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YÜKSEK LİSANS TEZİ

VOLATILITY SPILLOVER BETWEEN THE STOCK MARKET AND THE FOREIGN EXCHANGE MARKET IN TURKEY

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Danışman

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ABSTRACT

Master with Thesis

Volatility Spillover Between The Stock Market and

The Foreign Exchange Market in Turkey

Oya ÖZENGİN

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The recent increase in financial market liberalizations has accelerated the foreign capital flow to stock markets. As a consequence, the relationship between the exchange rate and the stock price index is being taken more seriously. In this study, the volatility spillover effect between Turkish stock market and foreign exchange market is analyzed. The goal is to determine if volatility shocks in one market influence the volatility of returns in the other market. The ARCH models such as GARCH (1,1) and EGARCH (1,1) is used for modeling spillovers between stock returns and exchange rate returns. It is found that the volatility in both markets is highly persistent and predictable on the basis of past innovations. The impact of these innovations is asymmetric. It is also found evidence of unidirectional volatility spillover from stock market to foreign exchange market. This result suggests that there is an information flow (transmission) from stock market to foreign exchange market and investors can predict the behavior of one market by using the information of the other. Finally, the implication of these results is particularly important for portfolio managers and domestic and international investors for hedging and diversifying their portfolios since they can obtain more insights in the management of their portfolio affected by these two variables.

Key Words: 1. Volatility, 2. Spillover Effect,

3. Foreign Exchange Market, 4. Stock Market.

ÖZET

Yüksek Lisans Tezi
Türkiye'de Hisse Senedi Piyasası ve Döviz Piyasası Arasındaki Oynaklığın Yayılma Etkisi
Oya ÖZENGİN

Dokuz Eylül Üniversitesi
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İngilizce İşletme Ana Bilim Dalı
İngilizce Finansman Programı

Son zamanlarda finansal piyasalarda artan liberalizasyon hisse senedi piyasasına yönelen yabancı sermaye hareketlerini hızlandırmıştır. Dolayısıyla, döviz kuru ve hisse senedi fiyat endeksi arasındaki ilişki daha önemli hale gelimiştir. Bu çalışmada, Türkiye'deki hisse senedi piyasası ile döviz piyasası arasındaki oynaklığın geçiş etkisi incelenmektedir. Çalışmanın amacı, bir piyasadaki oynaklığa yönelik herhangi bir şokun diğer piyasadaki getiri oynaklığını etkileyip etkilemediğini belirlemektir. Döviz kuru getirisi ile hisse senedi getirisi arasındaki geçiş etkisinin modellenmesinde ARCH modeline dayalı GARCH (1,1) ve EGARCH (1,1) modelleri kullanılmıştır. Elde edilen bulgular, geçmişte meydana gelen olaylara bağlı olarak her iki piyasadaki oynaklığın yüksek derecede sürekliliğe sahip ve öngörülebilir olduğu yönündedir. Bu olayların etkisi asimetriktir. Ayrıca, oynaklığın geçiş etkisi tek yönlü olup, hisse senedi piyasasından döviz piyasasına doğrudur. Bu sonuç, bilgi akışının hisse senedi piyasasından döviz piyasasına doğru olduğu sonucunu ortaya çıkarmaktadır. Dolayısıyla, yatırımcılar bir piyasadaki davranışı diğer piyasadaki bilgiyi kullanarak öngörebilirler. Sonuç olarak, elde dilen bulgular, özellikle portföy yöneticileri ile riskten kaçınmak ve portföylerini çeşitlendirmek amacıyla yerli ve yabancı yatırımcılar için önemlidir. Böylece, yatırımcılar söz konusu iki değişkenden etkilenen portföy yönetiminde daha fazla öngörü elde edebilirler.

Anahtar Kelimeler: 1. Oynaklık, 2. Geçiş Etkisi, 3. Döviz Piyasası, 4. Hisse Senedi Piyasası.

