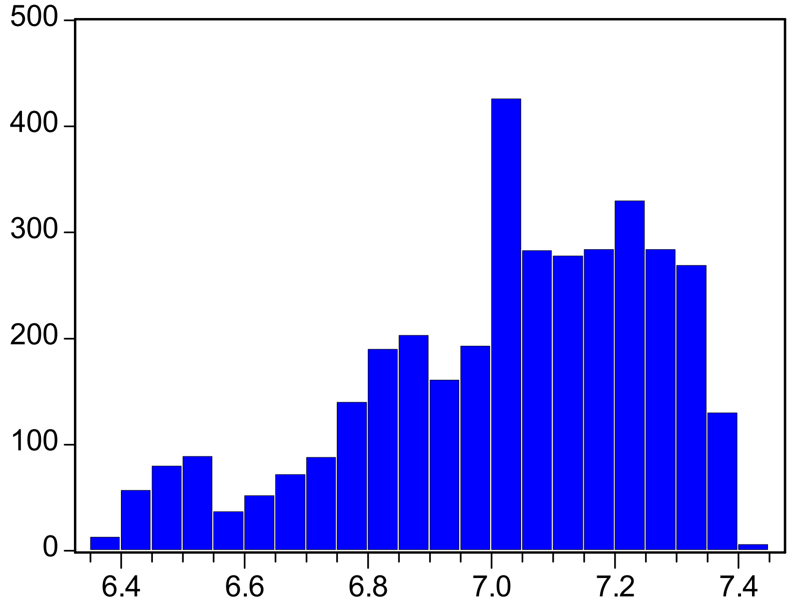
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	5.508041	0.009179	600.0488	0.0000
SIGMA	0.556240	0.006492	85.68547	0.0000
Log likelihood	-3056.009	Mean dependent var.		5.508041
No. of Coefficients	2	S.D. dependent var.		0.556240

The normal distribution has a number of important characteristics in statistical analysis. It is symmetric, has a given central tendency (mean), density (variance), symmetry (skewness) and tails (kurtosis). A normality test determines whether the data fits these specifications or not (Newbold et al 2006). The normality test is convincingly rejected. As expected the series are not normally distributed.

MSCI North American Index is a capitalization weighted index that monitors the performance of stocks from the continent of North America, namely two countries, United States of America and Canada.



Log return of MSCI North American Index (LNAP) has the following descriptive statistical data distribution properties:



Series: LNAP
Sample 10/23/1995 11/20/2009
Observations 3665

Mean	7.025768
Median	7.053689
Maximum	7.406395
Minimum	6.371680
Std. Dev.	0.238904
Skewness	-0.710397
Kurtosis	2.846657
Jarque-Bera	311.8565
Probability	0.000000

Empirical Distribution Test for LNAP
Hypothesis: Normal

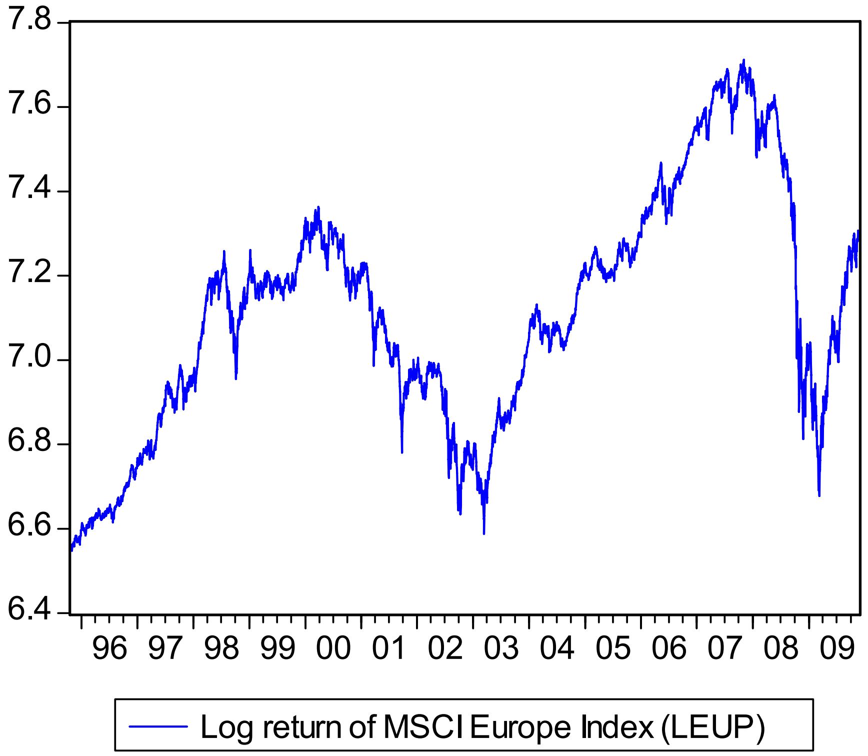
Method	Value	Adj. Value	Probability
Lilliefors (D)	0.085264	NA	0.0000
Cramer-von Mises (W2)	7.102934	7.103903	0.0000
Watson (U2)	5.411715	5.412454	0.0000
Anderson-Darling (A2)	49.65783	49.66800	0.0000

Method: Maximum Likelihood - d.f. corrected (Exact Solution)

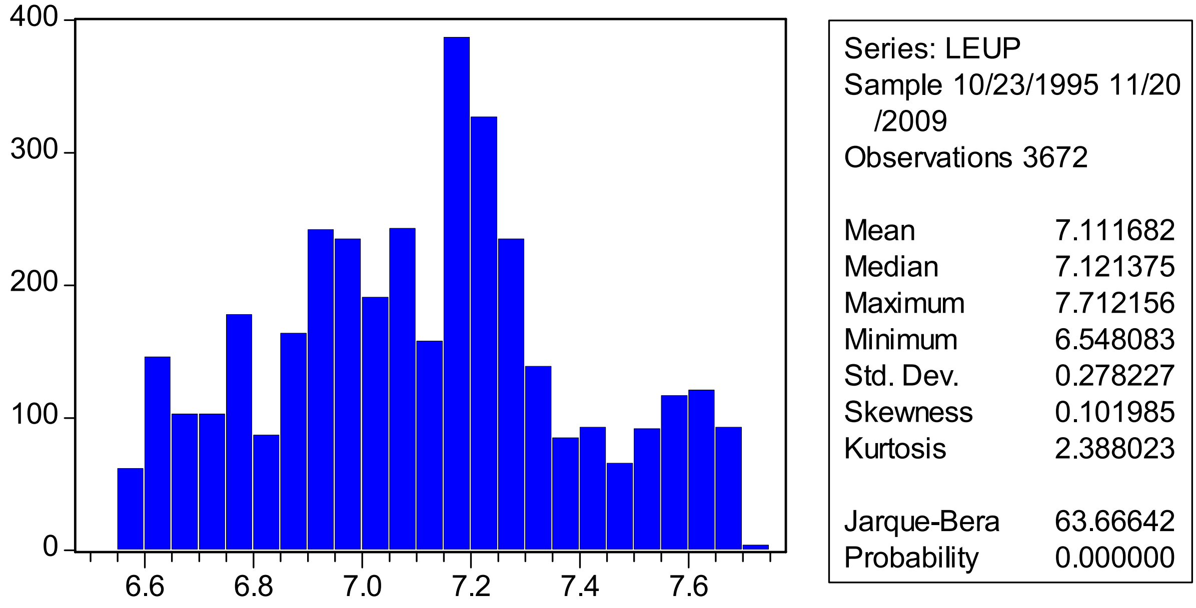
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	7.025768	0.003946	1780.361	0.0000
SIGMA	0.238904	0.002791	85.60374	0.0000
Log likelihood	47.25367	Mean dependent var.		7.025768
No. of Coefficients	2	S.D. dependent var.		0.238904

