STOCK MARKET INTEGRATION BETWEEN TURKEY AND EUROPEAN UNION COUNTRIES

A THESIS SUBMITTED TO
THE GRADUATED SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION

DECEMBER 2004

Approval of the Graduate School of Social Sciences

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ABSTRACT

STOCK MARKET INTEGRATION BETWEEN TURKEY AND EUROPEAN UNION COUNTRIES

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December 2004, 89 pages

The objective of the study is to analyze the effects of two breakpoints on the relationships of Istanbul Stock Exchange with the European stock markets and on the relationships among these European stock markets to increase the economic integration. The breakpoints are the execution of the Customs Union Agreement of Turkey with the European Union in 1/1/1996 and the introduction of the Euro in 1/1/1999. While both breakpoints have effects on Turkey's economic relations, the European Union countries are expected to be influenced by only the introduction of the Euro. Stock market indices provided by DataStream is utilized. The statistical techniques used include the correlation and cointegration analysis. Results indicate that when examined on pair wise basis Turkish stock market has more liaisons with the European stock markets, in general, after the Customs Union; but less liaisons after the conversion to Euro. However, when examined as a group, the cointegration result finds the Euro as influential as the Customs Union. Alternatively, the European stock markets have decreasing integrations as a result of correlation analysis after the Euro, but it is an influential breakpoint according to cointegrating structures.

Keywords: Stock Market, Integration, Comovement, ISE, European Stock Markets

ÖZ

TÜRKİYE VE AVRUPA BİRLİĞİ ÜYELERİ ARASINDA MENKUL KIYMET BORSALARININ ENTEGRASYONU

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Aralık 2004, 89 sayfa

Türkiye'nin Avrupa Birliği ile; Birlik'in kendi içindeki ekonomik entegrasyonunu artıran iki dönüm noktası olduğu tahmin edilmektedir. Bunlar Türkiye'nin Avrupa Birliği ile imzaladığı, 1/1/1996'da yürürlüğe giren Gümrük Birliği ve 1/1/1999'da Euro'nun tedavüle girmesidir. Her ikisi de Türkiye'nin Avrupa Birliği ülkeleri ile olan ilişkilerini etkilerken; Avrupa Birliği üyelerinin kendi aralarındaki ilişkilerinde sadece Euro'nun etkili olacağı öngörülmektedir. Bu çalışmanın amacı, bu tarihlerin İ.M.K.B. ile Avrupa Borsaları arasındaki ilişkilere ve Avrupa Borsalarının kendi aralarındaki ilişkilere etkisini incelemektir. Bu çalışmada, DataStream'den sağlanan endeksler kullanılmıştır. Kullanılan yöntemler korelasyon ve kointegrasyon analizlerinden oluşmaktadır. Bulunan sonuçlar, çift olarak incelendiğinde, genel olarak Gümrük Birliği'nden sonra Türkiye ile bu ülkeler arasındaki bağların arttığını; fakat Euro'ya geçişten sonra bu bağların azaldığını göstermektedir. Grup olarak ise, Türkiye'nin bire bir ilişkilerinde Euro da Gümrük Birliği kadar etkili görünmektedir. Korelasyon sonuçları ise Euro'dan sonra Birlik üyeleri arasında ilişkileri azaltıcı etkiyi yansıtırken, kointegrasyon sonuçları Euro'nun, sonuçları artırıcı etkisini ortaya koymaktadır.

Anahtar Kelimeler: Borsa, Entegrasyon, Ortak Hareket, İMKB, Avrupa Borsaları

To My Family

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my supervisor Assist. Prof. Dr. Seza Danışoğlu Rhoades for her guidance, criticism, suggestions and invaluable encouragements throughout the development of this thesis.

I would also like to thank Assoc. Prof. Dr. Z. Nuray Güner and Assoc. Prof. Dr. Zeynep Önder for their valuable suggestions and comments.

I acknowledge my friend, Aslıhan, for her continuous support and friendship all through this study. This study would have been harder without her help.

Finally, I extend my special thanks to my family for their love, patience and support they have presented during this study as they always did all through my life. Words are incapable of expressing my gratitude. With love, I dedicate this work to them.

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CHAPTER I

INTRODUCTION

Globalization is a trend that has been prominent since the end of World War II. According to Moshirian (1998), the Uruguay Round of Trade Negotiations in 1986 has facilitated the free trade in the services sector, especially the financial services, throughout the world. The social, economic and technological changes during this post war period have transformed the existing trend of nationalism to one of regionalism. Regionalism has showed its first effect on the European nations. A number of European countries came together and formed a common market in Europe, which later resulted in the formation of the European Union (EU). At the other end of the world, in 1996, the US and Canada (two developed countries) came together with Mexico (a developing country) to form the North America Free Trade Association (NAFTA). Finally, as part of the globalization trend, Asia-Pacific Economic Cooperation (APEC) was formed through a customs union agreement as the third example of regional economic integration. With the existence of such formations, it is plausible to forecast that the trend towards regionalism will continue to enhance globalization in the near future as well.

In addition to the trends of regionalism, there are other social, economic and technological factors that contribute to the globalization of financial markets. One such factor is the deregulation of financial markets around the world during the 1980s. Competition among financial markets, with the objective of gaining larger share from the world's trading volume, also augments the globalization trend. Additionally, Grundfest (1990) attributes the causes of globalization to the international differences in savings rates, investment opportunities and the international trade imbalance, a factor which lead to the formation of different groups of capital importers and exporters during the 1980s. Stoll (1990)

mentions three structural factors that are responsible for the globalization of financial markets. These factors are securitization, disintermediation, and institutionalization. The growth of Euromarkets, which offer global pooling and distribution of funds to borrowers from any country, has enhanced the links between national markets. Banks started to provide global services and open local subsidiaries with the relaxation of domestic entry barriers on foreign financial institutions. This movement further promoted an increase in the integration of the global financial services industry. Technological changes also act as a contributing factor to globalization by lowering the entry costs of foreign companies into domestic markets and by increasing the feasibility of offering services without a base in the consumer's country. According to Moshirian (1998), the most important factor that contributes to the trend of globalization is based on the principle of modern portfolio theory, which states that a portion of the risk in any investment can be reduced through diversification. Globalization allows investors all over the world to diversify their holdings internationally, thereby making it possible to hold portfolios with a systematic risk level that is usually lower than the home country's own systematic risk. Similarly, the growth of derivative instruments providing a means for hedging the risks involved in international transactions has been influential on the globalization of financial markets.

Financial globalization is a focal point in this study since it has not only made possible the internationalization of world economies and opening up of domestic markets, but it has also accelerated and facilitated the process of regionalism in different parts of the world. One of these regions is Europe with whom Turkey has direct economic, social and political relations. Since regional factors have an influential role in the integration of financial markets, this study aims to test this regional role in the financial interdependencies that potentially exist among Turkey and its several trading partners in the European region. The study concentrates on the period following the customs union agreement that Turkey has signed with the European Union on March 6, 1995 and has been executing since January 1, 1996. This date is important since it is an initial step for Turkey to be a part of the regionalism trend that led to the formation of the European Union.

Moreover, since the customs union is expected to increase economic integration, it may have an influence on the co-movement of the economies that are part of the integration. Thus, the period after the customs union provides a case study during which it is possible to analyze the interdependencies that may exist among these economies. Also significant in the European regionalization process is the introduction of the Euro as the common currency on January 1, 1999. The introduction of a common currency marks another milestone in the construction of economic integration among the European nations. As such, this date provides another break point in the sample period after which it is worthwhile to analyze the degree of interdependencies among the sample countries.

The reasons for choosing these two cornerstones will be discussed further in later sections. However, prior to that, history of the European integration and the history of Turkey's integration with this formation are discussed in the following sections.

1.1. The History of the European Integration

As stated above, the formation of the European Union is one of the first results of the regionalism trend that influenced the world after the World War II. France's official proposal on May 9, 1950 to create the first concrete foundation of a European federation has initiated the process of European integration. Six countries, Belgium, Germany, France, Italy, Luxembourg and the Netherlands, joined the formation from the beginning. The initial aim of the integration was restricted to the establishment of a common market for coal and steel among the six founder members. The union, thus, was combining the winners and the losers of the war in an organizational structure with the aim of securing the peace obtained.

In 1957, these six countries decided to form an economic community that intends to provide the free circulation of labor, commodity and services. The customs taxes in commodities were abolished on July 1, 1968 as planned and the common policies like agriculture and trade had been shaped by the end of 1960s.

The success of this formation has led the United Kingdom, Denmark and Ireland to apply for membership. These three countries were accepted as members in 1972 after two refusals of France in 1961 and 1967. With this first expansion, the Community gained new responsibilities in social, regional and environmental issues. At the beginning of 1970s, the necessity for economic integration and monetary union emerged with the US discontinuing the convertibility of the US dollar. Two oil crises in 1973 and 1979 further extended the monetary instability around the world. The functioning of the European Monetary System enhanced the stabilization of exchange rates in 1979 and allowed the member states to make use of the open economic area created by following consistent economic policies and to support each other.

The Community expanded to south with the accessions of Greece in 1981, and Spain and Portugal in 1986. These accessions created the need of adopting structural programs for the reduction of differences in economic development among the Twelves.

Despite its being the largest trade power in the world, the Community was late in developing structures that would enhance its diplomatic power. At the beginning of the 1980s, the recession in the world and the struggle about the distribution of financial responsibilities created a pessimistic view for the Community; yet, this pessimism was resolved with the hopes of revival of the community in 1984. The Community aimed to form a single market until 1993 based on the White Book prepared in 1984. Accordingly, the European Single Act was signed in 1986 and executed in 1987.

The unionization of the two Germanys in 1990, the democratization of Eastern European countries and the dissolvance of the Soviet Union have altered the political structure in Europe. These changes resulted in the European Union agreement signed in 1992 and executed in 1993 with the purpose of strengthening the relations among members. The agreement has forced new challenges for

the Union. These challenges were the monetary union until 1999, new common policies, European citizenship, diplomatic cooperation, common defense and internal security. Besides, in order to face worldwide competition and reduce unemployment, the Union decided to employ new projects. The world trade entered into a new phase with the agreement signed in Marrakech among all GATT members in 1994. The European Union negotiated as a block during these negotiations to take care of its benefits.

Three new members were accepted in 1995. The accessions of Austria, Finland and Sweden provided new openings in Middle and North Europe. The EU had 15 member states with these last accessions until May, 2004 when EU faced its biggest enlargement ever in terms of scope and diversity. On this date, ten new countries were accepted as union members, which are Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia.

The European Integration has been influential on the development of the continent and the perceptions of the public. Moreover, it has changed the equilibrium of power during the half century since its establishment. All the member governments are now aware of the fact that the nationality has lost its effect and they can only sustain the economic and social developments to preserve their position in the world by combining their sources. Today, the EU has four main objectives. These are to form a European citizenship, to guarantee freedom, security and justice, to support economic and social development and to assert Europe's role in the world (EUTURKEY, 2003).

The relations that the EU tries to establish throughout the world are indications of the EU's willingness to strengthen its political and economic presence in its region. By constructing long-term strategic partnerships, the EU aims to achieve economic diversification, increase its mutual trade and investment flows by accessing the world markets. The importance of being in touch with world markets for the Union is one of the motivations behind analyzing the relationship among the European and Turkish stock markets. As the EU's interest increases in the

countries and markets in its region, the economic interdependencies among these countries is expected to increase due to increasing trade and investment flows among them. From the point of view of international portfolio diversification, the increase and decrease in the degree of economic integration is an important factor since it has direct impact on the degree of correlation among the markets.

1.1.1. The Effect of Euro on EU-Turkey and EU-World Relations

The Euro was introduced at the beginning of 1999 and started to be circulated in 2002 as the single currency of the Union; however, the attempts to create a single currency were initiated 20 years earlier. European Currency Unit (ECU) was the basis of the European Monetary System. The European Monetary System (EMU) was launched on March 13, 1979. The system involved several steps. The first stage aimed to eliminate "all restrictions on the movement of capital between Member States and between Member States and third countries." This stage was to have been completed by January 1, 1994, but this objective was not achieved. This date marked the beginning of the second stage with the creation of the European Monetary Institute (EMI) in Frankfurt. EMI was the initial form of a proposed European Central Bank. The European Central Bank was to be responsible for implementing a common European monetary policy, conducting foreign exchange operations, holding reserves of member countries and promoting smooth payment mechanisms. The third stage started on January 1, 1999 when countries fixed their currencies to the Euro. In this transition period, which lasted for three years, the Euro and the national currencies circulated side by side. The EMI was dissolved into a European Central Bank (ECB) to be responsible for the common monetary policy. The government bonds, existing debts of some countries and accounts of European companies were converted to Euro. Finally, on January 1, 2002, Euro banknote and coins started to be circulated in different countries as well as the 12 member countries. The Euro was initially adopted by 11 members on January 1, 1999 (Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg,

the Netherlands, Portugal and Spain). Later, Greece adopted it on January 1, 2001 (India Education, 2003).

The conversion to Euro is being described as the biggest monetary changeover in history. Moreover, it is an important step towards closer cooperation within the European Union. Therefore, its effects on different areas should be carefully examined. One of these areas is the degree of correlation among the region's stock markets.

The overall economic benefit that will be obtained by the Euro for the involved states is a stable economic environment resulting in low inflation and low interest rates. It created a large area of currency stability for the countries that have faced exchange rate fluctuations and monetary misalignments in the past. The member states are expected to realize savings in three areas: the elimination of currency exchange will reduce costs, the healthy competition will allow easier price comparison across the Euro zone, and the elimination of the exchange rate risk will bring a more favorable trading and investment environment for businesses.

Given the size of the Euro zone, the role of the Euro as an international currency is also important. It is probable that it will be used in trade outside the Euro area as an alternative to the US dollar. With the stability-oriented monetary and fiscal policies employed by the ECB, the Euro can be a major reserve currency besides being indispensable in financial portfolios worldwide. Therefore, the Euro has the potential to stabilize the international economic environment and promote international trade. This will result in broader opportunities for international investors to diversify their portfolios and to control their risks.

The Euro is also expected to have an impact on the relationship of the EU countries with the third countries. The degree of this impact depends on the intensity of the economic ties of the EU countries with the third countries. The sustained monetary and fiscal stability resulting in economic strength may create an anchor for the world economy. The Japanese and US firms and citizens will

benefit from the elimination of currency barriers within the single European market and the consolidation of monetary stability. The world economy will be more symmetrical. Although the US has held a leading role in the past, the completion of EMU and the introduction of the Euro will reform the relations between the US, Japan and the EU. These countries will be forced to coordinate their economic policies as the key players in the international monetary system. In addition to these potentially global effects, the introduction of the Euro will provide two significant advantages for the "CFA franc zone" which is comprised of France and 14 partner countries in Africa who link their currencies to the French franc. With the translation of the currency zone parity to the Euro standard, the 14 African partners will have smaller risk premium in their domestic interest rates due to the stability of the Euro as long as their economic policies are consistent with the existing parity. The Euro will also allow these countries to lower the transaction costs for their external trade and other payments within the Euro zone.

Financial markets in Europe have been deeply affected by the introduction of the Euro since January 1, 1999. A single currency encourages more efficient and integrated stock markets with more liquidity and lower financing costs for borrowers. Stock markets around the EU started to consider mergers and partnerships even before the Euro was introduced. The Paris, Brussels and Amsterdam stock exchanges have made agreements to create Euronext most recently, which is planned to be the first cross-border equity, derivatives and commodities market in the Euro zone. This is expected to initiate further consolidation among 32 stock exchanges in the EU zone. With the introduction of the Euro, government bond markets were transformed into a single European bond market. Most of the outstanding debt and all new debt issued by participating states are denominated in Euro to create the second largest market after the US dollar government bond market (Europa, 2003).