VOLATILITY SPILLOVER BETWEEN THE STOCK MARKET AND THE FOREIGN EXCHANGE MARKET IN TURKEY

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LIST OF ABBREVATIONS

ISE	: Istanbul Stock Exchange
CBRT	: Central Bank of the Republic of Turkey
CMB	: Capital Markets Board
CML	: Capital Market Law
rexc	: Nominal Exchange Rate (Return)
rise	: Istanbul Stock Exchange (Return)

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INTRODUCTION

Early steps towards the trend of globalization were taken during the onset of trade between cities and countries. The trend further grew in the 16th century with the maritime technology and distinguished itself in the 19th century with the discovery of electricity and the steam power. Advancements in communication and transportation technologies accelerated globalization in the 20th century. Removal of restrictions and increase in financial transparency commenced as of 1970s and gained momentum as of 1980s in developed countries whereas the same followed in developing countries with a lapse of a decade to start from the 1980s and 1990s, respectively. The phenomenon consequently gave rise to commercial and financial integration among the countries. Despite the fact that commercial and financial integration follow an interdependent and parallel course, the international impact of financial integration is far more significant than that of the commercial integration. The reason is that the risks involved in financial investments are greater than those in the trade of goods and services. Moreover, funds are higher in quantity and flow more rapidly in the case of financial integration. Due to financial integration, investments have increased both in developed and developing countries whereby markets have become more susceptible to each other.

In general, globalization significantly reduces restrictions and adds dramatically to the range of opportunities. In such a case, countries and entrepreneurs make use of the comparative advantage and find a chance to increase their production and welfare levels. Such logic is also valid for the international finance. Hence, investments are made to realize certain income potentials. Since removing barriers on the foreign trade maximizes the economic growth and the level of welfare by the way of providing effective allocation of resources, we can expect the mechanism to work in a similar way to produce a similar result for the international investment emerging due to removal of barriers on international capital movements. On the other hand, liberalism in international investment allows a country to acquire investment amounts in excess of its domestic savings by borrowing loans from foreign markets or lending the surplus to

foreign markets by investing less than total domestic savings. As the change in the price of a good sold globally balances export and import, similarly the change in the price of capital balances the supply and demand of funding.

As a result of the globalization since mid-1980s, international equity flows have been increasing at a rate of 34% per annum. Internationalization of stock markets, liberalized capital flows, huge foreign investment in emerging equity markets have led stock and foreign exchange markets to be increasingly interdependent. Particularly, after the several financial as well as currency crises across emerging markets and the advent of floating exchange rate led the researchers to have a re-look into the nature of volatility spillovers between stock and foreign exchange markets. There are two other reasons for their increasing attention on the issue. First, positive and significant spillovers of volatility may increase the nonsystematic residual which is the international portfolio risk faced by the international investors, hence it reduces the gains form international portfolio diversification. Second, an understanding of the linkages between the volatility of stock returns and exchange rate changes may improve the ability of multinational firms to manage their exchange rate exposures (Kanas, 2000: 447-448).

There is theoretical consensus neither on the existence of relationship between stock prices and exchange rates nor on the direction of the relationship. Considering "flow-oriented" and "stock-oriented" models as two basic approaches to the exchange rate determination there is a main disagreement. First approach, the "Flow –oriented" models of exchange rates focus on the current account or the trade balance (Dornbusch and Fisher, 1980). These models posit that changes in exchange rates affect international competitiveness and trade balance, thereby influencing the real income and output. The stock price, generally interpreted as the present value of future cash flows of firms, reacts to exchange rate changes and forms the link between future income, interest rate innovations, and current investment and consumption decisions. Innovations in the stock market, on the other hand, affect aggregate demand through wealth and liquidity effects, thereby influencing money demand and exchange rates. The second approach is the

"Stock-oriented" models of exchange rates (Branson, 1983; Frankel, 1983). These models view exchange rates as equating the supply and demand for assets such as stocks and bonds. This approach gives the capital account an important role in determining exchange rate dynamics. Since the values of financial assets are determined by the present values of their future cash flows, expectations of relative currency values play a considerable role in their price movements especially for internationally held financial assets. Therefore, stock price innovations may affect, or be affected by, exchange rate dynamics.