The normality test is convincingly rejected. As expected the series are not normally distributed.

The MSCI Europe Index is a free float-adjusted market capitalization weighted index that is designed to measure the equity market performance of the developed markets in Europe. As of June 2007, the MSCI Europe Index consists of the following 16 developed market country indices: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.



Log return of MSCI Europe Index (LEUP) has the following descriptive statistical data distribution properties:



Empirical Distribution Test for LEUP
Hypothesis: Normal
Date: 01/12/10 Time: 23:48
Sample: 10/23/1995 11/20/2009
Included observations: 3672

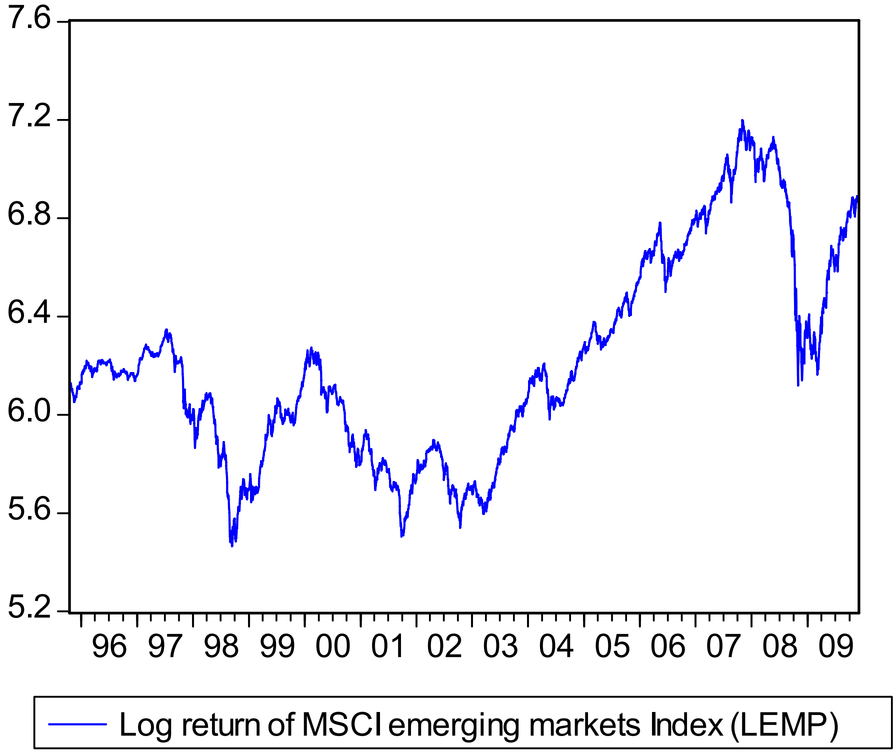
Method	Value	Adj. Value	Probability
Lilliefors (D)	0.038937	NA	0.0000
Cramer-von Mises (W2)	1.357970	1.358155	0.0000
Watson (U2)	1.329457	1.329638	0.0000
Anderson-Darling (A2)	12.64530	12.64788	0.0000

Method: Maximum Likelihood - d.f. corrected (Exact Solution)

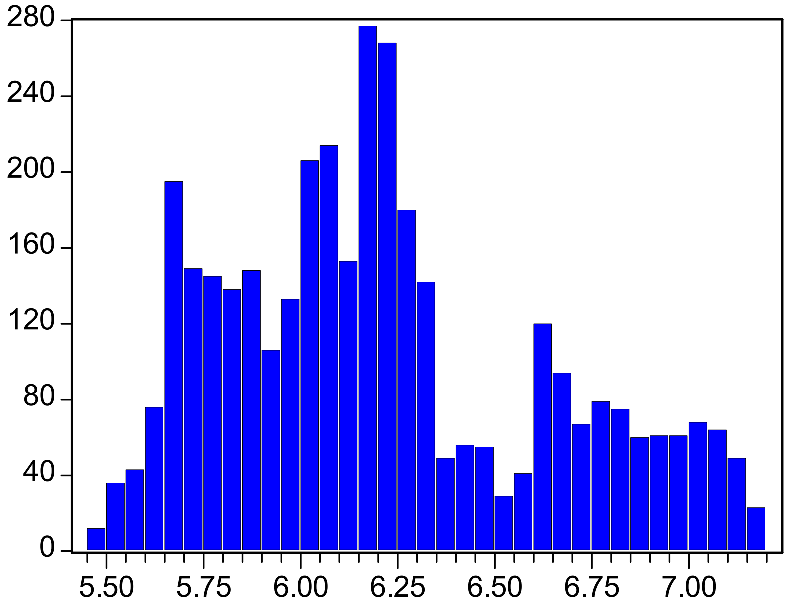
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	7.111682	0.004591	1548.905	0.0000
SIGMA	0.278227	0.003247	85.68547	0.0000
Log likelihood	-512.1825	Mean dependent var.		7.111682
No. of Coefficients	2	S.D. dependent var.		0.278227

The normality test is convincingly rejected. As expected the series are not normally distributed.

The MSCI Emerging Markets Index is a free float-adjusted market capitalization index that is designed to measure equity market performance of emerging markets. As of June 2009, the MSCI Emerging Markets Index consists of the following 22 emerging market country indices: Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, and Turkey.