The economic relations within the Union and between the Union and third countries have been altered with the introduction of the Euro. Since the date

Euro was introduced is an important breakpoint that has changed the economic relations, it is used as a breakpoint in this study, assuming that it has also changed the relations among the stock markets. The analysis provides information about how the relations among stock markets have changed. The expectation prior to the analysis is to have more integration among the stock markets following the introduction of the Euro. The more integrated the stock markets, the less portfolio diversification benefits the international investors will obtain. Therefore, the co-movement between the ISE and the stock markets of the EU or among EU stock markets and third country stock markets is predicted to be higher after the adoption of Euro. Consequently, the benefits to international diversification are expected to decrease.

1.2. The Integration Process of Turkey with the European Union

Turkey's reaction to regionalism has been shaped since the 1950s. Turkey, where westernization and modernization are always seen equivalent after the establishment of the Republic and particularly after the World War II, has aimed to be engaged in the political and defensive formations in Europe. This perception led Turkey to be a member in several organizations such as the Council of Europe, Organization for Economic Cooperation and Development (OECD) and North Atlantic Treaty Organization (NATO). The objective of modernization combined with the world's regionalism trend encouraged Turkey to be a part of the new economic integration that was taking place in Europe. Not much later than the establishment of the Economic Community, Turkey has made its first application to join it in 1959. At that time, Turkey's level of economic development was deemed to be insufficient to meet the requirements for accession. Instead, Turkey was offered to sign a partnership agreement with the Community until it is accepted as a member. The partnership agreement was signed in Ankara in 1963, which was expected to be in effect until the full accession of Turkey into the Community.

The Ankara Agreement envisaged the establishment of a customs union in three phases that would serve as an integrator among Turkey and the Community. Although the first phase was completed and the Additional Protocol was signed, that would form the principles of the new phase and responsibilities of the partners in 1970, the execution did not take place accordingly. The European Economic Community (EEC) would abolish tariff and quantitative barriers to its imports from Turkey with the execution of the Protocol, whereas Turkey would do the same in accordance with a timetable containing two calendars set for 12 or 22 years. Further, Turkey would be called for the harmonization of Turkish legislation with that of the EEC in economic matters. The Protocol also envisaged the free circulation of natural persons between the parties in the next 12 to 22 years. However, since the Additional Protocol was not implemented in full, the free circulation of goods and services and the harmonization of the Turkish legislation with the EEC were not achieved at the end of the 22-year period.

The frozen relations with the EU started again with the liberalization of the Turkish economy in the early 1980s. The EU Commission postponed Turkey's new application for full accession in 1987 to a future date and offered to finalize the Customs Union in 1995 as envisaged by the original Protocol. The negotiations began in 1994 and ended on March 1995 at the Turkey-EU Association Council. The Association Council decided on the completion of the Customs Union between Turkey and the EU in industrial and processed agricultural goods by December 31, 1995. Another resolution on accompanying measures was adopted and the EU also declared a financial cooperation agreement with Turkey as part of the customs union package in the same meeting.

Following the Customs Union, Turkey abolished all duties and equivalent charges on imports of industrial goods from the EU by January 1, 1996. Moreover, Turkey has been harmonizing its tariffs and equivalent charges on the importation of industrial goods from third countries with the EU's Common External Tariff and adapting itself to the commercial policy and preferential trade agreements with specific third parties. Although basic agricultural products have been

excluded from the initial agreement, a preferential trade regime for these products was adopted on January 1, 1998 (Secretariat General for the EU Affairs, 2003).

1.2.1. The Impact of the Customs Union on the Turkish-EU Relations

This study is focused on the period preceding and following Turkey's Customs Union agreement with the EU member countries. The Customs Union of 1996 is perceived as a breakpoint in the Turkish-EU relations. This date acts as a starting point for Turkey's integration into an existing regional formation. This date is an important mark for Turkey becoming a part of the regionalism trend. Additionally, the Customs Union is expected to have an effect on the degree of co-movement among the economies that are part of the integration since it is expected to increase the amount of economic cooperation. Thus, the period before and after the Customs Union between Turkey and the EU provides a very useful time window over which the interdependencies among these economies can be analyzed.

The existence or non-existence of the interdependency among Turkey and the EU stock markets are important in terms of international portfolio diversification. The Turkish stock market, Istanbul Stock Exchange (ISE) is currently deemed to be an attractive emerging market for international investors. The abolishment of restrictions on foreign portfolio investors and the permission for Turkish portfolio investors to buy and sell foreign securities in 1989 have increased the importance of ISE as an investment alternative for internationally diversified portfolios. The de-regulation also increased the amount of foreign investor involvement in the ISE. Despite the volatility, the proportion of foreign investor transactions in total transactions showed a slightly increasing trend from 1997 to 2002, with its highest level equaling 28 percent in August 1999 (IMKB). The trend in this proportion shows that ISE is being considered increasingly in the investment decisions of foreign investors.

It is a well-known financial argument that in order to benefit from international diversification, the comovement among the international securities included in a

portfolio should be as low as possible, if not negative. In other words, the risk of a portfolio can be reduced without having to sacrifice much from its return only when the securities in the portfolio have less than perfect positive correlation. When the degree of economic integration is considered between Turkey and the EU member countries, it becomes an interesting question to examine whether diversifying among these markets would provide any benefit to investors. Especially following the Customs Union, the co-movement among the Turkish and European economies is expected to have increased resulting probably in decreased diversification benefits among these countries. Considering these points, the identification of the nature of the relationship between ISE and the EU member country stock markets turns out to be indispensable for both foreign portfolio investors who invest in ISE and for Turkish investors who make portfolio investments in foreign stock markets. Therefore, the study aims to analyze the degree of co-movement among these economies with the objective of offering better investment advice for both Turkish and European investors.

The tests that will be used in identifying the interdependencies are correlation analyses and unit root and cointegration tests. These tests provide information on the long-term relationship among these markets.

To summarize, this study focuses on Turkey and the EU member countries to determine whether there exists any interdependency among these countries' stock markets and Turkey's stock market. It also tries to test whether the existence of an economic integration like the Customs Union and the adoption of Euro have any effect on the comovement structure among these countries. Therefore, the information gathered can prove to be helpful for international portfolio investors who seek to reduce the risk levels of their portfolios. In accordance with the stated purposes, the study reviews the literature about similar topics in the next section and the analysis that is conducted is explained in the third section.

CHAPTER II

LITERATURE SURVEY

2.1. Introduction

The issue of the international co-movement structure of national stock market indexes became popular among the researchers especially after the 1987 crash of the US stock market. The crash was important in understanding the correlation structure since it provided naive evidence about the contagion effect among stock markets. The same effect was also observed in the 1997 Asian crisis. This interest in the stock market crashes resulted in two approaches in examining the correlation structure among markets. The researchers in the first group choose to subdivide the sample period on the basis of a crash that occurred in one of the markets in order to examine the relationships among different market indexes and focus on the transmission mechanisms of shocks. The second group of researchers does not specifically examine the effect of any crash or shock in their studies but usually employs correlation and regression analysis similar to the first group in order to determine the international integration structure.

2.2. Studies Analyzing the Effect of Crash Dates

One of the earliest studies that can be included in the first group is the study by Hilliard (1979) examining the relationship between equity indexes. The study selects the OPEC Embargo announced in October 1973 as a crisis date and examines the international equity market indexes during this period. The sample period is from July 7, 1973 to April 30, 1974. Data used are the daily closing prices of 10 world exchanges, which are Amsterdam, Paris, London, Milan, Frankfurt, NY, Sydney, Tokyo, Toronto and Zurich.

Four spectral statistics, autospectrum, coherence, the phase angle and tan are studied. The results show some close relationships among markets. Amsterdam, Paris, Frankfurt and NYSE have high coherence while Milan, Sydney and Tokyo have low coherence with other markets. However, no evidence is found for a common worldwide financial factor since the markets do not show more significant coupling during the Embargo.

In Hilliards's study, a significant intra-continental commonality is detected for North American and European markets. However, London shows no coupling with other European markets and similarly Sydney and Tokyo have no coupling with each other or others. On the other hand, Amsterdam is closely related with NYSE, Frankfurt and Paris. The results of phase diagrams indicate that Amsterdam both leads Paris and London and there is a simultaneous relationship between NYSE and Toronto. Moreover, NYSE leads the Amsterdam market. Therefore, Hilliard concludes that intra-continental prices tend to move together but inter-continental prices do not, except for the NYSE and Amsterdam relationship.

Similar results about intra-continental correlations are detected in a later study by Eun and Shim (1989). They investigate the international transmission of stock market movements by employing the VAR analysis. The study handles the interdependence structure of national stock markets in three dimensions: (1) How much of the movements in one stock market can be explained by innovations in other markets?, (2) Does the US stock market influence other markets or are there any other markets whose movements are causally prior to those of other markets? (3) How rapidly is the price movements in one market transmitted to other markets?

Data include the daily stock market index values of nine major stock markets and cover the period from December 31, 1979 to December 20, 1985. The indexes are

transformed into daily rates of return to prevent the problems with non-stationary series. The nine sample markets are Australia, Canada, France, Germany, Hong Kong, Japan, Switzerland, UK and US.

The lag length of VAR is chosen to be 15 trading days. The contemporaneous correlations are calculated and the results reveal that, in general, the intra-regional pair-wise correlations tend to be higher than interregional correlations. The US and Canada show the highest correlation, followed by Germany and Switzerland, whereas the correlations of Canada vs. Japan and France vs. Hong Kong are close to zero. This result is interpreted to be caused by the time zone differences as well as the degree of economic integration. Another finding is that the US is the most influential market among others. This finding is also consistent with the results obtained from the forecast error variance of each stock market allocated to sources by orthogonalized innovations. Switzerland is the most interactive market, which is the result of the high degree of economic integration of Switzerland with the world economy. The interaction patterns among Australia, Canada, Hong Kong and UK suggest that there may be a British Commonwealth factor. Moreover, the Japanese market is found to show a follower pattern although it is large in terms of its market capitalization.

Different than Hilliard, Eun and Shim examine the dynamic response patterns as a third dimension. This dimension of the analysis suggests that European and Asia-Pacific markets respond to US-originated shocks on the first following day and adjustments in prices are completed by the second following day. The Canadian market responds on the same day and adjustments are completed on the first following day. UK overreacts to US-originated shocks on Days 0 and 1 with a negative correction on Day 2. Australian and Japanese market reactions to US shocks are different in nature. These markets observe the reaction of the UK market and respond to US shocks accordingly on Day 2.

The high intra-regional factor is also found in a study by Cheung and Mak (1992). The study aims to fill a gap in the literature by examining the causal relationship between the US and the Asia-Pacific markets and the Japanese market. The selected Asia-Pacific markets are Australia, Hong Kong, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand. The sample period is from January

1977 to June 1988 and the data used are stock returns computed as logarithmic price relatives using weekly price indexes from each country.

The authors initially calculate the autocorrelations, partial autocorrelations and inverse autocorrelations in order to identify the ARIMA model of each return series. Secondly, they use the Box-Pierce Q-Statistics to check whether the model is correctly specified and the residuals are approximately randomly distributed. Finally, the pre-whitened return series of the US and Japanese markets are used as the input series and the other markets' series are used as the output series in the model.

The obtained regression results show that, on the one hand, the US market leads the others and it has a significant lag relationship with these markets except for Korea, Taiwan and Thailand. On the other hand, the Japanese market leads the Asian-Pacific markets with shorter lags except for Taiwan and Thailand. This difference in the length of lags indicates more efficient information dissemination among the latter due to being in the same geographical region.

Next, Cheung and Mak repeat the analysis for six two-year periods in order to examine the inter-temporal stability of the relationships. The US is found to have a significant causal relationship with most of the Asia-Pacific markets, except Taiwan, in at least two of the six sub-periods. Also, the relationships are more significant during the period from 1987 to 1988 (the US market crash period) than any other two-year periods. This finding suggests that such negative news is

more influential in global markets. The Japanese market is found to be less influential in the region and Malaysia, Philippines and Taiwan are not even associated with Japan. The Japanese market has only one significant causal relationship with Australia during the 1977-1978 periods and it has significant causal relationships in two out of the six periods with Hong Kong, Korea and Thailand. It is also found to have a significant causal relationship in three periods among the six with only Singapore.

The combination of the two analyses shows that the US market has a leading role in the observed years excluding Korea, Taiwan and Thailand, which have strong restrictions on foreign investors. Additionally, the Japanese market has less influential role on the markets of region indicating that regional factors have less impact on the Asia-Pacific markets than the global factor. Another important conclusion is about the significant lag structure reflecting market inefficiency. Therefore, there is an arbitrage potential for international investors due to no instantaneous information in the Asian-Pacific market.

Although the breakpoint of the sample period utilized is not a crisis, Brocato's (1994) study can also be included among the first group since it investigates the correlation structure in two sub-periods. Brocato aims to provide evidence on the changing patterns of cross-market correlations in the1980s. For this purpose, six markets, the US, the UK, Canada, Japan, West Germany and Hong Kong are chosen and weekly average of the daily value-weighted index levels are analyzed for the 1980-1987 period. Also, two sub-periods, by dividing the period in half, using March 1984 as the breakpoint, are examined in order to run sub period VAR tests.

Sub-period stock market correlations are low for most of the cases. The US and Canada have strong correlations yet the US correlations exhibit a decline in the second sub-period with other markets except with Japan and W. Germany. Also,

Japan's negative correlation with the US and Canada is reversed in the second sub-period.

The VAR analysis results generally indicate that each market explains most of its own variability except for Canada. The results for the US show that it has lost some of its dominance in the second sub-period. The UK and Hong Kong's linkages with the US have declined, yet, Canada, Japan and West Germany show increased interdependence in the second sub-period. The UK's international linkages slightly increase in the second sub-period. During this time, the UK has increased her ties with non-North American markets with a decline with the US market. Canadian market became slightly autonomous in the late 1980s. Japanese market shows stronger ties with the US, W. Germany, Hong Kong in the second period with fewer ties with the UK. The linkage of W. Germany with other markets has slightly increased in the second period. As opposed to US and Canada's dominant role over Hong Kong in the first period, Western European and Pacific Basin markets are more influential in the second period. As a result, it can be summarized that US dominance has eroded during 1980s.

Knif, Pynnönen and Luoma (1996) also employ several crashes in their study, which analyzes the monthly index returns of Helsinki and Stockholm markets for the period from January 1920 to December 1993. The observed period is subdivided into three sub-periods as pre-war, war and post-war by taking World War II into consideration and postwar period is further divided into two sub-periods using the 1973 oil crisis as a breakpoint.

When two equity markets have a common feature, one can use past information from one market to predict the other. The common feature is also an indication of economic integration. There is a statistically significant correlation among the two markets for all periods except the post-war period including 1946-1973. An autocorrelation characteristic as a common feature is not found for the whole

period. However, a common autocorrelation feature is found in pre-war period and second post-war sub period. Therefore, it can be concluded that the two markets have not a common feature covering all the sub-periods. The result contradicts with previous findings indicating intra-regional correlations. Nevertheless, the common codependence detected in the last sub-period reveals increasing integration among the markets.

Apart from above mentioned studies, Karolyi and Stulz (1996) investigate the correlation structures in order to assess the impact of macroeconomic announcements. Their study focuses on daily and intra-day comovements among the US and Japanese stock markets. The first reason to use high-frequency data is to implement more powerful tests. Second, in order to better understand the impact of changes in macroeconomic variables on cross-country covariances, daily returns are argued to be more appropriate since they contain daily and intra-day information. Third, since cross-country covariances change overtime, shorter samples are more suitable to study. However, using daily returns creates the problems of different trading hours. In order to overcome this problem, the authors create an index of inter-listed Japanese stocks trading in the NYSE as ADRs.