The objective of this study is to contribute this body of literature by examining the relationship and volatility spillover between stock and foreign exchange market in an emerging market, namely Turkish market. Turkey provides an interesting arena to investigate interrelations between stock and exchange markets for two reasons. First, Istanbul stock exchange (ISE) is one of the fastest growing emerging stock markets. Market capitalization and number of listed companies have increased significantly in recent years. At the end of 1990, the market capitalization was $18.74 billion and the number of listed company was 110. At the end of 2001, on the other hand, the market capitalization had increased to $47.69 billion and the number of companies had increased to 310[1]. At the end of 2006, market capitalization was $163.78 billion and the number of companies was 316. Second, Turkish economy witnessed two major financial crises in recent years. The stock and foreign exchange markets suffered fluctuations from these financial crises, which broke out in 1994 and in 2001. For example, the stock index dropped from a peak of 288.84 at the beginning of January 1994 to 150.97 at the end of April 1994. In the meanwhile, the Turkish lira depreciated by 125.9% against the US dollar. The stock index was 11,539.99 at the beginning of January 2001 and dropped to 8,022.72 at the end of March 2001. Turkish lira depreciated 57.98% in that period. During the times of financial crises the Turkish central bank intervened in the foreign

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[1] At the end of 1999 the market capitalization was $120 billion. It dropped to $47.6 billon at the end of 2001. The Turkish stock market in 2001 registered huge dollar losses due entirely to 113% devaluation in the Turkish Lira.

exchange market to dampen the prevailing expectations of depreciation in the Turkish lira. These intervention squeezed funds out available for the stock market, further exaggerated fluctuations in the stock market. The performance of the stock market is clearly linked to situations of the foreign exchange market (Kasman, 2003: 71-72). Therefore, an understanding of the intermarket volatility is important to global fund investors who are planning to invest and the pricing of securities within and across the markets for trading and hedging strategies as well as for formulation of regulatory policies in an emerging market like Turkey that is rapidly getting integrated into the global economy.

This study is structured as follows: Chapter 1 provides the historical developments of stock and foreign exchange markets in Turkey. The empirical literature on the level and volatility of stock and foreign markets is explained in Chapter 2. Econometric analysis is reported in Chapter 3.

CHAPTER 1
HISTORY OF TURKISH FOREIGN EXCHANGE MARKET
AND STOCK EXCHANGE MARKET

1.1. HISTORY OF THE FOREIGN EXCHANGE MARKET IN TURKEY

Today countries apply different types of foreign exchange regimes as deemed appropriate by their specific conditions and they can frequently change these regimes over time. Such changes may take place in a planned and specific manner or emerge suddenly as a result of pressure and crises either in the financial markets or in the economy. Changes in the foreign exchange policy may have significant effects on the real and financial sector via foreign trade and foreign investments in addition to current foreign currency positions. Liberal policies gaining effect especially in beginning 1980s and liberalized foreign capital movements in 1989 accelerated the tendency to have an open economy in Turkey while also fortifying the role of foreign exchange (Özçam, 2004: 1).

In the years before 1980, Turkey's economic strategy had been inward-focused (inward-oriented) and its financial system was inefficient. Post 1980, due to a program of reforms, the strategy for development became less inward looking and regulated and more outward-orientated and market-based. In conjunction with this, a series of legal, economic and institutional reforms took place in the early 80's.

With the aim of financial market liberalization and thus, the shift to a more market-orientated policy was initiated by a change in policy of the exchange rate regime. Prior to 1980, a fixed rate of exchange was in practice – accordingly, the Turkish Lira's value was set by the government in accordance with the current economic situation. This system was hampered by an inherent time delay which from time to time meant that the Lira could be significantly overvalued. Consequently, the stabilization program was introduced in January 1980 as it allowed for a more flexible and realistic valuation of the

Lira. Subsequently, the Lira was often undervalued with respect to other currencies. Daily exchange rate adjustments were initiated by the Central Bank of the Republic of Turkey from May 1981 onwards (CBRT, 2002: 11).