Log return of MSCI Emerging Markets Index (LEMP) has the following descriptive statistical data distribution properties:



Series: LEMP	
Sample 10/23/1995 11/20/2009	
Observations 3672	
Mean	6.214786
Median	6.165376
Maximum	7.199297
Minimum	5.464721
Std. Dev.	0.414551
Skewness	0.529932
Kurtosis	2.416883
Jarque-Bera	223.8903
Probability	0.000000

Empirical Distribution Test for LEMP
Hypothesis: Normal
Date: 01/12/10 Time: 23:55
Sample: 10/23/1995 11/20/2009
Included observations: 3672

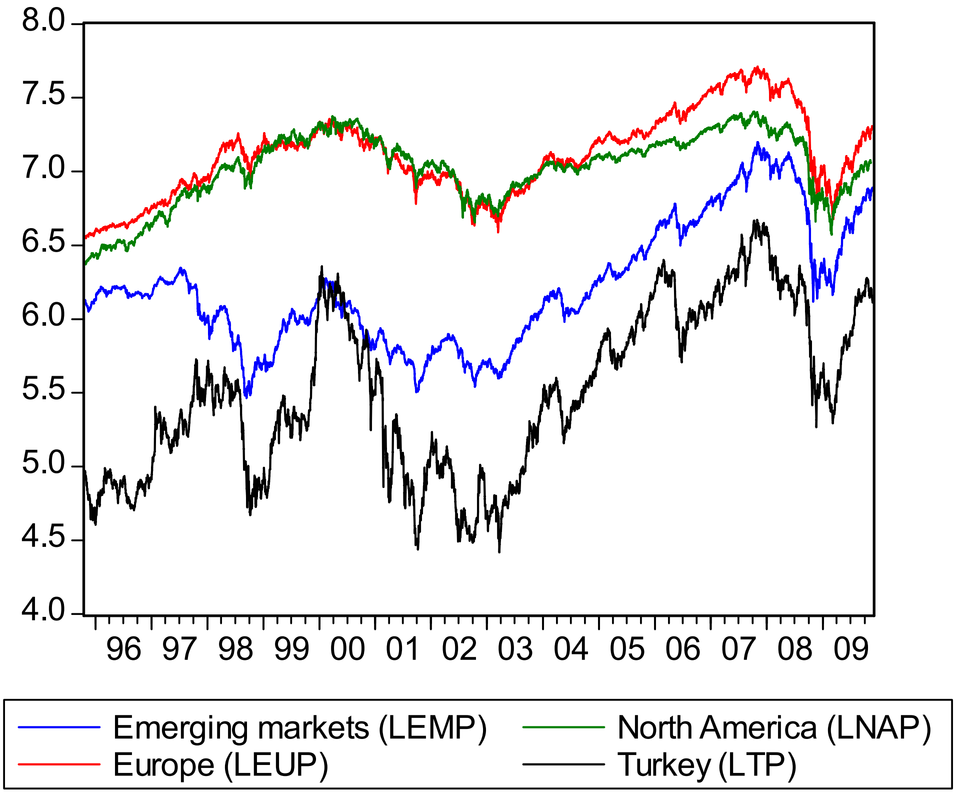
Method	Value	Adj. Value	Probability
Lilliefors (D)	0.097330	NA	0.0000
Cramer-von Mises (W2)	8.741158	8.742348	0.0000
Watson (U2)	7.480481	7.481499	0.0000
Anderson-Darling (A2)	54.46907	54.48021	0.0000

Method: Maximum Likelihood - d.f. corrected (Exact Solution)

Parameter	Value	Std. Error	z-Statistic	Prob.
MU	6.214786	0.006841	908.4458	0.0000
SIGMA	0.414551	0.004838	85.68547	0.0000

Log likelihood	-1976.433	Mean dependent var.	6.214786
No. of Coefficients	2	S.D. dependent var.	0.414551

The normality test is convincingly rejected. As expected, the series are not normally distributed. When all data are plotted together, we can clearly see that starting from the turn of the last millennium markets began to move together.



Summary information relating to the above plotted data is given in the following table:

Index name	# of countries	Countries
MSCI Turkey	1	Turkey
MSCI Europe	16	Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom.
MSCI North America	2	United States of America and Canada
MSCI Emerging Markets	22	Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, and Turkey.

V.2. Empirical model

We follow Narayan et al (2003) in their use of daily data as this is preferred to lower frequency data (e.g. weekly or monthly) because "longer time horizons can obscure transient processes to innovations which may last only few days". At the outset, we did not have any prejudice for using two lags. Our decision to use two lags is the result of the Johansen test that we applied in the empirical study which we conducted. The specification of the data used is given in the forthcoming sections. The variables used in the model are given in the following table:

	Index	Log index	First difference (Return)
MSCI Turkey	TP	LTP	Δ (LTP)
MSCI North America	NAP	LNAP	Δ (LNAP)
MSCI Europe	EUP	LEUP	Δ (LEUP)
MSCI Emerging Markets	EMP	LEMP	Δ (LEMP)

Where index denotes the row index figures, and

$LTP = ln\ (TP_t)$	$\Delta\ (LTP) = \ln\ (TP_t\ /\ TP_{t-1})$
$LNAP = ln\ (NAP_t)$	$\Delta\ (NAP) = \ln\ (NAP_t\ /\ NAP_{t-1})$
$LEUP = ln\ (EUP_t)$	$\Delta\ (EUP) = \ln\ (EUP_t\ /\ EUP_{t-1})$
$LEMP = ln\ (EMP_t)$	$\Delta\ (EMP) = \ln\ (EMP_t\ /\ EMP_{t-1})$

are the natural logs of the stock returns in the Turkish, North American, European and emerging markets at time *t* respectively. Δ denotes the first level differences of the variables.

$$\Delta\ (LEMP) = \beta_{11} + \beta_{12}\,\Delta\ (LEMP_{t-1}) + \beta_{13}\,\Delta(LEMP_{t-2})$$

$$+ \beta_{14} \Delta (LEUP_{t-1}) + \beta_{15} \Delta(LEUP_{t-2})$$
$$+ \beta_{16} \Delta (LNAP_{t-1}) + \beta_{17} \Delta(LNAP_{t-2})$$
$$+ \beta_{18} \Delta (LTP_{t-1}) + \beta_{19} \Delta(LTP_{t-2})$$
$$+ \beta_{10} (LEMP_{t-1} + \gamma_{11} LEUP_{t-1} + \gamma_{12} LNAP_{t-1} + \gamma_{13} LTP_{t-1})$$
$$+ u_{1t}$$

where the u terms are serially independent random errors with mean zero and finite covariance matrix. All equations for the remaining three variables are written in the same way. We did not include these equations in this section to facilitate the reading. The full set of equations is available in Appendix I. These equations are used to test whether the above mentioned markets are cointegrated.