The study classifies the shocks to three categories as global, competitive and idiosyncratic. Global shocks benefit both markets; competitive shocks benefit one market over the other and idiosyncratic shocks affect only one market but have no impact on the other. The sample period is selected as the period from May 31, 1988 to May 29, 1992. All Japanese firms traded on the NYSE as ADRs are chosen and daily returns and overnight returns are calculated. The sample includes 8 ADRs and for each ADR, three matching American firms of comparable size within the Japanese firm's industry and three American firms outside the industry are selected and three portfolios are constructed for all firm types.

The findings show that there is substantial variation in correlations across days; there is no systematic pattern in correlations between days during which macroeconomic announcements came and days without such announcements. S&P and Nikkei indexes' absolute returns are strongly positively related to correlations and there is no evidence that the correlations are different when using size-matched US portfolio instead of an industry-matched US portfolio. Another important result of the study is that shocks to foreign exchange and stock index returns are global, in contrary to expectations about exchange rate shocks being competitive. Moreover, US volume shocks have declining effect on correlations.

To summarize the results, macroeconomic announcements and interest rate shocks have no effect on comovements. Monday comovements are highest among others confirming the day-of-the-week effect. In addition, comovements increase with higher national market index returns and higher correlations of the period are spill over to the following periods. The results also show that correlations and covariances are high when markets are volatile suggesting that the international diversification does not provide sufficient diversification against large shocks to national indexes.

Another important finding about the effect of a crash in interdependencies of stock markets is found by Masih and Masih (1997). Monthly closing prices of the US, Japan, Canada, France, Germany, and the UK from January 1979 to June 1994 are utilized to assess the effect of October 1987 on transmission mechanism of world stock markets.

Granger causality, VECM, VCD, impulse response functions analyses are performed. The results show that the US acts as leader in world market, it has great contribution in explaining the volatilities in other markets yet it cannot be explained by any other market. Moreover, German and the British

markets became more dependent on other markets with the crash. Crash was also effective in increasing the interactions among markets.

In a later study, Kanas(1998) also selects the 1987 crash as a breakpoint, but finds no pair wise correlations among the US and European markets. Kanas aims to provide evidence on the linkages between the US and European equity markets. The study includes six largest markets in Europe, which are the UK, Germany, France, Switzerland, Italy, and the Netherlands, and employ three methods to test for pair-wise correlations. These methods are multivariate trace statistic developed by Phillips and Quliaris (1990), the Johansen approach and Bierens' test. Data studied are composed of daily closing values of stock indexes for the sample markets and the sample period extends from 3 January 1983 through 29 November 1996.

Initially, unit root tests are conducted in order to determine the order of integration. The results show that indexes are individually integrated of order 1. Second, cointegration tests based on the multivariate trace statistic are conducted. The results suggest that there is no pair-wise cointegration between the US and any of the European markets in the observed period. Moreover, when the period is subdivided into two periods by taking the October 1987 crash as a breakpoint, both the pre- and post-crash periods reveal the same results. As a third step, the Johansen method based on VAR analysis is applied. The results of this analysis also confirm the no-pair-wise correlation finding and this finding holds for both pre- and post-crash periods. Finally, the non-parametric cointegration test proposed by Bierens is implemented and the results are the same.

The results of all tests show that no pair-wise correlation in the observed period as well as pre- and post-crash periods for the equity markets in the sample. This finding suggests that the performance of any European market cannot be used to forecast the long-run performance of the US market and there exists potentially

long run gains in risk reduction from diversifying in the US stocks and stocks in any of the European markets.

Similar to Kanas, Ewing, Payne and Sowell (1999) also use 1987 crash. They investigate the existence of a long run comovement among the US, Canadian and Mexican stock markets and analyze whether the implementation of NAFTA has resulted in more integrated financial markets. Monthly stock returns are analyzed for the period November 1987 to March 1997.

ADF unit root tests are initially conducted to test for the stationarity of the time series and to make inferences about weak-form market efficiency. ADF tests show first-difference stationarity for the three series suggesting that each market follows a random walk. Next, the Johansen-Juselius test for multivariate cointegration is applied and the results suggest that there is no cointegration among these three markets. Even after a dummy variable is added to examine the role of NAFTA on integration, no significant cointegration is obtained.

The result of no cointegration between these markets implies several conclusions. First, North American stock markets are segmented with no long-run comovements. Second, there is no contagion effect associated with 1987 US stock market crash. Thirdly, NAFTA did not provide greater integration for these stock markets. Finally, long-run international diversification across these markets is still an effective strategy.

The 1997 Asian crisis is used as a focus to understand the financial market contagion by Baig and Goldfajn's study (1999). In this study, Thailand, Malaysia, Indonesia, Korea and the Philippines are included in the sample to analyze the contagion among financial markets. Pair-wise correlations and VAR are used initially for identifying the comovements during the crisis period. Then, tests are conducted to understand whether correlations change during the crisis and

by identifying good and bad news, the impact of these news on both home country and other markets in the region are assessed. Daily stock index data between 1995 and 1998 are used. The correlations among stock markets are found to be high, with the Malaysian and Indonesian markets having the highest correlation. VAR analysis, on the other hand, indicates that Thailand's stock market is influential among the other four markets. The authors also establish a control group from five European markets to see whether they show a different behavior than the Asian markets during the same period. However, the results are less clear for equity markets. By adding dummy variables of good and bad news, it is found that all five markets are strongly correlated with the US market. All markets except the Philippines react to news in the right direction and Thailand, Korea and Indonesia's reaction to bad news is greater in magnitude than their reaction to good news.

Another study finding increasing correlations in a regional concept is the one by Meric, Leal, Ratner and Meric (2001). They analyze the equity markets of Argentina, Brazil, Chile, Mexico as well as the US. The 1987 US stock market crash is chosen as a breakpoint to form three sub periods. The first period runs from February 1984 to September 1987; the second period goes from November 1987 to June 1991 and the other was from July 1991 to February 1995. Period I is the period in which markets are closed to foreign investors; second period includes some regulatory changes with the opening of markets to foreigners and in the third period, large portfolio inflows are observed into these emerging markets.

Correlations are found to be increasing between sample markets during the sample period, reducing the benefits of international diversification, but the study finds no significant difference in returns from investing in a well-diversified domestic US portfolio and a well-diversified Latin American portfolios.

In a most recent study, the purpose of Climent and Meneu's (2003) study is also to investigate the effects of the Asian crisis on the linkages of South East Asian stock markets with the stock markets of three areas of Europe, North America and Latin America. The countries included in the sample are Thailand, Malaysia, Indonesia, Philippines, South Korea, Hong Kong, Japan in Asia region; the UK, Germany, Austria, Belgium, Spain, Finland, France, Holland, Ireland, Italy, Portugal in Europe; the US in North America; Argentina, Brazil, Chile, Colombia, Mexico, Peru, Venezuela in the Latin America region. The study covers the period from January 4, 1995 to May 15, 2000 by dividing the period into pre-crash and post-crash periods.

First, the variability degree of stock index series is analyzed by calculating annual return and volatility. Second, unit root tests are conducted. Then test of Kwiatkowski et al. (1992) is used to test for stationarity of the series. Third, correlations are analyzed to learn whether the changing correlation structures reflect a contagion effect. It is found that the correlations among Asian markets and others have between the pre- and post-crash periods. As a next step, nonparametric cointegration tests are conducted and no long run relationship is found. The dynamic short run relationships are tested by using VAR. In the pre-crash period, the US is detected to be influential on Asian markets except S. Korea and Latin markets. In the post crash period, the greater dependence of Asian markets to main stock markets is observed. Finally, Impulse Response Function together with Forecast Error Variance D is used to understand the dynamic linkage. The results indicate that the US is one of the most exogenous markets, although other markets also had influential power on Asian markets after the crash. The results of FEVD analysis reveals that markets have reduced their own variability reveals that the contagion effect exists as a result of the crisis.

The first group of studies is finalized by the study of Climent and Meneu. The first group of studies, as mentioned above, selects a crash date and tries to assess the relationships among different market indexes in light of the selected crash, in

general. Similarly, the second group of researchers also tries to determine whether there are commonalties between different stock market indexes, however they are differentiated from the first group since they do not specifically examine the effect of crash on correlation structure. They usually evaluate the structure throughout the whole period by employing correlation or regression analysis. There are also several different studies included in this group, which have different hypothesis to test for or different methods.

2.3. The Second Group of Studies

One of the earliest studies in the second group is handled by Philippatos, Christofi and Christofi (1983). The study utilizes the monthly common stock market averages of fourteen industrial countries, which are Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway, Sweden, Switzerland, the UK and the US. The sample period covers the period of January 1959 to December 1978 and monthly returns are calculated for each country using the industrial share price indexes and exchange rates.

First, the study replicates the tests for annual and biennial correlation coefficients of the US with each country. Second, Box-Jenkins tests are conducted. Third, non-parametric tests on annual correlations are constructed. Finally, correlation coefficients are examined by dividing the period into two sub-periods as fixed exchange rate environment and flexible exchange rate environment. These tests are in fact a replication of the previous studies. Nevertheless, these analyses provide evidence that the inter-country correlation coefficients remain the same from one sub-period to the other over the 20 years examined.

After the replications, the study uses the principal components analysis for the sample period and two equal sub-periods and concludes that the national stock market indexes of the 14 sample countries are interrelated through a

common factor whose effect appears to be consistent over time. Therefore, it is not possible to benefit from international diversification.

Eun and Resnick's (1984) study is different from other studies in terms of its purpose. Eun and Resnick's focus is on offering a valid model for estimating the correlation structure of international share prices. They argue that obtaining accurate correlation coefficients among countries is not likely due to several reasons like fluctuating exchange rates or governmental interventions in the capital and foreign exchange markets. Therefore, the study aims to offer alternative forecasting techniques in order to estimate the correlation structure of international stock prices. The study uses monthly return data for two non-overlapping samples of 80 firms from 12 major industries in 8 major stock markets. The included markets are Australia, France, Germany, Japan, the Netherlands, Switzerland, the UK and the US markets. The period of January 1973 through December 1982 is separated into two sub-periods to be used as the estimation and forecasting periods. The study employs a full historical model, three mean models and eight index models. The full historical model assumes that the past values of correlation coefficients are the best estimates of the future values. This model is used as a benchmark to test for other models. Mean models assume that the best estimate of the pair-wise differences is zero, so the performance of these models depend on the degree of inter-temporal stability of the pair-wise differences. The three mean models employed are global, national and industrial models, which calculate pair-wise correlation coefficients worldwide, within country and inter-country, respectively. Four variants of the single-index model and four variants of the multiple index model are also used with the assumption that the securities move together only because of their common responses to indexes. In order to evaluate the performance of the models, the mean squared forecast error and stochastic dominance in terms of the frequency distribution of the forecast errors are used.

The results suggest that the National Index Model dominated all other models in terms of forecasting accuracy. It has a lower MSE at a significant level than

any other model and its probability of producing an error of any size is smaller than any of the models. Since the national index model is dominant over Industry Mean Model, it can be concluded that a country factor affects the return generating process. When the performance of each model is analyzed by adjusting each model to have the same mean forecast, National Index Model is again outperforming all the other models.

Like Kanas (1998), Schöllhammer and Sand (1985) also investigate the interdependence among the European and US markets. They use the daily stock price changes from January, 1 1981 through June 30, 1983 in order to investigate the comovements among stock market indexes of the major European markets and the US. The UK, West Germany, France, Italy, and the Netherlands are included in the sample as EC member countries and Switzerland is included as a non-EC country. Since the existing patterns of national stock price changes could distort the results of interdependence, the series are prewhitened and then the residuals are cross-correlated on a pair-wise basis.

French, German, Swiss and British indexes are found to follow random walk and the Dutch and Italian display autoregressive patterns. The behavior of changes in the US stock price indexes indicates the existence of a weekly pattern. These deviations from random walk suggest inefficiencies in the pricing mechanisms of these markets.

The results of the comovement analysis show that Italian stock prices are entirely unaffected by either the European markets or the US market. Similarly, France shows no comovements with the other European markets; however, the US Dow Jones Index affects the French index with a lag of one day. Also, there are significant interdependencies among Germany, Netherlands, Switzerland, UK and US. In descending order, the relatively strongest interrelationships exist between the US and the Netherlands, Germany and the UK, France and Switzerland. The

study also discovers that there is no lag between the Dutch and the US indexes. There is also significant degree of comovement between the US, Switzerland and the UK on the same day. This finding suggests an effective arbitrage opportunity. In addition, German, Swiss, Dutch and British stock price indexes exhibit comovements among them. This is an expected result due to the economic integration among these countries. Also, the most significant comovement occurs among the Dutch and the British indexes. These findings are also signals for unexploited arbitrage opportunities.

Although the study points to the existence of some profit opportunities, the most important finding is that stock price indexes like the French and Italian are unaffected by stock price changes in other European countries in spite of the economic integration among the EC member countries.

A similar study is conducted by Mathur and Subrahmanyam (1990) with the examples of Nordic and US markets. They argue that there are high interdependencies among the stock markets of countries, which have high economic interdependency. Since the four Nordic countries have a high degree of economic collaboration, the study tries to identify the degree of interdependency among Denmark, Finland, Norway, and Sweden. Moreover, the US stock market is also included for control purposes. The monthly levels of stock indexes for the period 1974 to 1985 are used.

VAR analysis results indicate that the US market is influential on only Denmark and not on any others. In the mean time, none of the four markets have an effect on the US market. Swedish market is found to be influential on the Norwegian and Finnish markets and the Norwegian, Finnish and Danish markets do not affect any changes in other markets. These results suggest that the Nordic markets are less than fully integrated implying that investors can earn abnormal returns by taking advantage of the lead-lag relationships among these markets.

The paper by Wheatley (1988) is different from other studies in terms of the method employed. This study uses consumption-based asset pricing model to test for international equity market integration. Monthly data from the US and 17 other countries from January 1960 to December 1985 are examined to construct a model which forms the asset pricing line for each country. The test of international equity market integration is a test of whether foreign equities plot along these countries asset pricing line for each country. The international equity integration tests derived from this model tests whether the foreign equities are a given country's asset pricing line. If they are not, then the two markets are said to be not integrated with asset pricing model being invalid. The tests conducted accordingly provide little evidence against the joint hypothesis that equity markets are internationally integrated and APM is valid.

Roll (1992) has a different perspective. He aims to explain the underlying reasons of why stock price indexes from different countries exhibit disparate behavior. He argues that this difference may be due to technical procedures in index construction, industry composition of the nation or the effect of exchange rates. He uses equity prices of 24 countries from the sample period of April 1988 through March 1991. This sample period includes events like the crash of October 1987, the US mini crash of October 1989, the large Japanese market decline of the early 1990 and the eight months of Kuwait Invasion/ Desert Storm.

As part of his study, Roll presents correlation coefficients computed from daily dollar-denominated returns from each of the 24 countries. The correlations are found to be low since only 50 of the 276 are above 0.5. The correlations that are above 0.5 are mainly among the Western European countries and regional trading partners. The regional trading partners that have high correlations are Australia and New Zealand; Canada and the US; and Malaysia and Singapore. Roll attributes the existence of low correlations to the time zone differences among Far East, Europe and North America. In order to test for this possibility, he estimates multiple regressions with index returns for each pair of countries and takes the

square root of the multiple coefficient of determination as an indicator of total correlation. Results show that there was little difference among the simple correlations of daily returns and the multiple regression analogs for the countries in the same trading zone; however, the correlations are significantly higher for countries in different time zones.

Roll also forms industry-weighted portfolios for each country and calculates inter-country correlations in order to test whether the correlations are affected from the industrial structures. Results show that these correlations are generally higher than the correlations computed before among raw indexes. These empirical findings suggest that two countries with similar industry structures will be more highly correlated yet the importance of regional characteristics should not be ignored.

Corhay and Urbain's (1993) study also concentrates on methods used in investigating the correlations. The study argues that when investigating the correlation among stock markets, there is a problem with using returns calculated from log prices, since the long run components are lost during the process of transforming a non-stationary process into a stationary one by taking the natural log of prices. Therefore, they offer to use cointegration or common stochastic trends when the series are stationary in order to examine whether stock prices of two or more countries move together. In accordance with this idea, they use biweekly observations of stock price indexes from France, Germany, Italy, the Netherlands and the UK for the period March 1975 to September 1991.

As a first step, they conduct unit root tests to see whether the index series are stationary. The hypothesis of a unit root for the series is not rejected. Secondly, the hypothesis of no bivariate cointegration is tested using static cointegration regressions and with this method, significant bivariate cointegrating relationships among Germany, the UK, the Netherlands and France are detected; yet, Italy has no significant relationships with any of the observed countries. However, Corhay and Urbain argue that with the static regression framework, it is impossible

to identify more than one cointegrated vector when there are more than two-dimensional variables. In order to test the number of cointegrating relationships, Corhay and Urbain estimate a reparameterised vector error correction form a Gaussian VAR model. The results reveal that the cointegrating vector involves all five markets. The component of the Italian stock index is relatively low compared to others and the results of the Likelihood Ratio test is not sufficient to reject the hypothesis that Italian stock prices do not share common trends with the remaining stock indexes.

The authors conclude that the cointegration analysis can be used for finding the links between stock markets and their results indicate the existence of a long run stochastic trend among four major European countries.

King, Sentana and Wadhwani (1994) attempt to assess the impact of economic variables on the changes in comovements among stock markets. This study is important since it focuses on whether the existing comovement is changing rather than focusing on whether there is a comovement. The observed economic factors are short-term interest rate, long term interest rate, dollar/yen exchange rate, dollar/DM exchange rate, industrial production, inflation, US trade account, real money supply, oil price and commodity prices. Australia, Austria, Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, the UK and the US stock markets are examined and the contribution of observable economic factors to variation in conditional covariance is tested. It is found that the observable economic variables can only explain a small proportion of the covariances between national stock markets and their time-variation in covariances. The result suggests that unobservable factors may increase the comovements, and when the volatility of these factors increase, markets show greater intercorrelation. In addition, although it is expected that national stock markets are moving more closely as a result of globalization, the study was unable to find strong evidence to support this idea.

In another study, Erb, Harvey and Viskanta (1994) find that correlations in the G-7 countries are affected by the business cycle. When both countries are in a recession, the correlation is highest and it declines during periods of recovery and out of phase. The correlations are not symmetric in up and down markets. The intra-European ties increase the correlation patterns among these countries. The US and Canada markets have the lowest correlations with the other markets.

Kwan, Sim and Cotsomitis (1995) try to provide evidence on the existence of causal relationships among world equity markets. They conduct both cointegration and causality tests on the data, which consist of monthly time series from nine stock market indexes from January 1982 to February 1991. The markets are Australia, Hong Kong, Japan, Singapore, South Korea, Taiwan, the UK, the USA and West Germany.

They utilize unit root tests to prove the stationarity of the series, Akaike information criterion (AIC) to determine the optimal lag length, Lagrange multiplier test, filtering procedure and F-tests in order to examine the causal relationships.

Cointegration test results indicate that world stock markets are less than informationally efficient yet the four little tigers (Hong Kong, Singapore, S. Korea and Taiwan) and four major G-7 countries (Japan, the US, the UK and W. Germany) show no significant results on the high order tests of cointegration. However, each of the four little tigers is found to be cointegrated with the G-7 countries. In addition, the markets are detected to be weak form efficient in the long run. F-tests suggest that bi-directional causality exists among Japan- S. Korea, Singapore – Australia, Singapore- Hong Kong, Singapore- UK, Taiwan-Japan, and Taiwan -Singapore, Taiwan- S. Korea. However, no such relation is detected among the North American and European markets. The US

market's influential role is also supported while no other market has influence on the US market.

US market's leading role is also supported by a study by Engle and Susmel (1993). This study tests time-varying volatility in international stock markets, the relationships between markets within and outside their region and the common components of the volatilities. The data consist of weekly stock market indexes from January 1980 to January 1990 for eighteen major stock markets. These indexes are then transformed into rates of return.

The study finds a common factor that has time-varying volatility both in Europe and in Far East. The two groups showing the same volatility in Europe and Far East are composed of Belgium, Germany, Norway, Sweden and Spain in one hand and Hong Kong, Singapore, Malaysia, and Australia on the other. This result also indicates that common factors are regional factors and not world factors.

Like Kwan, Sim, Cotsomitis (1995), Masih and Masih (1999) also concentrate particularly on Asian emerging markets. In order to examine the short and long term dynamic causal linkages among stock market indexes while particularly focusing on Southeast Asian markets, Masih and Masih examine end-of-day price indexes of eight stock markets from 14 February 1992 to 19 June 1997. The results provide evidence on interdependencies among OECD and emerging markets as well as the influence of the US and UK markets in both the short and long run. However, the relationships of the US and UK markets with Asian markets are more significant than their relationships with other advanced countries. There is also greater interdependency among Asian markets.

Masih and Masih (2001) further studied the subject. According to Masih and Masih, previous studies have some limitations such as ignoring long run relationships or lack of explanation of implications about statistical results.

Therefore, their second study aims to address these limitations while investigating causal linkages. Data used are monthly average stock price indexes for the period from January 1982 to June 1994 for nine countries, which are the US, the UK, Japan, Germany, Hong Kong, Taiwan, South Korea, Sweden and Austria. The study finds significant interdependencies among the OECD and emerging Asian markets, with UK and US acting as leader both in the short and long run. Moreover, Japanese market's influential role is increasing.

In one of the latest studies, Chue (2002) focuses on how shocks are spilled over across countries through the channel of time varying risk preferences and the reasons why the countries are vulnerable to movements in other countries. The potential contribution of time varying risk preferences of an investor is seen as an important factor when combined with market integration that affects comovements. For studying the influence of this factor and market integration, Mexico and Korea are selected as the two emerging markets. Argentina and Mexico are also included for robustness checks. These two pair countries both have positive return correlations. In order to test for the hypothesis, the monthly data for the stock return and dividend yield are used from December 1984 to December 1999.

As a conclusion, it is found that time-varying investor risk preferences can significantly contribute to the transmission of shocks across international financial markets and when the markets are internationally integrated, domestic equity returns can be affected by foreign shocks, which do not directly influence their home market.

Although there are different approaches and methods employed in examining the international comovement structure of different national stock markets by different studies, there are some commonalties founded in these studies. For example, both Hilliard (1979); Engle and Susmel (1993) and Eun and Shim (1989) find that the

intra-regional correlations are usually higher than inter-regional correlations. The US stock markets influential role is the most common feature detected by Eun and Shim(1989), Cheug and Mak (1992), Masih and Masih(1997), Climent and Meneu(2003), Kwan, Sim and Cotsomitis(1995), Engle and Susmel(1993) and Masih and Masih(2001). However, some of these researchers also find that there are some exceptional countries that the US market has no influence or its influence is declining. Despite these common finding about US market's dominant role, the study by Kanas (1998) finds no pair-wise correlation among the US and European markets. Similarly, Ewing, Payne and Sowell (1999) find no cointegration among the US, Canadian and Mexican indexes. Moreover, the US market is found to be influential on only Denmark by Mathur and Subrahmanyam (1990) and Brocato (1994) claimed that the US dominance has eroded during 1980s. Similar conflicting findings are also present for Japanese market. Cheung and Mak(1992) states that Japanese market has less impact on Asia-Pacific markets and Eun and Shim(1989) identifies it as a follower, yet Masih and Masih(2001) finds its role to be increasing. In general, the global factors have more effect on Asia-Pacific markets than Japanese market. The effect of crash is another important finding that needs to be reminded. Masih and Masih (1997) test for October 1987 crash and conclude that crash is effective in increasing correlations Climent and Meneu (2003) also detected changes in relationships after the 1997 Asian Crisis. Ewing, Payne and Sowell (1999), on the other hand, find no contagion effect associated with this crash. Kanas (1998), similarly observed no change in correlations after the crash. Karolyi and Stulz (1996), from a wider perspective, try to test the impact of different kind of shocks to correlation structure and see that the correlations and covariances are increasing with the volatile markets. Like Karolyi and Stulz, increasing inter-correlation as a result of volatility is also identified by King, Santana and Wadhwani (1994).

There are also some studies that aim to find high interdependencies among indexes of countries which have high economic dependencies. One of them is the study of Erb, Harvey, and Viskanta (1994). In their study, they focus on G-7 countries and

see that correlations in these countries are affected by the business cycle and the intra-European ties increase the correlation patterns. Knif, Pynnönen and Luoma (1996) similarly find significant correlation among Helsinki and Stockholm markets. In contrast, Schöllhammer and Sand (1985) obtain the result that stock price indexes like French and Italian are unaffected by the changes in other European indexes despite the economic integration. On the other hand, Corhay and Urbain's (1993) results only exclude Italy as the market that has no significant relationship among the observed European countries. King, Sentana and Wadhwani's (1994) study is also an interesting one since it claims that the observable economic variables can only explain a small proportion of the covariances and the variation in this covariance through the time. There are also some other studies which have results obtained by examining correlation structures and some which have different objectives like the study of Eun and Resnick(1984) or Wheatley(1988) as mentioned above.

CHAPTER III

DATA AND METHODOLOGY

3.1. Introduction

Globalization is a trend that has been prominent since the end of World War II. According to Moshirian (1998), the Uruguay Round of Trade Negotiations in 1986 has facilitated the free trade in the services sector, especially the financial services, throughout the world. The social, economic and technological changes during this post war period have transformed the existing trend of nationalism to one of regionalism. Regionalism has showed its first effect on the European nations. A number of European countries came together and formed a common market in Europe, which later resulted in the formation of the European Union (EU). At the other end of the world, in 1996, the US and Canada (two developed countries) came together with Mexico (a developing country) to form the North America Free Trade Association (NAFTA). Finally, as part of the globalization trend, Asia-Pacific Economic Cooperation (APEC) was formed through a customs union agreement as the third example of regional economic integration. With the existence of such formations, it is plausible to forecast that the trend towards regionalism will continue to enhance globalization in the near future as well.

In addition to the trends of regionalism, there are other social, economic and technological factors that contribute to the globalization of financial markets. One such factor is the deregulation of financial markets around the world during the 1980s. Competition among financial markets, with the objective of gaining larger share from the world's trading volume, also augments the globalization trend. Additionally, Grundfest (1990) attributes the causes of globalization to the international differences in savings rates, investment opportunities and the international trade imbalance, a factor which lead to the formation of different groups of capital importers and exporters during the 1980s. Stoll (1990)

mentions three structural factors that are responsible for the globalization of financial markets. These factors are securitization, disintermediation, and institutionalization. The growth of Euromarkets, which offer global pooling and distribution of funds to borrowers from any country, has enhanced the links between national markets. Banks started to provide global services and open local subsidiaries with the relaxation of domestic entry barriers on foreign financial institutions. This movement further promoted an increase in the integration of the global financial services industry. Technological changes also act as a contributing factor to globalization by lowering the entry costs of foreign companies into domestic markets and by increasing the feasibility of offering services without a base in the consumer's country. According to Moshirian (1998), the most important factor that contributes to the trend of globalization is based on the principle of modern portfolio theory which states that a portion of the risk in any investment can be reduced through diversification. Globalization allows investors all over the world to diversify their holdings internationally, thereby making it possible to hold portfolios with a systematic risk level that is usually lower than the home country's own systematic risk. Similarly, the growth of derivative instruments providing a means for hedging the risks involved in international transactions has been influential on the globalization of financial markets.

Financial globalization is a focal point in this study since it has not only made possible the internationalization of world economies and opening up of domestic markets, but it has also accelerated and facilitated the process of regionalism in different parts of the world. One of these regions is Europe with whom Turkey has direct economic, social and political relations. Since regional factors have an influential role in the integration of financial markets, this study aims to test this regional role in the financial interdependencies that potentially exist among Turkey and its several trading partners in the European region. The study concentrates on the period following the customs union agreement that Turkey has signed with the European Union on March 6, 1995 and has been executing since January 1, 1996. This date is important since it is an initial step for Turkey to be a part of the regionalism trend that led to the formation of the European Union.

Moreover, since the customs union is expected to increase economic integration, it may have an influence on the comovement of the economies that are part of the integration. Thus, the period after the customs union provides a case study during which it is possible to analyze the interdependencies that may exist among these economies.

As the practical aspect of the study, the referred integration can be detected by examining the co-movement structure among the indexes of stock markets that are located in a certain region or that are members of a regional formation. The European Union region that contains 15 members located in Europe is a good example for conducting such a test since the Union has direct economic, social and political relations with Turkey. The integration among the stock markets should also be analyzed in light of major economic changes. One such important economic change is the introduction of the Euro at the beginning of 1999. This date, along with the customs union date, is given special emphasis while testing for the degree of integration among the European and Turkish stock markets.

In the initial stage of the study, the potentially high interdependencies among Turkey and its regional partners are analyzed by examining the correlation structure for these two groups. Therefore, the purpose of this study can be summarized as determining whether the interdependencies among observed countries increase as a result of regionalism.

Considering these objectives, the ultimate aim of this study can be generalized as to provide useful information to investors who seek to benefit from international diversification. In order to benefit from international diversification, the securities included in a portfolio should not have a high degree of interdependence. In other words, securities that are not perfectly positively correlated with each other create a diversification effect and make it possible to decrease the portfolio's risk without having to sacrifice substantially from the returns obtained. If an investor is interested in holding a portfolio of securities that are selected from different world markets, then such an investor should first analyze the interdependencies

among the markets proposed for investment. The systematic risk of a portfolio can be reduced to levels lower than the investor's home country systematic risk only if the

securities in the portfolio are selected from world markets that are not perfectly positively correlated with each other.

With the potential of international diversification in mind, the first stage of this study entails the analysis of the correlation structure among the Turkish and European stock markets. By taking the customs union between Turkey and the European Union and the introduction of the Euro as two break-points in the sample period, the study attempts to discover whether the nature of the correlation structure changes in the latter periods and whether these types of economic events increase the interdependence among the markets under study. The second stage of the analysis involves the examination of the long-term relationship between the stock markets mentioned.

3.2. Sample and Data

The countries that are included in the sample are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom, Switzerland and Turkey. In addition to Turkey, the first 15 countries are the members of the EU prior to the recent accessions. Switzerland is included as an important non-member economy in the European region. For each country, the respective stock market index time-series is downloaded from the DataStream Database for the period between January 1990 and December 2003. The stock market index returns that are provided by DataStream are adjusted for capital changes. Table 3.1 provides a list of the indexes used in the study.

In addition to the individual country indexes, DataStream also provides regional indexes that are calculated as a weighted average of individual stock

market indexes from certain regions around the world. The list of the regional indexes used in this study is provided in Table 3.2. The sample period is divided using two breakpoints as stated above. The sub-periods examined in order to detect the interdependence among ISE and the European and US stock markets are given in Table 3.3.

3.3. Methodology

The statistical procedures employed in the study make it possible to detect whether the correlation that exists among the sample markets has a leading/lagging pattern in any particular direction. The analysis of the co-movement of these markets provides essential information to be used in determining international diversification strategies. The analysis is similar to the methodology followed by Climent and Meneu (2003). The methodology is composed of three main analyses: (1) unit root tests, (2) correlation analysis, and, (3) cointegration tests.