V.3. Unit root test

We conducted unit root tests, namely Augmented Dickey-Fuller and Phillips-Perron tests to check the stationarity of the series. The results of both tests are given in the following table:

Exogenous:	Constant				Constant, Linear Trend			
Lag Length:	0		1		0		1	
	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*	t-Statistic	Prob.*
ADF test statistic								
Emerging Markets	-0.657747	0.8551	-47.20824	0.0001	-1.658895	0.7692	-47.21937	0
Europe	-1.985637	0.2934	-29.03036	0	-1.811914	0.699	-29.04275	0
North America	-2.710322	0.0723	-46.49883	0.0001	-2.259566	0.4556	-46.53243	0
Turkey	-1.811097	0.3755	-57.72245	0.0001	-2.335999	0.4136	-57.71461	0
	Adj. t-Stat	Prob.*	Adj. t-Stat	Prob.*	Adj. t-Stat	Prob.*	Adj. t-Stat	Prob.*
P-P test statistic								
Emerging Markets	-0.572237	0.8742	-47.11088	0.0001	-1.596738	0.7945	-47.11837	0
Europe	-2.010678	0.2824	-59.69691	0.0001	-1.869172	0.6702	-59.70104	0
North America	-2.690437	0.0757	-64.38498	0.0001	-2.231547	0.4712	-64.44773	0
Turkey	-1.773742	0.394	-57.69035	0.0001	-2.301522	0.4325	-57.6824	0

Phillips-Perron test critical values		Augmented Dickey-Fuller test critical values	
1% level	-3.96054	1% level	-3.4319
5% level	-3.41103	5% level	-2.8621
10% level	-3.127331	10% level	-2.5671

*MacKinnon (1996) one-sided p-values.

By looking at the ADF statistics for levels, we can easily observe that all of the series are nonstationary at 5% significance level. All differenced series are stationary at all significance levels. By looking at the P-P statistics for levels, we can easily observe that all series are nonstationary at 5% significance level. All of the differenced series are stationary at all significance levels.

Thus, we can conclude that all of the series are **I**(1). We also performed Engle-Granger (Engle et al.1987) two step approach to see the existence of cointegration equation for bivariate cases. We decided that the levels of all the series are nonstationary, since we cannot reject the existence of unit roots in all series. (ADF and P-P test results given above). Then, we will check if the first differences of the series are stationary or not. This time, the null hypothesis can convincingly be rejected therefore we can say that the series is integrated of order 1.

Once the test is applied to other series we find out that the same result is reached for European, North American and Turkish series, i.e. the hypothesis that there is a unit root is convincingly rejected and the first differences are stationary.

As the second step, we will check if the residuals of the regressions of various pairs are stationary or not. There are six possible combinations. The following table is the results of the unit root test applied to the residuals of the regressed pairs.

		t-Statistic	Prob.*
Emerging markets- Europe		-49.57197	0.0001
Emerging markets- North America		-48.26409	0.0001
Emerging markets- Turkey		-47.30086	0.0001
Europe- North America		-48.02891	0.0001
Europe- Turkey		-29.06202	0.0000
North America- Turkey		-46.52928	0.0001
Test critical values:	1% level	-3.431949	
	5% level	-2.862132	
	10% level	-2.567129	

*MacKinnon (1996) one-sided p-values.

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This analysis reveals that all of residuals of the possible pairs are stationary. Thus, we can conclude that these pairs are cointegrated at all levels of significance.

V.4. Cointegration analysis

As the next step, we will check the existence of cointegration equitation. The following table is the summary of five different types of cointegration tests with different trend and intercept.

Lags interval: 1 to 2, 3 to 4

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	1	1	1	1	1
Max-Eig	1	1	2	1	1

*Critical values based on MacKinnon-Haug-Michelis (1999)

Information Criteria by Rank and Model

Data Trend:	None	None	Linear	Linear	Quadratic
Rank or No. of CEs	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
	Log Likelihood by Rank (rows) and Model (columns)				
0	41298.74	41298.74	41299.45	41299.45	41304.59
1	41317.11	41327.92	41328.62	41328.65	41333.04
2	41322.18	41338.85	41339.49	41340.68	41343.91
3	41322.65	41342.75	41342.86	41346.59	41346.63
4	41322.93	41343.04	41343.04	41348.65	41348.65
	Akaike Information Criteria by Rank (rows) and Model (columns)				
0	-22.53265	-22.53265	-22.53084	-22.53084	-22.53147
1	-22.53831	-22.54367	-22.54241	-22.54188	-22.54264
2	-22.53671	-22.54472*	-22.54399	-22.54354	-22.54421
3	-22.53260	-22.54194	-22.54145	-22.54185	-22.54133
4	-22.52838	-22.53718	-22.53718	-22.53806	-22.53806
	Schwarz Criteria by Rank (rows) and Model (columns)				
0	-22.42414*	-22.42414*	-22.41556	-22.41556	-22.40940
1	-22.41624	-22.41990	-22.41356	-22.41134	-22.40701
2	-22.40108	-22.40570	-22.40157	-22.39774	-22.39501
3	-22.38340	-22.38766	-22.38547	-22.38079	-22.37857
4	-22.36562	-22.36764	-22.36764	-22.36174	-22.36174

By looking at trace and maximum eigenvalue tests we conclude that there is one cointegration equation at 5% confidence level. In the following table the details of Johansen test with intercept and trend are presented.

Series: LEMP LEUP LNAP LTP
Lags interval (in first differences): 1 to 2
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.015161	86.85878	54.07904	0.0000
At most 1	0.006050	30.91217	35.19275	0.1347
At most 2	0.002200	8.690283	20.26184	0.7648
At most 3	0.000171	0.625580	9.164546	0.9880

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.015161	55.94660	28.58808	0.0000
At most 1	0.006050	22.22189	22.29962	0.0513
At most 2	0.002200	8.064703	15.89210	0.5400
At most 3	0.000171	0.625580	9.164546	0.9880

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

1 Cointegrating Equation(s): Log likelihood 41205.62

Normalized cointegrating coefficients (standard error in parentheses)

LEMP	LEUP	LNAP	LTP	C
1.000000	-2.561608	2.913926	-0.409194	-6.213804
	(0.29419)	(0.24426)	(0.08567)	(0.78932)

Adjustment coefficients (standard error in parentheses)

D(LEMP)	0.000973
	(0.00092)
D(LEUP)	0.002763
	(0.00125)
D(LNAP)	-0.005822
	(0.00124)
D(LTP)	0.015080
	(0.00320)

V.5. Vector Error Correction Modelling

By using the Zivot and Andrews test (Appendix II), we found a structural break in November 2000. After performing the Johansen test, we decided to see the mentioned cointegrating equation and form the following VECM. A dummy has been used for November 2000 as suggested by the Zivot and Andrews test. The estimates are shown in the table below:

Vector Error Correction Estimates
Sample (adjusted): 10/26/1995 11/11/2009
Included observations: 3662 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegration Restrictions:
A(1,1)=0
LR test for binding restrictions (rank = 1):

Chi-square(1)	1.175042
Probability	0.278368

Cointegrating Eq:	CointEq1
LEMP(-1)	-6.016763
LEUP(-1)	15.73249
LNAP(-1)	-17.70930
LTP(-1)	2.383766
C	36.80183

Error Correction:	D(LEMP)	D(LEUP)	D(LNAP)	D(LTP)
CointEq1	0.000000	-0.000459	0.000974	-0.002472
	(0.00000)	(0.00021)	(0.00020)	(0.00053)
	[NA]	[-2.22528]	[4.78016]	[-4.67869]
D(LEMP(-1))	0.078850	-0.008375	-0.051388	0.038449
	(0.01626)	(0.02200)	(0.02176)	(0.05629)
	[4.84816]	[-0.38063]	[-2.36178]	[0.68310]
D(LEMP(-2))	0.006955	-0.024276	-0.006882	0.008309
	(0.01259)	(0.01704)	(0.01685)	(0.04359)
	[0.55221]	[-1.42477]	[-0.40842]	[0.19063]
D(LEUP(-1))	0.605769	-0.003091	0.217602	0.045512
	(0.01203)	(0.01627)	(0.01609)	(0.04162)

	[50.3674]	[-0.18995]	[13.5240]	[1.09343]
D(LEUP(-2))	0.169429	-0.044262	0.055760	0.043593
	(0.01556)	(0.02105)	(0.02081)	(0.05384)
	[10.8899]	[-2.10299]	[2.67893]	[0.80960]
D(LNAP(-1))	0.002827	-0.009043	-0.099166	0.110264
	(0.01261)	(0.01706)	(0.01687)	(0.04364)
	[0.22419]	[-0.53016]	[-5.87864]	[2.52678]
D(LNAP(-2))	-0.015038	0.017331	-0.056392	-0.016358
	(0.01245)	(0.01684)	(0.01665)	(0.04308)
	[-1.20819]	[1.02927]	[-3.38659]	[-0.37974]
D(LTP(-1))	0.010423	0.029851	0.020197	0.044741
	(0.00477)	(0.00645)	(0.00638)	(0.01649)
	[2.18695]	[4.62996]	[3.16762]	[2.71255]
D(LTP(-2))	0.041975	0.122384	0.016365	0.002417
	(0.00478)	(0.00647)	(0.00639)	(0.01654)
	[8.78331]	[18.9302]	[2.55958]	[0.14613]
C	2.70E-05	0.000155	0.000168	0.000399
	(0.00015)	(0.00021)	(0.00021)	(0.00053)
	[0.17637]	[0.74820]	[0.82020]	[0.75184]
LTPDUMMYM	-0.001589	0.000985	-0.001220	-0.018555
	(0.00198)	(0.00268)	(0.00265)	(0.00685)
	[-0.80315]	[0.36787]	[-0.46069]	[-2.70939]
R-squared	0.478040	0.100435	0.071934	0.014740
Adj. R-squared	0.476611	0.097971	0.069392	0.012041
Sum sq. resids	0.311753	0.570528	0.557970	3.733970
S.E. equation	0.009241	0.012501	0.012362	0.031980
F-statistic	334.3794	40.76271	28.29874	5.462041
Log likelihood	11962.71	10856.15	10896.90	7416.311
Akaike AIC	-6.527424	-5.923073	-5.945329	-4.044408
Schwarz SC	-6.508783	-5.904432	-5.926688	-4.025767
Mean dependent	0.000198	0.000198	0.000185	0.000346
S.D. dependent	0.012773	0.013162	0.012815	0.032174

Determinant resid covariance (dof adj.)	2.00E-15
Determinant resid covariance	1.97E-15
Log likelihood	41209.89
Akaike information criterion	-22.48055
Schwarz criterion	-22.39921

By observing this table we write the estimated equations as follows:

$\Delta(LEMP) = 0*(- 6.016 * LEMP_{t-1} + 15.7324 * LEUP_{t-1} - 17.7093 * LNAP_{t-1}$
$+2.3837 * LTP_{t-1} + 36.8018)$
$+ 0.0788 * \Delta (LEMP_{t-1}) + 0.0069* \Delta (LEMP_{t-2})$
$+ 0.6057 * \Delta (LEUP_{t-1}) + 0.1694 * \Delta (LEUP_{t-2})$
$+ 0.0028 * \Delta (LNAP_{t-1}) - 0.01503 * \Delta (LNAP_{t-2})$
$+ 0.0104 * \Delta (LTP_{t-1}) + 0.04194* \Delta (LTP_{t-2}) + 2.7027e-005$
$- 0.0015 * LTPDUMMYM$

$\Delta (LEUP) =$
$- 0.0004 * (- 6.0167 * LEMP_{t-1} + 15.7324 * LEUP_{t-1} - 17.7093 * LNAP_{t-1}$
$+ 2.3837 * LTP_{t-1} + 36.8018)$
$- 0.0083 * \Delta (LEMP_{t-1}) - 0.0242 * \Delta (LEMP_{t-2})$
$- 0.0030* \Delta (LEUP_{t-1}) - 0.0442 * \Delta (LEUP_{t-2})$
$- 0.0090 * \Delta (LNAP_{t-1}) + 0.0173 * \Delta (LNAP_{t-2})$
$+ 0.0298 * \Delta (LTP_{t-1}) + 0.1223 * \Delta (LTP_{t-2}) + 0.0001 + 0.0009 * LTPDUMMYM$

$\Delta (LNAP) =$
$0.0009 * (- 6.016 * LEMP_{t-1} + 15.7324 * LEUP_{t-1}- 17.7093 * LNAP_{t-1}$
$+ 2.3837 * LTP_{t-1} + 36.8018)$
$- 0.0513* \Delta (LEMP_{t-1}) - 0.0068 * \Delta (LEMP_{t-2})$
$+ 0.2176 * \Delta (LEUP_{t-1}) + 0.0557 * \Delta (LEUP_{t-2})$
$- 0.0991 * \Delta (LNAP_{t-1}) - 0.0563 * \Delta (LNAP_{t-2})$
$+ 0.0201 * \Delta (LTP_{t-1}) + 0.0163 * \Delta (LTP_{t-2}) + 0.0001$
$- 0.001219595484 * LTPDUMMYM$