3.3.1. Unit Root Tests

In the second stage of the analysis, correlation and cointegration tests are conducted for the Turkish and European markets. However, before cointegration can be tested among two financial markets, it has to be shown that the return series from the markets in question are integrated of the same order and that their residual sequences are stationary. In this context, the term "stationary time series" should be explained in detail. The stationarity concept arises from the difficulty of obtaining multiple time-series data on a variable that has the same process characteristics over the same time period. Therefore, usually only one set of realizations for any particular series is observed. In this study, the stock market indexes are examined for their stationarity characteristic. The analysis is based on the idea that if the price index series of the stock market i at time t (P_{it}) is a stationary series, the mean, variance and autocorrelations of this series can usually be approximated by using sufficiently long time-series averages based on a single set of realizations. A stochastic process, which can also be called a random

process (in this case P_{it}) is said to be covariance stationary for all t and t-s periods if the following three conditions are met:

1. $E(P_t) = E(P_{t-s}) = \mu$ (3.4)

where μ is constant.

This condition means that the expected mean of the price index is μ and it is invariant over time. This further means that the mean obtained from a price index series over an observed period will represent the mean of the price index series over another period. Therefore, the mean obtained from a sample period may be used to approximate the mean level for different periods if the index series is stationary.

2. $E\left[\left(p_t - \mu\right)^2\right] = E\left[\left(p_{t-s} - \mu\right)^2\right] = \sigma_p^2$ (3.5)

where σ_p^2 is constant.

The second condition means that the variance of a price index series is the sum of the squared deviations from the mean of the price index at time t and is equal to σ_p^2. Similarly, the equal sign in this condition indicates that the variance is not affected by time and that the expected variances will be the same for different sample periods.

3. $E\left[\left(P_t - \mu\right)\left(P_{t-s} - \mu\right)\right] = E\left[\left(P_{t-j} - \mu\right)\left(P_{t-j-s} - \mu\right)\right] = \gamma_s$ (3.6)

where γ_s is constant.

The third condition adresses the autocovariance of the price index between time t and t-s. This condition means that the product of the deviation of each P_t and P_{t-s} from its sample mean μ, and the product of the deviation of each p_{t-j} and p_{t-j-s} from its sample mean μ are both equal to γ_s. This equality indicates that the covariances for the price index series for different sample periods are not different from each other if the time series is stationary.

If a stochastic process meets the above mentioned three criteria, it will have a finite mean and variance and it is covariance stationary. If P_t is a stationary series, then, the mean, variance and autocorrelations of the series can be approximated by using sufficiently long time-series averages based on a single set of realizations. For a covariance stationary series, the autocorrelation between P_t and P_{t-s} can be defined as the ratio of γ_s to γ_0. Suppose that there is a sequence of a price index P_t, (t=0,1,2,…) with mean μ and variance σ^2. In this case, the autocorrelation function or the correlogram between P_t and P_{t-s} is expressed in the following manner:

$$\rho_s = \frac{\gamma_s}{\gamma_o} = \frac{E(p_t - \mu)(p_{t-s} - \mu)}{\sigma^2}, (s = 0,1,2,\ldots t.) \qquad (3.7)$$

Allowing *s* to be equal to 0 means that γ_0 is equivalent to the variance of P_t. The correlation coefficient for the sample is the covariance of the price index series divided by the variance of the series. The calculated autocorrelation coefficients ρ_s is time-independent since γ_s and γ_0 are time-independent. A series is said to be covariance stationary when the mean fluctuates around a constant long-run mean, when the mean is finite and its theoretical correlogram decays as the lag length increases.

There are important differences between stationary and non-stationary time series. Shocks to a stationary time series are necessarily temporary over time. The effects of the shocks dissipate and the series will revert to its long run mean level. Similarly, long-term forecasts of a stationary series will converge to the unconditional mean of the series. A covariance-stationary series exhibits mean reversion in that it fluctuates around a constant long-run mean, it has a finite variance that is time-invariant and it has a theoretical correlogram that diminishes as the lag length increases. However, a non-stationary series necessarily has permanent components. The mean and variance of a non-stationary series are time dependent. A non-stationary series has no long-run mean to which the series returns, it has time–dependent variance that goes to infinity as time approaches

infinity and the theoretical autocorrelations do not decay, but, in finite samples, the sample correlogram dies out slowly.

In order to understand whether a sequence is stationary or not, there are several tests that can be conducted. The first test is the one developed by Dickey and Fuller (1979, 1981) and the alternative test that is widely used in literature is the one proposed by Phillips and Perron (1988). In the empirical literature, it has been argued that the standard Dickey-Fuller and Phillips-Perron unit root tests have a tendency to fail to reject the null hypothesis of the existence of a unit root, especially when a unit root and a moving average are present simultaneously in the data series. Therefore, in this study, the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) (1992) test is used to test for the existence of a unit root in the stock index series. Kwiatkowski et al. propose to test the null hypothesis that an observable series is stationary around a deterministic trend. The series is expressed as the sum of the deterministic trend, a random walk and a stationary error. The null hypothesis states that the random walk has a zero variance. The hypotheses to be tested by using the KPSS test are formulated in the following manner.

Let P_t, for t=1,2,...,T, to be the series under study. Assume that the price index series is generated by the following process.

$$P_t=\xi_t+r_t+\varepsilon_t \tag{3.8}$$

In this statement, ξ_t is the deterministic trend, r_t is a random walk and ε_t is the stationary error term. The term r_t is further decomposed in the following manner.

$$r_t = r_{t-1} + u_t \quad (u_t \sim iid\ (0,\sigma_u^2)) \tag{3.9}$$

Based on the equation for r_t, the null and alternative hypotheses for stationarity are formulated as follows.

H_0: $\sigma_u^2 = 0$

H_A: $\sigma_u^2 > 0$

The null hypothesis is that the random walk has a zero variance and the alternative hypothesis is that the variance of the random walk is greater than zero. The null hypothesis of zero variance for the random walk error reflects the stationarity of

the price index series and accordingly, the alternative hypothesis points to the non-stationarity of the price index series. The cases in which the null hypothesis is rejected indicate the presence of a unit root. If there is indication of a unit root, further tests of integration are needed to determine the form of the time series that carries the stationarity characteristics.

To sum up, the purpose of the unit root test is to show that the price index series of each stock market is stationary around a deterministic trend so that the cointegration among the stock market indices can be tested in the next stage of the analysis. Cointegration can be tested only if the price index series are proven to be integrated of the same order. If the unit root hypothesis is rejected for the level form of the market index series, then, it is not possible to test for cointegration among these series since, in this case, the index series will have mean and variance values that are not changing over time. If the mean and variance of the individual series are not changing over the long run, then, it is not possible for these series to move together, in other words, for them to be cointegrated. In the KPSS unit root test, the rejection of the null hypothesis implies that the series under analysis is non-stationary in its level form but is stationary around a deterministic linear trend. If the KPSS null hypothesis can be rejected for all stock market index series under analysis, then, this implies that they are all non-stationary in their level form, but, at the same time, are all integrated of the first order. When all the series are integrated of the same order, it is possible to test for cointegration among these series.

3.3.2. Correlation Analysis

After obtaining the results of the unit root tests, the next step is to test for cross-correlations. The tendency of two variables to move together is called correlation and the correlation coefficient (ρ) measures this tendency. The correlation coefficient between x and y is defined as the following.

$$\rho_{xy} = \frac{\text{cov}(x, y)}{\sqrt{\text{var}(x)}\sqrt{\text{var}(y)}} = \frac{\sigma_{xy}}{\sigma_x \sigma_y} \tag{3.10}$$

The correlation calculated in this study shows the linear relationship among the stock markets. It also provides an indication about the degree and the direction of the relationships. A correlation coefficient of +1.0 denotes a perfect positive correlation, meaning that the two variables move up and down in perfect synchronization. A correlation coefficient of –1.0 denotes a perfect negative correlation, meaning that the variables always move in exactly opposite directions. A correlation coefficient of zero indicates that the two variables are not related to each other, meaning that changes in one variable are independent of changes in other. Finally, a correlation coefficient that takes a non-zero value between −1.0 and +1.0 indicates the existence of a less than perfect linear relationship between the variables under study (Brigham and Ehrhardt, 2002).

The correlation coefficients among the stock markets have implications for the investment strategies involving international diversification. Returns on two perfectly positively correlated stock market indices will move together and a portfolio consisting of these two perfectly correlated indexes will be as risky as each individual index. Therefore, the diversification will have no benefit in terms of reducing the risk of such a portfolio. On the other hand, when the two market indexes are perfectly negatively correlated, all risk can be diversified away. In practice, it is almost impossible to find two stock market indexes that are perfectly negatively correlated. However, the good news is that any correlation that is less than +1.0 will help reduce the risk but will not eliminate it, totally. Therefore, the degree of risk reduction in a portfolio depends on the degree of correlation among the stock market indices.

In addition to identifying the degree and sign of the linear relationship among the stock markets, the change in the correlation structure over the sub-periods can be an implication for the existence of a contagion effect. As stated by Baig and Goldfajn (1999), when two markets are correlated historically, a change in one

market will be accompanied by a change in the other. In accordance with this idea, if the cross correlations among the markets do not show a significant variation, then, these two markets are said to be evolving according to their traditional relationship. However, if a substantial variation occurs in the cross-correlations around a breakpoint, this change can be interpreted as evidence for the existence of a contagion effect.

In this study, the cross-correlations and the change in these correlations over time are analyzed. In order to develop investment strategies by capturing the benefits of diversifying across the sample countries, the calculated correlations should be less than +1.0. Also, if the degree of integration does increase following the two breakpoints in the sample period, the correlation among the markets should increase, rendering diversification in later periods less beneficial compared to the earlier periods.

The null hypothesis being tested is whether there is any change in the correlation coefficients among the observed markets between the pre-integration and post-integration periods.

H_0: $\rho_{xyt} - \rho_{xyt-1} = 0$

H_A: $\rho_{xyt} - \rho_{xyt-1} \neq 0$

The failure to reject the null hypothesis shows that there is no change in the correlation structure and the rejection indicates that the breakpoints have affected the structure. Although the rejection of the null indicates a change in the correlation structure, the sign of the change is important for further interpretations about the effect of the breakpoints. An increase in the correlation coefficients means that the breakpoints have increased the integration among the stock markets, which can further be interpreted as a result of the globalization/regionalization effect. Although the increase in integration is not desirable in terms of portfolio diversification, this result is in line with the a priori expectation in the study regarding the effects of globalization/regionalization.

On the other hand, a decrease in the correlation coefficients indicates that the integration among the sample countries did not increase. Such a result is desirable in terms of portfolio diversification since risk will be reduced further with decreasing correlation coefficients when investment strategies are developed involving diversification among the sample countries.

The correlation analysis is a basic and simple step to detect the direct relationship among the sample stock markets. It provides a preliminary verification for the presence of integration before other tests are conducted.

3.3.3. Cointegration Analysis

This step of the analysis includes the cointegration tests. This section aims to determine the long-term relationship among the sample stock markets. The existence of cointegration indicates that there exists a stationary linear combination of variables that are non-stationary in their level form. Any equilibrium relationship among a set of non-stationary variables implies that their stochastic trends must be linked. The equilibrium relationship means that the variables cannot move independently of each other in the long-run. The linkage among the stochastic trends necessitates that the variables be cointegrated. This kind of a result does not tell much about the short run relationship; yet, cointegration would reflect a long run relationship between the stock market indices. If the null hypothesis that there is no cointegration is not rejected, this further implies that there may be benefits to diversification in these markets since these markets do not have a long run relationship that makes them move or drift together.

Originally, the concept of cointegration arose from the concern about spurious regression relationships that were observed in time series data. For instance, the following is a typical regression model which analyzes a linear relationship in the levels of the economic variables x and y over time.

$$y_t = \alpha + \beta x_t + u_t \tag{3.11}$$

The estimation of such a model often produces empirical results in which the R^2 is quite high, while the Durbin-Watson statistic, showing the degree of autocorrelation among the error terms, is quite low. Such a finding is typically the result of the economic times series being dominated by smooth and long term trends. In other words, because the variables behave individually as non-stationary random walks, the linear combination of these variables in the regression model appears to be stationary. This result, however, gives little information about the short run relationship between y_t and x_t. As a typical result, the hypothesis of no relationship between them is often rejected if the two series are both integrated of the first order (i.e., first differences). In fact, these non-stationary series are cointegrated within a long-run equilibrium relationship.

In order to detect cointegration, the first step should be identifying whether the two series, y_t and x_t, are both integrated of the first order. This further means determining whether they contain unit roots. If both series are shown to be integrated of the first order, the parameters of the following cointegration relationship are estimated.

$$y_t = \beta_0 + \beta_1 x_t + u_t \tag{3.12}$$

As the last step in the cointegration analysis, the residual term from this regression model is tested to determine whether it is integrated of order zero; in other words, whether the residual term is stationary in its level form.

In this procedure, there is still a chance that the tests can capture a spurious relationship between x_t and y_t. The solution for overcoming the possibly spurious relationship between two variables has been to take the first difference of each series and to re-estimate the regression. However, this method has been criticized in that valuable long run information might be lost. In this case, the problem becomes one of working with two possibly non-stationary series in order to capture both long and short run effects.

The specific analysis of cointegration, as it was introduced by Engle and Granger (1987), calls for considering a set of variables in long run equilibrium such that there is a linear combination of these variables that equals zero in the following manner.

$$\beta_1 x_{1t} + \beta_2 x_{2t} + \cdots + \beta_n x_{nt} = 0 \tag{3.13}$$

In this context, if β and x_t denote the vectors (β_1, β_2,…,β_n) and (x_{1t}, x_{2t},…,x_{nt}), then, the system is said to be in long run equilibrium when $\beta x_t = 0$. The deviation from the long run equilibrium is e_t, called the equilibrium error, and is expressed as follows.

$$e_t = \beta x_t \tag{3.14}$$

Engle and Granger argue that if the long-run equilibrium is meaningful, it must be the case that the equilibrium error process is stationary. They propose the following definition for cointegration.

The components of the vector $x_t = (x_{1t}, x_{2t},\ldots,x_{nt})'$ are said to be cointegrated of order *d,b*, denoted by $x_t \sim CI(d,b)$ if the following conditions are met.

1. All components of x_t are integrated of order *d*.
2. There exists a vector $\beta = (\beta_1, \beta_2,\ldots, \beta_n)$ such that the linear combination is integrated of order (d,b), where $b > 0$.

Here, the vector β is called the cointegrating vector. A series may have more than one cointegrating vectors and the number of cointegrating vectors is called the cointegrating rank (π).

After the introduction of the cointegration concept by Engel and Granger in 1987, Johansen (1988) proposed a method that can be utilized for hypothesis testing. The Johansen procedure allows for testing restricted forms of the cointegrating vectors. The key assumption for this type of hypothesis testing is that if there are *r* cointegrating vectors, only these *r* linear combinations of the variables are

stationary. All other linear combinations are nonstationary. If the restrictions are not binding, the number of cointegrating vectors should not diminish while estimating the model and restricting the parameters of π.

The multivariate cointegration test proposed by Johansen (1988) is used to test the multivariate cointegration between the Istanbul Stock Exchange ISE-100 index and the market indexes of each of the other sample stock markets. The test uses statistics to contrast the following hypotheses.

H_0: There are a maximum of *r* cointegrating vectors (r goes from 0 to 18)
H_1: There exist at least *r*+1 cointegrating vectors (r goes from 0 to 18)

If the null hypothesis is not rejected, this indicates that there is no cointegrating relationship among the sample stock markets. The rejection of the null hypothesis provides evidence that there is a long run equilibrium relationship among the stock markets of the sample countries and this further can be interpreted as evidence of increased economic integration among these countries.

CHAPTER IV

RESULTS AND ANALYSIS

4.1. The Results of Unit Root Tests

4.1.1. The Results of Unit Root Tests Considering the Introduction of the Euro as the Single Breakpoint

The unit root tests are applied for the period from 1.1.1990 to 12.31.2003. The sample period is divided into two periods considering the introduction of the Euro (1.1.1999) as the breakpoint. As mentioned in the methodology section, the KPSS test is used to test for the presence of unit root in the observed series. The unit root test is an initial step for the cointegration tests because the cointegration test can only be conducted among the series that are integrated of the same order. In the KPSS test, the null hypothesis states that an observable series is stationary around a deterministic trend. The KPSS tests are conducted for the null hypothesis of stationarity regarding a model with a constant (η_μ) or a model with a constant and a trend (η_τ).

The results obtained from the KPSS test are presented in Table 4.1. The critical value for the models with a constant (η_μ) is 0.739 at the 1% level, and the critical value for the models with a constant and a trend (η_τ) is 0.216 at the 1% level. Considering these critical values, the KPSS test statistics are much bigger than the critical values for each of the models with a constant or with a constant and a trend in the level form. These results provide evidence for the rejection of the null hypothesis since all KPSS test statistics are significant at the 1% level. The

rejection of the null hypothesis implies that the series under analysis are all non-stationary in their level form.

Following the rejection of the null hypothesis, a second KPSS test is conducted by using the first differences in the series and this time it is not possible to reject the null hypothesis of stationarity for all but three of the series. The KPSS test statistics for the first differences are smaller than the critical values mentioned above. Therefore, it is concluded that these series are first-difference stationary. As a result, all but the series of Belgium, Austria and Greece can be included in the cointegration analysis in the next step.

4.1.2. The Results of Unit Root Tests for the First Two Sub-Periods

The period from 1990 to 1998 is subdivided into two by using the Customs Union as a breakpoint; in order to see the affect of it in the sample markets. As the second part of the analysis, unit root tests are conducted for the periods from 1.1.1990 to 12.31.1995 and from 1.1.1996 to 12.31.1998. Similar to what is presented in the above section; the KPSS stationarity tests are conducted with the purpose of testing whether the series are stationary around a level or a trend. If it can be shown that the series are integrated of the same order, it is possible to test for cointegration as the next step. Using the same critical values at the 1% level, the KPSS test statistics are examined. The test statistics associated are presented in Table 4.2 by also including the last period.

During the period from 1/1/1990 to 12/31/1995, which is the period prior to the Customs Union, the test statistics obtained are greater than the critical values. Since the test statistics are significant considering the critical values, the null hypotheses for all countries are rejected at the 1% level. The rejection of the null hypotheses implies that the series under analysis are all non-stationary in their level form. Following the rejection of the null hypothesis, a second KPSS test is conducted by using the first differences in the series for the models with a

constant and with a constant and a trend. This time, all test statistics are smaller than the critical value and as a result the null hypothesis of stationarity cannot be rejected for these series in their first difference form. Again, since the series are integrated of the same order, it is possible to test for cointegration during the first sub-period.

In the second sub-period that is between 1.1.1996 and.12.31.1998, the KPSS test statistics are found to be significant at the 1% level compared to critical values and the null hypotheses of stationarity are rejected for the level form series for all countries. However, when the KPSS tests are repeated for the first differences of the series, it is not possible to reject the null hypotheses. Again, it is concluded that the series are all integrated of order one, making it possible to conduct cointegration tests for this sub-period as well.

4.2. Correlation Analysis

The correlation analysis investigates whether there is a linear relationship among the sample stock markets. The correlation coefficients obtained by the analysis give information about the degree and the direction of this relationship. A positive correlation coefficient indicates a positive linear relationship where two series move in synchronization; whereas a negative correlation coefficient indicates a negative linear relationship where two series move in opposite directions. After obtaining the correlation coefficients, a comparison of the coefficients among the sub-periods reveals information on how the breakpoints have affected the linear relationships among the observed stock markets. The results of the correlation analysis are examined in three separate sections in order to better analyze the effect of the breakpoints on the relationship among the stock markets. These three sections look at (1) the correlation between ISE and European markets, (2) the correlation between ISE and the regional indices, and (3) the correlation among the European Union countries.

4.2.1. Correlation between ISE and European Markets

The correlation coefficients are presented in Table 4.3. During the first period that covers 1990 through 1996, the Turkish stock market has the highest correlation with the Greek stock market. When the correlation coefficients of the pre-customs union and post- customs union periods are compared, it is generally observed that the correlations have increased. Only the correlations with Greece and Spain have declined. It is also seen that negative correlations of the Turkish stock market with the Belgian, French, Dutch, Swiss and British stock markets are turned into positive correlations in the second period and no negative correlation coefficient is observed in this later period. ISE has its highest correlation with the Austrian stock market during the post-customs union period. In addition, the Danish, Irish and Swedish stock markets have similar high correlations with ISE, whose coefficients are found to be greater than 0.5. Moreover, there is no coefficient smaller than 0.315, which is the correlation between the Turkish and Belgian stock markets during the post-customs union period.

When the third period starting with the introduction of Euro is examined, the only negative correlation is found to be with Austria, which had high positive correlations in the pre-Euro periods. The highest correlations are observed for the Finnish and Swedish stock markets, followed by the German, French and Luxembourgian stock markets. The period has usually higher correlations than prior periods in which some coefficients almost doubled; however, some declining correlations are witnessed for Austria, Belgium, Denmark, Switzerland and Ireland.

The findings obtained by the correlation tests result in the rejection of the null hypothesis that there is no change in the correlation structure for both periods. With the rejection of the null hypothesis, it is implied that the correlation structure has changed with the effect of the two breakpoints. Since most of the pair-wise

results indicate an increase in the correlation coefficients after both breakpoints, it can be concluded that the customs union and the introduction of the Euro have an increasing effect on the economic integration among Turkey and the European Union countries. This outcome is similar to what is expected in the initial stages of this study. There are few correlation coefficients that have decreased. These decreasing coefficients show that the breakpoints have an effect to reduce the integration between Turkey and these markets. Turkey's integration has decreased with Greece and Spain after the Customs Union and with Austria, Belgium, Denmark and Switzerland after the introduction of the Euro.

4.2.2. Correlation between ISE and the Regional Indexes

The correlations of Turkey with the regional indices are examined in two parts. In the first part, the CU is introduced as the single breakpoint in order to divide whole period into two. Then, the period is again subdivided into two by the Euro breakpoint.

4.2.2.1. Correlation Considering the Customs Union as the Breakpoint

The results associated are presented in Table 4.4. The correlation coefficient between ISE and the EU index is -0.028 for the period of 1990 through 1995, and 0.618 for the period of 1996 through 2003. The negative correlation coefficient prior to the execution of the CU reflects a negative linear relationship and positive coefficient indicates a positive linear relationship. The correlation coefficient between Turkey and the EMU index is, on the other hand, 0.081 in the pre-customs union period and 0.627 in the post-customs union period. The results show that there is an increase in the correlation structure between Turkey and regional indices after the execution of the Customs Union reflecting more synchronization in their movements.

4.2.2.2. Correlation Considering the Euro as the Breakpoint

These correlations are presented in the Table 4.5. The correlation coefficient between ISE and the EMU index is 0.270 for the period of 1990 through 1998, and 0.720 for the period of 1999 through 2003. These positive correlations indicate a positive linear relationship for the two indexes, yet they show more synchronization in their movements during the post-Euro period. On the other hand, the correlation relationship between the EU index and ISE is negative during the pre-customs union period although it is small in scale. This negative correlation coefficient becomes positive during the post-customs union period. The coefficient of -0.028 during the first period becomes 0.618 during the post-customs union period.

The findings related with these two indexes are in line with the a priori expectation of the study. The two breakpoints are influential on the relationship between Turkey and the European Union countries. With the effect of the customs union, Turkey has a higher integration in general with the European Monetary Union members after 1996. Similarly, after 1999, with the influence of the introduction of the Euro, Turkey has a higher integration with the EU members when they are represented altogether with a single index. This outcome results in the rejection of the null hypotheses for both indexes for both periods showing that the breakpoints have affected the correlation structure with an increasing effect that indicates a higher integration between ISE and these indexes.

4.2.3. Correlation among European Union Countries

The results of the correlation tests for both sub-periods are given in Table 4.6. The utilized breakpoint is the introduction of the Euro (1/1/1999) to subdivide the sample period into two. The period covering 1990 through 1998 has usually high correlations for all the observed countries with a few exceptions. Greece is the first exception that has only one very strong correlation with Luxembourg during

this period and all other correlation coefficients of Greece are at moderate levels. One other such example is Austria. Like Greece, Austria also has a strong correlation with Luxembourg, but not as strong as the correlation between Greece and Luxembourg. Furthermore, Austria has similarly moderate levels of correlation with the other countries, but as an exceptional result, it has a negative correlation with the UK. This negative correlation is also unique for the period. Unlike these two countries, Switzerland has very strong correlations with other countries. Similar to Switzerland, Luxembourg and Ireland has usually high correlations. The highest correlation coefficient observed in the period is between Switzerland and Netherlands. Belgium has the highest correlations with France and Finland and likewise, France and Finland have their highest correlations with Belgium. The highest correlations of Denmark are with the UK and Sweden. Germany's highest correlation is with Netherlands. As a result of geographical proximity, Italy, Portugal and Spain have strong correlations with each other. A similar result is present between Sweden and Denmark.

After the introduction of the Euro, the general finding about the correlation structure is that the coefficients mostly decreased. Another notable result is that most of the correlations of Austria became negative after the breakpoint. The correlation of the Greek stock market, on the other hand, has increased contrary to other countries. Most of the correlations decrease to moderate levels; yet, there are still some strong correlations. The highest correlation is between Netherlands and Germany. Another strong correlation is between UK and Belgium. French stock market becomes the market that has most of the strongest correlations for the second period. The regional strong correlations are still observed with smaller coefficients among Portugal, Spain and Italy and between Sweden and Finland.

The null hypotheses related with the European countries state that there is no change in the correlation structure. Considering the results gathered from the correlation analysis, the null hypotheses related with all the countries are rejected. The rejection indicates that the introduction of the Euro has affected the correlation structure. The sign of this change is also important. An increase in

the correlation coefficients shows that the introduction of the Euro has increased the integration among the stock markets and a decrease indicates that the integration among the sample markets decreased. The a priori expectation of this study is to reject the null hypothesis and to find increasing correlation coefficients after the breakpoint reflecting an increasing level of integration. However, although it is possible to reject the entire null hypothesis, the sign of the change does not indicate increasing integration for all the stock markets. Most of the stock markets are found to have less integration with other stock markets, but Greece's integration with the others has increased with the introduction of the Euro. Some coefficients of France, Italy and Sweden also increased after the breakpoint. Therefore, although there are some exceptions, it can be concluded that the introduction of the Euro has a decreasing effect on the integration among the European Union members, except for Greece, to the extent that the correlation coefficient among the markets is a good indicator of economic integration.

As a summary, it can be concluded that the correlations during the post-Euro period are smaller than the pre-Euro period, which indicates a statistically significant effect from the introduction of the Euro. Another finding is that Greece and Austria have the weakest correlation relationships with the other European countries. However, in most of the cases, Greece's correlations with the others increase as a result of the introduction of Euro. Similar to Greece, France, Italy and Sweden also have increasing correlations during the second period. Portugal and Spain have strong correlations with each other, as well as with Italy, This result is not surprising considering the geographical proximity of these countries. Similarly, Sweden, Finland and Ireland, and to a certain extent Denmark and Belgium, have strong correlations among each other.

4.3. Cointegration Analysis

The aim of the cointegration analysis is to identify the presence of a long term relationship among the sample stock markets. In line with the purpose of the study, this section is organized into two parts. In the first part, the cointegration

structure among the Turkish and European stock markets is examined. This part considers the Customs Union agreement and the introduction of the Euro as a common currency as two breakpoints and attempts to determine whether there is any change in the cointegration structure following both of these economic events. In the second part of this section, the aim is to test the effect of the introduction of the Euro on the long term relationship among the European countries and therefore, Euro is the only breakpoint that is used. In each part, the Johansen cointegration tests are used to analyze the cointegration relationships.

4.3.1. Pair-Wise Cointegrations among Turkey and the European Stock Markets

In this section, the pair-wise cointegration structure of the Turkish stock market with the European stock markets is tested with the objective of determining whether the Customs Union and the introduction of the Euro have an influence on the long-run relationship among the mentioned stock markets.

There are three sub-periods to be compared in this section. The first period goes from 1.1.1990 to 12.31.1995; the second sub-period goes from 1.1.1996 to 12.31.1998; and, the last sub-period goes from 1.1.1999 to 12.31.2003. The countries that are included in this part of the analysis are determined according to the results of the unit root tests from the previous section. The series of Austria, and Greece are found to be non-stationary for the third sub-period and therefore, they are not included in the pair-wise analysis in any of the three sub-periods. Therefore, Belgium, Britain, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, Switzerland and Turkey are the countries included in the cointegration tests in this section.

The null hypothesis of the Johansen cointegration test states that there are r or fewer cointegrating vectors among the data series under study. A failure to reject the null hypothesis would indicate that there is no cointegration among the

sample stock markets. The a priori expectation is to determine the presence of cointegrating relationships, especially after both breakpoints as an indication of increased economic integration.

An important preliminary step in the cointegration analysis is to select the appropriate lag length by analyzing the data since the lag length has crucial implications for the accuracy of the cointegration tests. If *p*, the lag length, is selected to be too short, the model is misspecified or if it is selected to be too long, degrees of freedom is unnecessarily decreased during the test. Lag orders are determined according to the Final Prediction Error (FPE) and the Akaike Information Criteria (AIC).

In this part of the analysis, both FPE and AIC tests select the same lag length for each of the three sub-periods. The results of lag order selection and the trace and max-eigenvalue tests are presented in Table 4.7 for each country. The results generally indicate that all countries but Luxembourg have one cointegrating vector with Turkey during the first sub-period, which is the pre-customs union period. Surprisingly, and in contradiction with the expectations of this study, the number of cointegrating vectors between Turkey and the other 10 countries remains the same or decreases to zero during the post-customs union and pre-Euro period. This result implies that the customs union had no effect to change the long-run relationship between Turkey and these countries. In the post-Euro period, both tests again indicate no cointegration between Turkey and most of the countries. There are two exceptions to this result. Turkey has one cointegrating vector with each of Finland and Sweden during the post-Euro period. In light of these findings, it is concluded that Turkey generally has no pair-wise cointegration with these countries after the introduction of the Euro, showing that the Euro has no effect on the long-run relationship between Turkey and the sample countries.

As previously mentioned, the cointegration test determines whether there is a long-run relationship among the observed stock markets. When the results of pair-wise cointegration tests are examined, it is seen that during the pre-customs union

period, there is only one cointegrating relationship between Turkey and the sample EU countries. Surprisingly and in contradiction with the a priori expectations, the presence of this relationship does not continue after the customs union agreement. During the post-customs union period, the results of the cointegration tests generally fail to identify any cointegrating relationship between these markets. This result can be interpreted as a sign of a lack of economic integration during this period or an indication that the customs union was not effective in bringing the Turkish stock market closer to the European stock markets. Although the customs union agreement may have increased the trade relationship between Turkey and the sample markets, it seems like this was not a factor that helped to bring these countries' stock market movements closer.