$\Delta (LTP) =$
$- 0.0024 *(- 6.0167 * LEMP_{t-1} + 15.7324 * LEUP_{t-1} - 17.7093 * LNAP_{t-1} + 2.3837 *$
$LTP_{t-1} + 36.8018)$
$+ 0.0384 * \Delta (LEMP_{t-1}) + 0.0083 * \Delta (LEMP_{t-2})$
$+ 0.0455 * \Delta (LEUP_{t-1}) + 0.0435 * \Delta (LEUP_{t-2})$
$+ 0.1102 * \Delta (LNAP_{t-1}) - 0.0163 * \Delta (LNAP_{t-2})$
$+ 0.0447 * \Delta (LTP_{t-1}) + 0.0024 * \Delta (LTP_{t-2})$
$+ 0.0003 - 0.0185 * LTPDUMMYM$

From the above equations, we observe two types of relations between variables, long term and short term. The long term relation is driven by cointegrating term which is constant for four variables.

$$- 6.0167 * LEMP_{t-1} + 15.7324 * LEUP_{t-1} - 17.7093 * LNAP_{t-1} + 2.3837 * LTP_{t-1} + 36.8018$$

To illustrate the setup for the Turkish market, one can conclude that coefficient of cointegrating equation for Turkey is 0.002 which means that the residuals of the long term relationship between four markets at time t-1 affect the short term return of Turkish market 0.2% at time t.

Other coefficients such as 0.038 of Δ ($LEMP_{t-1}$) show the short term relationship of returns between four markets. We did not comment on these short term coefficients as we did not consider them as significant. This comment can be generalized for all variables.

CHAPTER VI

Policy Implications and Conclusions

The objective of this study was to identify and model a relationship between four financial markets namely, Turkish, European, North American and emerging markets using cointegration technique. We first checked the existence of cointegrating equation between four stock market indices. Furthermore, we constructed a VECM to observe short and long run relationships between the four markets. In our study, we used daily data from the October 23, 1995 until November 20, 2009 of the relevant Morgan Stanley Capital International (MSCI) indices, namely MSCI Turkey, MSCI North America, MSCI Europe and MSCI Emerging Markets. All indices are denominated in USD. Bloomberg information system is utilized to access and extract the data. We first checked the data for stationarity. To check the stationarity and establish the order of integration of the series, we applied the Augmented Dickey Fuller and Phillips-Perron unit root tests. As the Turkish economy underwent a major financial crisis at the turn of the century, we also used the Zivot Andres test to allow for the effects of such structural breaks. Furthermore, we applied the Johansen test to check for the existence of a cointegrating vector, and then we constructed the VECM. To illustrate the setup for the Turkish market one can conclude that coefficient of cointegrating equation for Turkey is 0.002 which means that the residuals of the long term relationship between four markets at time t-1 affect the short term return of Turkish market 0.2% at time t.

Our first finding is that the Turkish equity market is cointegrated with the European, North American and emerging markets. The fact that the Turkish equity markets are cointegrated with the European, North American and emerging markets indicates that investing in the Turkish markets does not provide an opportunity for risk diversification in the long run. It is only possible to benefit from the discrepancies which may occur in the short run.

As our second finding we should mention the fact that the structural break date unsurprisingly coincides with the crisis of November 2000. The details of this financial crisis are explained in Chapter III. The practical implication of the crisis has been the abandonment of fixed exchange rate regime. Thus, the November 2000 crisis is of greater significance from the capital inflows point of view when compared to other several crises experienced throughout the recent Turkish economic history.

Our finding is in line with two previous studies. First of which is Korkmaz et al. (2009) who concluded that Turkish equity market is cointegrated with 16 developed and 21 emerging countries' markets using monthly data. The second one is Erbaykal et al (2008) who spotted a long run relationship among Istanbul (Turkey), Merval (Argentina) and Bovespa (Brazil) stock exchange markets also using monthly data.

There are two policy implications: First, as the Turkish equity markets are not offering a diversification opportunity for international investors, it would not be realistic to expect an increase in the amount of the portfolio investments coming into Turkey. Therefore, from the companies' point of view, it would be more appropriate to seek direct investment opportunities from abroad. The ISE may attract companies operating abroad for listing to change the existing long run relationship we found in our study and thus start to offer diversification opportunities to international investors.

The second policy implication is for Turkish companies. As far as Turkish companies are concerned, opportunities to finance their growth through funds coming in the form of portfolio investments from abroad looks slimmer than the funds coming in the form of foreign direct investment.

It is worthwhile to mention that our finding is also in line with the finding of previous studies pointing out the fact that national stock markets become more interrelated after a crash and strengthening co-movement among national stock markets is observed (Metin et al 2001).

One should also keep in mind that there might be a cost attached to financial integration; financial integration can heighten a country's vulnerability to macroeconomic and financial crises.

Appendix I

$$\Delta\,(LEMP) = \beta_{11}$$
$$+ \beta_{12}\,\Delta(LEMP_{t-1}) + \beta_{13}\,\Delta(LEMP_{t-2})$$
$$+ \beta_{14}\,\Delta(LEUP_{t-1}) + \beta_{15}\,\Delta(LEUP_{t-2})$$
$$+ \beta_{16}\,\Delta(LNAP_{t-1}) + \beta_{17}\,\Delta(LNAP_{t-2})$$
$$+ \beta_{18}\,\Delta(LTP_{t-1}) + \beta_{19}\,\Delta(LTP_{t-2})$$
$$+ \beta_{10}\,(\,LEMP_{t-1} + \gamma_{11}\,LEUP_{t-1} + \gamma_{12}\,LNAP_{t-1} + \gamma_{13}\,LTP_{t-1})$$
$$+ u_{1t}$$

$$\Delta\,(LEUP) = \beta_{21}$$
$$+ \beta_{22}\,\Delta(LEMP_{\,t-1}) + \beta_{23}\,\Delta(LEMP_{\,t-2})$$
$$+ \beta_{24}\,\Delta(LEUP_{\,t-1}) - \beta_{25}\,\Delta(LEUP_{\,t-2})$$
$$+ \beta_{26}\,\Delta(LNAP_{\,t-1}) + \beta_{27}\,\Delta(LNAP_{\,t-2})$$
$$+ \beta_{28}\,\Delta(LTP_{\,t-1}) + \beta_{29}\,\Delta(LTP_{\,t-2})$$
$$+ \beta_{20}\,(\,LEMP_{t-1} + \gamma_{21}\,LEUP_{\,t-1} + \gamma_{22}\,LNAP_{\,t-1} + \gamma_{23}\,LTP_{\,t-1})$$
$$+ u_{2t}$$