A similar result is obtained when the long-run relationship is examined following the second breakpoint (the introduction of Euro). Test results indicate that Euro made no difference in terms of creating new liaisons between the Turkish and European stock markets. This second result may not be surprising since Turkey is not one of the countries who adopted Euro as its currency.

4.3.2. The Cointegration among European Stock Markets Including Turkey

In this section, the sample period is divided into two considering the introduction of Euro as the single breakpoint. The first sub-period is goes from 1.1.1990 to 12.31.1998 and the second period goes from 1.1.1999 to 12.31.2003. The objective in this part is to determine whether the introduction of the Euro has any effect on the long-term relationship among the observed stock markets. The Johansen test is conducted for a sample of 10 EU countries and Turkey. Only 11 countries are included in these tests because the statistical software that is used to conduct these tests (E-Views) allows a maximum of 11 countries in cointegration tests. The 10 EU countries are selected on the basis of the unit root test results and

the criterion of the 10 highest volume of trade with Turkey[1]. Austria, Belgium and Greece are eliminated since they are not integrated of the same order with other series. After the inspection of import and export figures, the 10 countries that are included are Britain, Denmark, Finland, France, Germany, Italy, Netherlands, Spain, Sweden, and Switzerland.

Once again, the appropriate lag length should be selected prior to the cointegration analysis. The lag orders are determined by using the Final Prediction Error and the Akaike Information Criteria. The lag order is determined as 15 in the first sub-period and as 2 in the second period.

The null hypothesis of the Johansen cointegration test states that there are r or fewer cointegrating vectors among the data series under study. A failure to reject the null hypothesis would indicate that there is no cointegration among the sample stock markets. The a priori expectation is to determine the presence of cointegrating relationships, especially after the introduction of the Euro as an indication of increased economic integration. The results of the Johansen cointegration tests are presented in Table 4.8. For the first sub-period before the introduction of Euro, the results indicate that there are two cointegrating equations according to the trace test and one cointegrating equation according to the max-eigenvalue test at the 1% level. For the post-Euro period, trace test indicates that there are three cointegrating equations at the 1% level and max-eigenvalue test indicates that there is one cointegrating vector at the same level.

The presence of a cointegrating relationship between two markets indicates that there is a link connecting these markets over the long run. For some countries, it is possible to find more than one link that establishes a long run relationship between these counties. These links are economic, geographic or political ties that make the countries to move in unison over the long run. For instance, for the sample countries, it is plausible to expect to find such economic, geographic or political ties since these countries are either all part of the European Union or, in the case of

[1] Trade figures are for the year-end 2003 and obtained from the Undersecretariat of Foreign Trade.

Turkey, have strong relationships with the union. In this study, these common links are hypothesized to change and become even stronger over time as a result of structural changes in the economic relationships among the sample countries. One of these changes is the introduction of Euro as the common currency for most of the sample countries.

When the trace test and max-eigenvalue test results are examined for the two sub-periods, it is seen that the trace test implies an increase in the number of cointegrating equations after the breakpoint. On the other hand, according to the results of the max-eigenvalue test, the number of cointegrating vectors remains the same. The results of the trace test imply that the number of links that tie the sample countries together over the long-run increases after the introduction of Euro.

The markets included in this test are Britain, Denmark, Finland, France, Germany, Italy, Netherlands, Spain, Sweden, Switzerland and Turkey, as mentioned above. According to the test results it can be concluded that the introduction of the Euro has an effect on the relationships among these sample countries. This result is in accordance with the a priori expectations of this study. To begin with, the cointegration analysis indicates two ties that link the observed markets. There may be several links among these countries but the first link is plausibly the European Union membership of the sample countries. Although Switzerland and Turkey are not members of this formation, the Union still represents a tie for this group since the social, political and economical decisions taken by the Union have an effect on all countries because of geographical closeness. In addition to the geographical proximity, Turkey and Switzerland have close economic relationships with the Union. For instance, a majority of Turkey's and Switzerland's international trade is conducted with the EU countries. These trade relations can also be seen as a second factor that ties the observed countries to each other. As well as being important trade partners of Turkey, these countries also have strong trade liaisons with each other. Thus, the connections prior to the breakpoint are hypothesized to be the EU membership and close relations with it. Following the breakpoint, the ties increase and this is hypothesized to be a direct effect of the introduction of

Euro. With the introduction of the Euro, as previously mentioned, the whole economic relations change for both the member countries and non-member countries. For instance, a common currency provides closer cooperation for the member states. In addition, Euro is used as an alternative to the US dollar in international trade around the world. These examples reveal that the introduction of the Euro has an important impact on each sample country and on the economic relations around the world in general. Considering Euro's affect on the world, Turkey is expected to have been more affected from this economic change since it is both a geographical, economical and trade partner of the Union and a future member. When the countries are examined as a group, different from pair wise cointegration analysis, it is possible to see the effect of the Euro breakpoint in increasing the economic ties. However, in the pair-wise cointegration analysis, the Euro breakpoint mostly did not affect the relationship of each country with Turkey. It can be concluded that while the Euro has an affect on the long-term relationship among the EU countries, the pair-wise long term relationship of Turkey with these countries is not really affected from the introduction of Euro.

CHAPTER V

CONCLUSION

The idea for this study originates from the fact that globalization is an important trend that has arisen after the World War II and is well known ever since. Globalization has not only affected the establishment of regional formations, but it has also created a new economic environment all around the world and lead to the globalization of financial markets simultaneously. In fact, globalization and the new economic developments constantly enhance each other. Some economic developments are worth mentioning here. One such factor is the deregulation of financial markets. Competition among financial markets is another factor. The securitization, disintermediation and institutionalization are also responsible for the globalization of financial markets. The growth of Euromarkets has enhanced the links between national markets and banks started to provide global services with local subsidiaries due to the relaxation of domestic entry barriers. Another significant contribution of globalization for the financial markets comes from the modern portfolio theory, which states that a portion of the risk in any investment can be reduced through diversification. Globalization allowed all international investors to diversify globally in order to reduce their portfolio's systematic risk level to a level lower than their home country's systematic risk level. In addition, through its affects on financial markets, globalization also resulted in the construction of regional formations. One of these regions is Europe with whom Turkey has close political and economic relations. In light of these empirical observations, this study aims to determine whether this regional formation is influential on the stock market relationships.

In order to keep the analysis focused, the study selects two breakpoints in line with the literature. The Customs Union Agreement between Turkey and the European

Union, which has been in effect since January 1, 1996, is the first breakpoint that is utilized in the study. With the Customs Union, Turkey eliminated all duties and equivalent charges on imports of industrial goods from the EU. The reason to include such a breakpoint in this study is that the date acts as a starting point for Turkey to be a part of a regional formation that was formed following the World War II. Therefore, with this date Turkey becomes a part of the regionalism trend. Another reason is that the Customs Union is expected to have an effect on the economic relations between Turkey and the EU and therefore, it is expected to influence the co-movement structure of the Turkish and European stock markets.

The second breakpoint is the introduction of the Euro in January 1, 1999 as a common currency of 11 members of the European Union. There are several reasons to include the introduction of the Euro in this study. First, the conversion to Euro is seen as the biggest monetary changeover in history. Second, it provides closer cooperation within the European Union and is expected to change the nature of the economic links between the stock markets of the Euro-zone. A single currency encourages more efficient and integrated stock markets with more liquidity and lower financing costs for borrowers and as a result, the EU envisages mergers and partnerships among the stock markets. Moreover, the conversion has an impact on the relations of the EU countries with the third countries and the degree of the impact depends on the degree of economic ties that the third country has with the EU.

Considering both breakpoints, the study expects to find an increased level of integration among the stock markets after each economic change. International investors prefer to diversify in markets that are not closely integrated so that each market can have a different level of systematic risk. In contrast with this suggestion, the European Union countries already seem integrated and the introduction of Euro is anticipated to increase this integration further. Similarly, for Turkey, the EU member countries are expected to have already close relationships due to geographical proximity and social and political links. Moreover, the Customs Union is projected to enhance these ties further.

Therefore, it is plausible to expect to find a higher level of integration after both of the breakpoints. This means that the co-movement of the Turkish and the European stock markets will be higher due to higher integration and this will decrease the benefits of diversification among these countries. In other words, the foreign portfolio investors who invest in ISE and Turkish investors who invest in the European Union countries' stock markets will not be able to benefit from investing internationally as much as they used to prior to the two economic events.

With these initial expectations, the aim of the study comes out as determining whether the interdependencies among the observed countries increase after these two breakpoints. The countries included in this study are Turkey, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom and Switzerland. With this objective in mind, the study conducts several analyses that can be summarized in three parts. The first analysis is on variabilities, the second one is on the correlation structures of the sample stock markets and the third one is on the long-term relations among the stock markets mentioned.

The second stage of analysis conducts correlation tests in order to detect whether there is any linear relationship among the sample stock markets. After identifying the presence of a linear relationship, the analysis makes a comparison of the correlation coefficients among the observed periods to see the differences after the breakpoints. The results obtained are classified into three parts. As a first part of the correlation analyses, the correlation between ISE and European markets is examined. In this part, the correlations are found to be increasing with the effect of the Customs Union and further increasing with the introduction of the Euro in general. There are also a few declining correlation coefficients. These results reveal that, in line with the a priori expectations, the increasing correlation coefficients are an indication of increasing integration among the observed markets. This also means that the diversification benefits in including these stock markets in the same portfolio when investing in ISE declines following the

two breakpoints. In addition, the few decreasing correlation coefficients show that Turkey's integration with these countries has declined after the breakpoints and therefore, the diversification benefits that will be obtained are increasing for the investors who invest both in ISE and in one of these markets in the same portfolio. In the second part of the correlation analyses, the correlation between Turkey and some regional indexes are examined. The regional indexes belong to the European Union members and the European Monetary Union members and can provide a rough and general understanding on how the breakpoints have affected the correlation structure between Turkey and these countries. The results are in line with the a priori expectations and the correlations are found to be increasing. The increasing correlations, again, reflect increasing integration, but smaller chances of diversification among these markets. Therefore, an investor who invests in such a regional index as well as the ISE may not be able to reduce the portfolio risk because of increasing linear relationship among these markets.

As the final step of the correlation analyses, correlations among European Union countries are investigated by utilizing the introduction of the Euro as the single breakpoint. In contrast with the a priori expectations, the general finding about this part is decreasing correlation coefficients and the most significant one is the correlations of Austria, which became negative after the breakpoint. The Greek stock market, on the other hand, has increasing correlations after the Euro. Some regional strong correlations are also observed in this part, namely among Portugal, Spain and Italy as one group and Sweden and Finland as another. Considering these results, the introduction of the Euro is not as influential as expected. Its affect on increasing the correlations is limited. This reduction in correlations may provide better diversification opportunities for international. In light of these findings, several investment strategies can be offered for an investor who invests in European stock markets. For instance, when investing among these markets to form a portfolio, inclusion of Austria may help to decrease the portfolio risk since it has negative correlations with others. The Greek market may be eliminated since it does not provide any diversification benefits. Netherlands and Germany or the UK and Belgium should not be included in the same portfolio because their pair-

wise correlations are high. In addition, the regional neighbors with high correlations, which are Portugal, Spain, Italy or Sweden and Finland, should not be included in the same portfolio because diversification benefits would be very limited.

Similar to the correlation analyses, the cointegration analyses are also divided into two parts as (1) the pair-wise cointegration relationships between Turkey and the European stock markets and (2) the cointegration relationships among European Union countries including Turkey. In the first part, both breakpoints are utilized, but in the second part, only the introduction of the Euro is used. The cointegration analyses reveal information about the long-term relationships of the stock markets. The analysis results give an idea about the number of long-term connections that link these markets. Prior to the Customs Union, there is only one link between most of these countries and Turkey. The number of these links remains the same or declines to zero after this breakpoint. This implies that the Customs Union has no affect to change the long run relationship between Turkey and these countries. Similarly, the conversion to Euro also has no affect on the long run relationship between Turkey and the EU countries. These results do not necessarily imply a lack of economic integration after the breakpoints but possibly show that the two breakpoints represent no significant economic change that would help bring the Turkish stock market closer to the European stock markets. Although the Customs Union is anticipated to increase the trade relations, it does not seem to be a factor that makes these markets move together. On the other hand, Euro also has no impact on the long-run relations between Turkey and the EU countries, but this result is more understandable since Turkey has not been involved in the Monetary Union or adopted Euro as its currency. Even though the results contradict with the a priori expectations, they point to possible diversification benefits between Turkey and these markets, especially after the breakpoints. Therefore, an international investor may benefit from investing in Turkey and one of these markets within the same portfolio.

In the second part of the cointegration analysis, a second group is formed to test the cointegration relationship by taking the Euro as the single breakpoint. The results reveal that the breakpoint has been influential in increasing the ties among the EU markets. The number of cointegrating relationships increases after the introduction of the Euro compared to before the breakpoint. These cointegrating relationships are plausibly EU membership or trade relations with the EU and even geographical closeness. The new link that makes the markets move in unison after the breakpoint is hypothesized to be the introduction of the Euro. The investment strategy, constructed based on this finding should not include investing in this group of countries all at the same time since they have a tendency to move in harmony.

To summarize, the results of this study imply that when examined on pair-wise basis, the Turkish stock market has a larger number of cointegrating liaisons with the European stock markets after the Customs Union. However, the long run pair-wise relationships do not really change following the introduction of the Euro. Alternatively, the European stock markets have an increasing relationship following the introduction of the Euro.

Literature in this topic is revised in previous chapters. As it is seen from that review, the literature sampling different countries all around the world is widely present, yet the studies working on Turkish stock market is very limited. However, ISE is an attractive emerging stock market for the international investors. For that reason, its correlation structure and long-term relationship with other stock markets should be clarified when including it in a portfolio composed of different stock markets. This study aims to fill this gap partially while guiding the investors who invest both in Turkey and European stock markets at the same time.

This study can be expanded by examining longer sample periods and a larger number of countries. The role of the US stock market can also be tested, since it is widely mentioned as a dominant market in the literature. The sample can be enlarged by including countries from different regions around the world as

well. Since the EU has some regional programs that it executes with different regions such as Asia or Africa, the presence of any integration with these regions can be tested to understand the relationships among the EU stock markets and third party stock markets or indexes.

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APPENDICES

APPENDIX A

Table 3.1
Stock Market Indexes

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom, Switzerland, Turkey, and USA are the countries selected to be included in the sample. The indexes are chosen accordingly. The sample period for all indexes except for the Luxembourg index is between January 1, 1990 and December 31, 2003. The period for the Luxembourg DS-Market index is between January 1, 1992 and December 31, 2003.

COUNTRY	**STOCK MARKET**	STOCK MARKET INDEX
AUSTRIA	Vienna Stock Exchange	**Austria ATX DS-Calculated**
BELGIUM	Brussels Stock Exchange	**Bel-20 DS-Calculated**
DENMARK	Copenhagen Stock Exchange	**Denmark DS-Market**
FINLAND	Helsinki Stock Exchange	**Finland Market**
FRANCE	Paris Stock Exchange	**France CAC 40**
GERMANY	Frankfurt Stock Exchange	**DAX 200**
GREECE	Athens Stock Exchange	**Athens SE General**
IRELAND	Irish Stock Exchange	**Ireland SE General**
ITALY	Milan Stock Exchange	**Milan Comit 30 DS**
LUXEMBOURG	Luxembourg Stock Exchange	**Luxembourg DS-Market**
NETHERLANDS	Amsterdam Stock Exchange	**Netherlands DS-Market**
PORTUGAL	Lisbon Stock Exchange	**Portugal PSI General**
SPAIN	Madrid Stock Exchange	**Madrid SE General**
SWEDEN	Stockholm Stock Exchange	**Sweden DS-Market**
UNITED KINGDOM	London Stock Exchange	**FTSE 100**
TURKEY	Istanbul Stock Exchange	**ISE National 100**
SWITZERLAND	Swiss Stock Market	**Swiss Market**
USA	New York Stock Exchange	**S&P 500**

Table 3.2
Regional Indexes

NAME OF THE INDEX	INCLUDED MARKETS	PERIOD
EU DS-MARKET	Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom	**1.1.1990 - 31.12.2003**
EMU DS-MARKET	Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain	**1.1.1990 - 31.12.2003**

Table 3.3
Sub-Periods

There are three sub-periods analyzed using two breakpoints: the Customs Union on 1.1.1996 and the introduction of Euro on 1.1.1999.