$$\Delta\,(LNAP) = \beta_{31}$$
$$+ \beta_{32}\,\Delta(LEMP_{\,t-1}) + \beta_{33}\,\Delta(LEMP_{\,t-2})$$
$$+ \beta_{34}\,\Delta(LEUP_{\,t-1}) + \beta_{35}\,\Delta(LEUP_{\,t-2})$$
$$+ \beta_{36}\,\Delta(LNAP_{\,t-1}) + \beta_{37}\,\Delta(LNAP_{\,t-2})$$
$$+ \beta_{38}\,\Delta(LTP_{\,t-1}) + \beta_{39}\,\Delta(LTP_{\,t-2})$$
$$+ \beta_{30}\,(\,LEMP_{\,t-1} + \gamma_{31}\,LEUP_{\,t-1} + \gamma_{32}\,LNAP_{\,t-1} + \gamma_{33}\,LTP_{\,t-1})$$
$$+ u_{3t}$$

$$\Delta\,(LTP) = \beta_{41}$$
$$+ \beta_{42}\,\Delta(LEMP_{t-1}) + \beta_{43}\,\Delta(LEMP_{\,t-2})$$
$$+ \beta_{44}\,\Delta(LEUP_{\,t-1}) + \beta_{45}\,\Delta(LEUP_{\,t-2})$$
$$+ \beta_{46}\,\Delta(LNAP_{\,t-1}) + \beta_{47}\,\Delta(LNAP_{\,t-2})$$
$$+ \beta_{48}\,\Delta(LTP_{\,t-1}) + \beta_{49}\,\Delta(LTP_{\,t-2})$$
$$+ \beta_{40}\,(\,LEMP_{\,t-1} + \gamma_{31}\,LEUP_{\,t-1} + \gamma_{31}\,LNAP_{\,t-1} + \gamma_{31}\,LTP_{\,t-1})$$
$$+ u_{4t}$$

Appendix II

The results for the Zivot and Andrews test are reported on the table below:

Variable(s)	LTP
t-stat(s)	-8.289766
Lag(s)	0.000000
Break	11/01/2000
DU1 p-value	1.17E-05
Model	C

This gives us a break date for November 2000.

Dependent Variable: DLTP
Method: Least Squares
Sample (adjusted): 10/24/1995 11/20/2009
Included observations: 3671 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LTP(-1)	-0.036072	0.004351	-8.289766	0.0000
C	0.171957	0.021978	7.824064	0.0000
@TREND	3.12E-05	1.04E-05	3.002285	0.0027
DU	-0.046673	0.010633	-4.389378	0.0000
DT	-2.04E-06	1.05E-05	-0.193954	0.8462

R-squared	0.018418	Mean dependent var	0.000311
Adjusted R-squared	0.017347	S.D. dependent var	0.134179
S.E. of regression	0.133010	Akaike info criterion	-1.195418
Sum squared resid	64.85799	Schwarz criterion	-1.186962
Log likelihood	2199.190	F-statistic	17.19652
Durbin-Watson stat	1.966562	Prob(F-statistic)	0.000000

Abbreviations

ADF	Augmented Dickey Fuller
CE	Cointegrating equation
DF	Dickey and Fuller
EU	European Union
ISE	Istanbul Stock Exchange
LEMP	Log return of MSCI Emerging Markets Index
LEUP	Log return of MSCI Europe Index
LNAP	Log return of MSCI North America Index
LOP	Law of One Price
LTP	Log return of MSCI Turkish Index
MSCI	Morgan Stanley Capital International
NASDAQ	National Association of Securities Dealers Automated Quotations
NYSE	New York Stock Exchange
OLS	Ordinary least squares
PP	Phillips and Perron
USD	United States Dollars
VAR	Vector autoregression
VECM	Vector error correction model

References

Adjaouté and Danthine 2002 - Kpate Adjaouté, Jean-Pierre Danthine, October 2002. European Financial Integration and Equity Returns: A Theory-Based Assessment, *Second ECB Central Banking Conference*

Ammer and Mei 1996 - John Ammer, Jianping Mei, 1996. Measuring International Economic Linkages with Stock Market Data, *The Journal of Finance, Vol. 51, No. 5 (Dec., 1996), pp. 1743-1763*

Baele et al 2004 - By Lieven Baele, Annalisa Ferrando, Peter Hördahl, Elizaveta Krylova, Cyril Monnet, April 2004. Measuring Financial Integration In The Euro Area, *European Cenral Bank Occasional Paper Series No. 14*

Bairoch and Wright 1996 - Paul Bairoch, Richard Kozul-Wright, March 1996. Globalization Myths: Some Historical Reflections On Integration, Industrialization And Growth In The World Economy, *UNCTAD Discussion Papers No. 113*

Bekaert et al 2005 - Bekaert, G., Harvey, C.R., Ng, A., 2005. Market integration and contagion, *Journal of Business*, *78, 39-69.*

Berben and Jansen 2005 - Berben, R.P., Jansen, W.J., 2005. Co-movement in international equity markets: a sectoral view, *Journal of International Money & Finance, 24 (5), 832-857.*

Brooks 2008 - Introductory Econometrics for Finance, 2008, Second Edition, Cambridge University Press.

Carrieri et al 2004 - Carrieri, F., Errunza, V., Sarkissian, S., 2004. Industry risk and market integration*, Management Science, 50(2), 207-221.*

Chambers 2006 - Nurgül R. Chambers, The Creation, Development and Operation of the Istanbul Stock Exchange, published by Istanbul Chamber of Certified Public Accountants for 17th World Congress of Accountants, 13-16 November 2006.

Citak et al 2007 – Levent Citak and Onur Gozbasi, İMKB İle Bazı Önde Gelen Gelişmiş Ve Gelişmekte Olan Ülke Borsaları Arasındaki Bütünleşmenin Temel Endeks Ve Ana Sektör Endeksleri Temelinde Analizi, *Dokuz Eylül Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi Cilt:22, Sayı:2, Yıl:2007,*

Claessens and Schmukler 2007 - Stijn Claessens and Sergio L. Schmukler, June 2007. International Financial IntegrationThrough Equity Markets: Which Firms from Which Countries Go Global?, *IMF Working Paper WP/07/138*

Dornbusch et al 2000 - Rudiger Dornbusch, Yung Chul Park, Stijn Claessens, 2000. Contagion: How it spreads and How it can be stopped, *Forthcoming World Bank Research Observer*

Engle et al 1987 - Robert F. Engle and C. W. J. Granger: Co-Integration and Error Correction: Representation, Estimation, and Testing, *Econometrica*, Vol. 55, No. 2 (Mar., 1987), pp. 251-276

Erbaykal et al (2008) – Erman Erbaykal, H. Aydin Okuyan, Ozgur Kadioglu: Cointegration and Priority Relationships between Stock Markets of Trukey, Brasil and Argentina, *European Journal of Economics, Finance and Administrative Sciences,* Issue 10 (2008)

Forbes and Chinn 2003 - Kristin J. Forbes, Menzie D. Chinn, 2003. A Decomposition of Global Linkages in Financial Markets Over Time, *MIT Sloan School of Management Working Paper 4414-03*

Forbes and Rigobon 1999 - Kristin Forbes, Roberto Rigobon, November 1999. Measuring Contagion: Conceptual and Empirical Issues

Forbes and Rigobon 2002 - Forbes, K., Rigobon, R., 2002. No contagion, only interdependence: measuring stock market co-movements, *Journal of Finance*, *57, 2223-62.*

Fratzscher 2001 - Marcel Fratzscher, March 2001. Financial Market Integration In Europe: On The Effects of Emu on Stock Markets, *European Central Bank Working Paper Series No. 48*

García-Herrero and Wooldridge 2007 - Alicia García-Herrero, Philip Wooldridge, 2007. Global and regional financial integration: progress in emerging markets, *BIS Quarterly Review, September 2007*

Goetzmann and Li and Rouwenhorst 2004 - William N. Goetzmann, Lingfeng Li, K. Geert Rouwenhorst, 2004. LongTerm Global Market Correlations, *Yale ICF Working Paper No. 0804*

Goldberg and Delgado 2001 - Cathy S. Goldberg, Francisco A. Delgado, 2001. Financial Integration of Emerging Markets: An Analysis of Latin America Versus South Asia Using Individual Stocks, *Multinational Finance Journal, 2001, vol. 5, no. 4, pp. 259–301*

Hassan 2003 - Aqil Mohd. Hadi Hassan, 2003. Financial Integration of Stock Markets in the Gulf: A Multivariate Cointegration Analysis, *International Journal Of Business, 8(3), 2003 ISSN:1083-4346*

Herrmann and Winkler 2008 - Sabine Herrmann, Adalbert Winkler, June 2008. Real convergence, financial markets, and the current account, Emerging Europe versus emerging Asia, *European Cenral Bank Occasional Paper Series No. 88*

Johansen et al 1990 - Soren Johansen and Katarina Juselius, Maximum Likelihood estimation and Inference on Cointegration – With Application to the Demand for Money, Oxford Bulletin of Economics and Statistics, 52,2 (1990)

Karim et al 2003 - Khondkar E. Karim, A Taha, 2003. An examinarion of financial integration for the group of seven (G7) industrialized countries using an 1(2) cointegratin model, *Applied Financial Economics, 2003 ,35, 1-9*

King et al 1990 - King, M., Wadhwani, S., 1990. Transmission of volatility between stock markets, *The Review of Financial Studies, 3(1), 5-33.*

Korajczyk 1995 - Robert A. Korajczyk, 1995. A Measure of Stock Market Integration for Developed and Emerging Markets, *The World Bank Policy Research Working Paper 1482*

Korkmaz et al 2009 -Turhan Korkmaz , Selin Zaman and Emrah İsmail Çevik, The Analysis of Integration Relation between ISE and International Equity Markets with Structural Break Tests, Akdeniz İ.İ.B.F. Dergisi (17) 2009, 40-71

Laopodis 2004 - Nikiforos T. Laopodis, 2004. Financial market liberalization and stock market efficiency: Evidence from the Athens Stock Exchange, *Department of Finance, School of Business, Fairfield University.*

Metin et al 2001 - Kivilcim Metin and Gülnur Muradoglu, Forecasting Integrated Stock Markets Using International Co-Movements, *Russian and East European Finance and Trade*, vol. 37, no. 5, September–October 2001, pp. 45–63

Moroza 2008 - Julija Moroza, January 2008, Dynamic linkages between Baltic and International stock markets, *School of Economics and Management Lund Univesity Master Thesis*

Narayan et al 2003 - Paresh Narayan, Russell Smyth, Mohan Nandha, 2003. Interdependence and dynamic linkages between the emerging stock markets of South Asia. *Accounting and Finance, 44 (2004) 419-439*

Nayyar 2005 - Deepak Nayyar, 2005. Globalisation, history and development: a tale of two centuries, *Centre for Economic Studies and Planning, School of Social Sciences.*

Newbold et al 2006 – Paul Newbold, William L Carlson, Betty M Thorn. – 6th edition. Pearson Prentice Hall

Onay 2006 - Ceylan Onay, A Co-integration Analysis Approach to European Union Integration: The Case of Acceding and Candidate Countries, *European Integration online Papers, Vol. 10 (2006)*

Pan et al 2008 - Jun Pan, Kenneth J. Singleton, October 2008. Default And Recovery Implicit in the Term Structure of Sovereign CDS Spreads, *The Journal of Finance Vol. Lxiii, No. 5*

Phylaktis et al 2002 - Phylaktis, K., Ravazzolo, F., 2002. Measuring financial and economic integration with equity prices in emerging markets, *Journal of International Money & Finance, 21(6), 879-903*

Phylaktis et al 2006 - Kate Phylaktis, Lichuan Xia, 2006. Equity Market Comovement and Contagion:A Sectoral Perspective, *Sir John Cass Business School*

Pritsker 2000 - Matt Pritsker, 2000. The Channels for Financial Contagion, *Discussion paper in UNU/WIDER Contagion Project.*

Uygur 2001- Ercan Uygur, Krizden Krize Türkiye: 2000 Kasim ve 2001 Şubat Krizleri, T*ürkiye Ekonomi Kurumu Tartişma Meting*, 7 Nisan, 2001

Verbeek 2004 – Marno Verbeek, Aguide to Modern Econometrics, 2nd edition, John Wiley & Sons, Ltd.

Worthington et al 2003 - Andrew C. Worthington, Masaki Katsuura, Helen Higgs, May 2003. Financial Integration in European Equity Markets: The Final stage of Economic and Monetary Union (EMU) and its impact on capital markets, *Economia Vol.54 No.1*

Wilmott 2007 – Paul Wilmott, Frequently Asked Questions in Quantitative Finance, John Wiley & Sons, Ltd.

Yilmazkuday 2008 - Hakan Yilmazkuday, Twin Crises in Turkey: A Comparison of Currency Crisis Models 1, *The European Journal of Comparative Economics*, Vol. 5, n. 1, pp. 107-124

Yuhn 1997 - Ky-Hyang Yuhn, Financial Integration And Market Efficiency: Some International Evidence From Cointegration Tests, *International Economic Journal 103 Volume 11, Number 2, Summer 1997*.