PERIOD	**DATES**	BREAKPOINT
Pre-customs union and pre-Euro period	Jan. 1, 1990 – Dec. 31, 1995	**Customs Union**
Post-customs union and pre-Euro period	Jan. 1, 1996 – Dec. 31, 1998	**Introduction of Euro**
Post-customs union and post-Euro period	Jan. 1, 1999 – Dec. 31, 2003	

Table 4.1
KPSS Stationarity Test (Considering Euro as only Breakpoint)

	LEVELS		FIRST DIFFERENCES	
	(η_μ)	(η_τ)	(η_μ)	(η_τ)
1/1/1990-31/12/1998				
Austria	1.516296*	0.726105*	0.038178	0.039915
Belgium	4.58164*	1.046521*	1.008887*	0.087282
Britain	1.247554*	0.323164**	0.323164	0.034991
Denmark	4.702458*	1.261887*	0.301255	0.030677
EMU	4.594544*	1.154722*	0.575966	0.030051
EU	4.815659*	1.216996*	0.474901	0.025912
Finland	4.651127*	1.035279*	0.880001	0.055562
France	4.060816*	0.920826*	0.370215	0.043384
Germany	4.767191*	1.119287*	0.366959	0.017543
Greece	1.00649*	0.973978*	0.219847	0.127136
Ireland	4.866044*	1.209019*	0.375755	0.055873
Italy	2.995834*	1.003708*	0.507217	0.042641
Luxembourg	5.175119*	0.2638*	0.073301	0.047367
Netherlands	5.319113*	1.291636*	0.429483	0.015057
Portugal	3.781243*	1.116499*	0.587051	0.033974
Spain	3.353605*	1.238893*	0.669610	0.042958
Sweden	4.719618*	1.260621*	0.221208	0.044588
Switzerland	5.310528*	1.130067*	0.364858	0.018508
Turkey	0.563326*	0.555978*	0.014337	0.01506
1/1/1998-31/12/2003				
Austria	2.291536*	0.750786*	1.014864*	0.068508
Belgium	2.686098*	0.416067*	0.374081	0.058176
Britain	3.494318*	0.647425*	0.489961	0.049126
Denmark	0.921023*	0.612358*	0.361554	0.115626
EMU	3.126246*	0.759046*	0.426628	0.068602
EU	3.189568*	0.740943*	0.482471	0.064543
Finland	2.975991*	0.837673*	0.215299	0.021263
France	3.401833*	0.694337*	0.328271	0.082331
Germany	3.427720*	0.623459*	0.326786	0.072394
Greece	2.802947*	0.847493*	0.983032*	0.037278
Ireland	2.704611*	0.476993*	0.314827	0.178217
Italy	3.077633*	0.811459*	0.259113	0.081311
Luxembourg	2.908595*	0.826128*	0.333571	0.152155
Netherlands	3.622090*	0.519224*	0.266878	0.059235
Portugal	2.502063*	0.841094*	0.493615	0.06718
Spain	1.649047*	0.806097*	0.525503	0.045566
Sweden	2.903387*	0.864242*	0.357532	0.066826
Switzerland	2.708385*	0.373136*	0.219092	0.074936
Turkey	2.420658*	0.818716*	0.193816	0.032381

* Significant at 1%

Table 4.2
KPSS Stationarity Test (Considering both Breakpoints)

	LEVELS		FIRST DIFFERENCES	
	(η_μ)	(η_τ)	(η_μ)	(η_τ)
1/1/1990-31/12/1995				
Austria	1.030611*	0.949587*	0.056328	0.052741
Belgium	3.512056*	0.780337*	0.259388	0.021497
Britain	3.559914*	0.332783*	0.055198	0.029465
Denmark	2.475032*	0.819755*	0.116416	0.039718
EMU	3.055913*	0.894560*	0.164344	0.023481
EU	3.718987*	0.779741*	0.115836	0.020009
Finland	2.482444*	1.159619*	0.532774	0.138728
France	2.665035*	0.185290	0.027633	0.019662
Germany	3.024635*	0.872356*	0.146425	0.023109
Greece	2.315054*	0.377459*	0.183043	0.155364
Ireland	2.151421*	0.974471*	0.316371	0.02951
Italy	0.718766*	0.708168*	0.074215	0.034152
Luxembourg	3.877546*	0.470325*	0.140060	0.140147
Netherlands	4.548323*	1.024107*	0.430593	0.016151
Portugal	1.315230*	1.022755*	0.386281	0.064844
Spain	1.342916*	0.596340*	0.100579	0.026854
Sweden	1.839726*	1.022401*	0.309900	0.031600
Switzerland	4.501414*	0.851481*	0.540440	0.038354
Turkey	1.139716*	0.447166*	0.012563	0.01287
1/1/1996-31/12/1998				
Austria	0.821859*	0.183403	0.123216	0.067112
Belgium	3.042274*	0.661274*	0.372032	0.043216
Britain	3.319313*	0.262861*	0.061508	0.062306
Denmark	3.150683*	0.330405*	0.068906	0.057328
EMU	3.208082*	0.298242*	0.103867	0.052859
EU	3.283068*	0.189720	0.067667	0.054767
Finland	3.239342*	0.256874*	0.209304	0.049806
France	3.064975*	0.384665*	0.103576	0.037772
Germany	3.161885*	0.225687*	0.055848	0.042855
Greece	2.881133*	0.243545*	0.156696	0.041951
Ireland	2.808559*	0.253094*	0.155817	0.076033
Italy	3.154901*	0.452434*	0.122373	0.039878
Luxembourg	3.068706*	0.150775	0.086690	0.072607
Netherlands	3.259713*	0.144806	0.041683	0.040573
Portugal	3.023890*	0.279734*	0.095829	0.095287
Spain	3.226635*	0.276006*	0.106713	0.050110
Sweden	2.919389*	0.269324*	0.113284	0.055933
Switzerland	3.232997*	0.337060*	0.082807	0.052452
Turkey	0.952327*	0.177893	0.056691	0.046129

* Significant at 1%

Table 4.2 (continued)
KPSS Stationarity Test (Considering both Breakpoints)

	LEVEL		FIRST DIFFERENCES	
	(η_μ)	(η_τ)	(η_μ)	(η_τ)
1/1/1999-31/12/2003				
Austria	2.291536*	0.750786*	1.014864*	0.068508
Belgium	2.686098*	0.416067*	0.374081	0.058176
Britain	3.494318*	0.647425*	0.489961	0.049126
Denmark	0.921023*	0.612358*	0.361554	0.115626
EMU	3.126246*	0.759046*	0.426628	0.068602
EU	3.189568*	0.740943*	0.482471	0.064543
Finland	2.975991*	0.837673*	0.215299	0.021263
France	3.401833*	0.694337*	0.328271	0.082331
Germany	3.427720*	0.623459*	0.326786	0.072394
Greece	2.802947*	0.847493*	0.983032*	0.037278
Ireland	2.704611*	0.476993*	0.314827	0.178217
Italy	3.077633*	0.811459*	0.259113	0.081311
Luxembourg	2.908595*	0.826128*	0.333571	0.152155
Netherlands	3.622090*	0.519224*	0.266878	0.059235
Portugal	2.502063*	0.841094*	0.493615	0.06718
Spain	1.649047*	0.806097*	0.525503	0.045566
Sweden	2.903387*	0.864242*	0.357532	0.066826
Switzerland	2.708385*	0.373136*	0.219092	0.074936
Turkey	2.420658*	0.818716*	0.193816	0.032381

* Significant at 1%

Table 4.3
Cross Correlation Analysis for Turkey

	1ST SUBPERIOD	2ND SUBPERIOD	3RD SUBPERIOD
Turkey-Austria	0.511*	0.571*	-0.203*
Turkey-Belgium	-0.026	0.315*	0.206*
Turkey-Denmark	0.155*	0.529*	0.389*
Turkey-Finland	0.159*	0.391*	0.886*
Turkey-France	-0.099*	0.398*	0.735*
Turkey-Germany	0.057**	0.456*	0.700*
Turkey-Greece	0.583*	0.391*	0.540*
Turkey-Ireland	0.181*	0.555*	0.439*
Turkey-Italy	0.392*	0.436	0.696*
Turkey-Luxembourg	0.296*	0.424*	0.762*
Turkey-Netherlands	-0.161*	0.463*	0.610*
Turkey-Portugal	0.363*	0.465*	0.667*
Turkey-Spain	0.460*	0.415*	0.564*
Turkey-Sweden	0.260*	0.528**	0.856*
Turkey-Switzerland	-0.158*	0.458*	0.385*
Turkey-UK	-0.174*	0.469*	0.541*

* Significant at 1% level
** Significant at 5% level

Table 4.4
Cross Correlation between ISE and the Regional Indexes
Correlation Considering the Customs Union as the Breakpoint

	1/1/1990 – 12/31/1995		
	ISE	**EU**	**EMU**
ISE	1	-0.028	0.081*
	1/1/1996 – 12/31/2003		
	ISE	**EU**	**EMU**
ISE	1	0.618*	0.627*

*Significant at the 1% level

Table 4.5
Correlation between ISE and the Regional Indexes
Correlation Considering the Euro as the Breakpoint

	1/1/1990 – 12/31/1998		
	ISE	**EU**	**EMU**
ISE	1	-0.028	0.270*
	1/1/1998 – 12/31/2003		
	ISE	**EU**	**EMU**
ISE	1	0.628*	0.720*

*Significant at the 1% level

Table 4.6
Cross Correlation Analysis(Considering Euro as only Breakpoint)
1st Subperiod (1/1/1990-12/31/1998)

	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	Sweden	Switzerland	UK
Austria	1															
Belgium	0.528	1														
Denmark	0.581	0.947	1													
Finland	0.631	0.964	0.950	1												
France	0.511	0.977	0.933	0.931	1											
Germany	0.602	0.980	0.978	0.972	0.968	1										
Greece	0.520	0.501	0.486	0.505	0.524	0.484	1									
Ireland	0.637	0.924	0.980	0.944	0.902	0.967	0.429	1								
Italy	0.625	0.915	0.896	0.907	0.933	0.913	0.860	0.860	1							
Luxembourg	0.870	0.925	0.950	0.963	0.876	0.955	0.961	0.961	0.867	1						
Netherlands	0.516	0.959	0.978	0.951	0.937	0.981	0.388	0.973	0.848	0.965	1					
Portugal	0.613	0.955	0.959	0.948	0.963	0.967	0.597	0.933	0.965	0.914	0.929	1				
Spain	0.578	0.934	0.937	0.911	0.947	0.935	0.675	0.901	0.964	0.880	0.893	0.976	1			
Sweden	0.640	0.930	0.983	0.953	0.910	0.972	0.498	0.988	0.875	0.961	0.973	0.942	0.919	1		
Switzerland	0.506	0.964	0.969	0.951	0.938	0.978	0.377	0.960	0.852	0.960	0992	0.928	0.887	0.956	1	
UK	0.484	0.949	0.985	0.934	0.945	0.970	0.454	0.962	0.873	0.927	0.983	0.947	0.931	0.965	0.975	1

All significant at 1% level.

Table 4.6(continued)
Cross Correlation Analysis(Considering Euro as only Breakpoint)
2nd Subperiod (1/1/1999-12/31/2003)

	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland	Italy	Luxembourg	Netherlands	Portugal	Spain	Sweden	Switzerland	UK
Austria	1															
Belgium	0.221*	1														
Denmark	0.261*	0.198*	1													
Finland	-0.253*	0.332*	0.489*	1												
France	-0.197*	0.624*	0.567*	0.897*	1											
Germany	-0.143*	0.730*	0.457*	0.841*	0.969*	1										
Greece	0.103*	0.753*	0.237*	0.643*	0.749*	0.814*	1									
Ireland	-0.092*	0.648*	0.577*	0.623*	0.841*	0.849*	0.615*	1								
Italy	-0.055**	0.704*	0.547*	0.843*	0.956*	0.954*	0.733*	0.834*	1							
Luxembourg	-0.065**	0.611*	0.553*	0.881*	0.952*	0.936*	0.756*	0.788*	0.952*	1						
Netherlands	-0.168*	0.786*	0.415*	0.777*	0.956*	0.820*	0.820*	0.842*	0.934*	0.903*	1					
Portugal	0.126*	0.770*	0.482*	0.777*	0.874*	0.806*	0.806*	0.741*	0.939*	0.908*	0.873*	1				
Spain	0.378*	0.783*	0.541*	0.658*	0.783*	0.806*	0.806*	0.714*	0.862*	0.831*	0.795*	0.941*	1			
Sweden	-0.129*	0.499*	0.544*	0.961*	0.949*	0.748*	0.748*	0.723*	0.917*	0.963*	0.865*	0.878*	0.793*	1		
Switzerland	0.040	0.900*	0.448*	0.575*	0.838*	0.730*	0.730*	0.791*	0.865*	0.785*	0.920*	0.834*	0.803*	0.698*	1	
UK	-0.017	0.874*	0.318*	0.691*	0.878*	0.887*	0.887*	0.795*	0.888*	0.847*	0.963*	0.881*	0.847*	0.802*	0.802*	1

* Significant at 1% level
** Significant at 5% level

Table 4.7
Pair-wise Cointegration Analysis for Turkey (1% level)

	LAG ORDER			TRACE TEST (# OF COINTEGRATING RELATIONSHIPS)			MAX-EIGEN VALUE (# OF COINTEGRATING RELATIONSHIPS)		
	1st Per	2nd Per	3rd Per	1st Per	2nd Per	3rd Per	1st Per	2nd Per	3rd Per
Belgium	3	16	3	1	No	No	1	No	No
Britain	5	14	7	1	No	No	1	No	No
Denmark	3	14	2	1	No	No	1	1	No
EMU	3	16	2	1	No	No	1	No	No
EU	3	16	2	1	No	No	1	No	No
Finland	3	16	4	1	No	1	1	No	1
France	5	15	2	1	No	No	1	No	No
Germany	3	16	2	1	No	No	1	No	No
Ireland	3	16	2	1	No	No	1	No	No
Italy	3	16	6	1	No	No	1	No	No
Luxembourg	3	14	2	No	No	No	No	No	No
Netherlands	5	16	2	1	No	No	1	No	No
Portugal	5	14	4	1	No	No	1	No	No
Spain	3	16	2	1	No	No	1	No	No
Sweden	5	14	2	1	No	No	1	No	1
Switzerland	5	14	2	1	No	No	1	No	No

Table 4.8
Cointegration Analysis as a Group* (1% level)

LAG ORDER		TRACE TEST (# OF COINTEGRATING RELATIONSHIPS)		MAX-EIGEN VALUE (# OF COINTEGRATING RELATIONSHIPS)	
1st Per	**2nd Per**	**1st Per**	**2nd Per**	**1st Per**	**2nd Per**
15	2	2	3	1	1

* The countries included in the group:
Britain, Denmark, Finland, France, Germany, Italy, the Netherlands, Spain, Switzerland, Sweden, Turkey