1.1.1. From the Ottoman Empire to 1980s

In times of the Ottoman Empire when the monetary system was linked to gold and silver, the domestic currency enjoyed stability and permanence with respect to its domestic as well as the relative value against other foreign currencies. However, no sooner than the Empire entered stagnation and recession periods, it frequently coined money unreturned and borrowed from domestic and foreign markets in order to meet the financial deficits as of 18th century-end and 19th century-beginning which in turn severely impaired the foreign trade balance resulting ultimately in high rates of increased inflation and devaluation with actual figures even more than 100% in some years.

During the last days of the Ottoman Empire it was the official duty of the Ottoman Bank to coin money in return for gold reserves and to function as the Central Bank. The Ottoman Bank, a foreign capital bank, operative since 1860s, maintained its status despite the announcement of Republic and even in 1925 assumed the duty of exchanging Ottoman banknotes with the new Turkish Republic banknotes. The seniorage being used by the Ottoman Bank in its favour and some other inconveniences were brought to an end when the Turkish Central Bank was founded in 1930.

With the enactment of Law on Protection of the Value Turkish Currency in 1930, the government started to implement a tight control over the foreign exchange regime which resorted measures like ban from operational activities, monetary penalties and imprisonment. Although within time new arrangements were made to the said regime, which limited the hold of foreign currency by real and legal person and bound foreign

exchange transactions by stringent rules, its basic principle of tight control did not alter until 1980s.

Until 1980s the exchange rate policy implemented by the government followed principally a parallel discourse with the world trends. The international monetary system established after World War I was tied to British Sterling and its exchange with gold. This system that ran on fixed exchange rates terminated when the UK declared that it could no longer exchange sterling for gold due to economic concerns, so the relative value of domestic currencies started to be market-determined. When the instability provoked by floating exchange rates in the up-coming years joined as of 1930s with the general tendency of countries to increase their exports via devaluations while on the other hand decreasing their imports via increased customs duties, this paved the way to Bretton Woods Agreement by the end of World War II.

With the Bretton Woods Agreement fixed exchange rate system was resumed where the US dollar and British Sterling were tied essentially to gold under the control of IMF. However the shortage of gold reserves in USA in comparison to amount of dollars in circulation increased the pressure on the system towards the end of 1960s. Measures like Special Drawing Rights hardly decreased the pressure and in 1971 USA ceased exchanging dollars with gold, so the fixed exchange rate system was ended. In the years to come, a system based more on flexible exchange rates developed whereby the role of gold reduced in international payments.

When we analyze the development paths of exchange rate regimes in the post Republic period, along with practical alignment with the general world order, we observe, at some specific time intervals, significant rates of devaluation made depending on the prevailing conditions with respect to inflation, foreign trade balance and balance of payments. While the average value of USD against the Lira remained 1.55 between 1923-1945, at the time when Turkey became a member to IMF and World Bank in 1946 the relative value 1 USD was increased from 1.3 to 2.81 Lira with a devaluation rate of

116% in pursuit of adapting to post-war conditions and with the purposes of curbing the increase in imports as opposed to encouraged increase in exports, both ways of foreign trade on which there were to be no longer any price or quantity control. The parity remained fixed until 1959, but became no more credible due to inflation rates emerged as of mid 1950s that exceeded an annual rate of 15% and resulted in gradual increase of foreign trade deficit. In order to overcome the adverse conditions, monetary authorities resorted a series of measures in 1958 which foresaw a premium system to reduce the effects of price differentials in domestic and foreign markets. A tax of 6.22 Lira was imposed for 1 USD in imports, and in 1960 the Turkish lira was devalued by 220%, increasing the USD/TL parity to 9.

Stable growth in world economy between the years 1960-1970 cultivated a fertile environment for proper practice of the international monetary system which depended on fixed exchange rates. Despite the positive reflections to Turkey, the pressure on domestic economy increased towards the end of 1960s due to adverse effects of increased domestic demand on foreign trade balance accompanied by insufficient amounts of international finance resources against massive back-payments of foreign borrowings. In 1970, stability measures were put into force and the relative value of 1 USD increased from 9 to 15 Lira, devaluating by 67%.

In a couple of years after the devaluation, the relative value of US dollar (USD) was depreciated against the Turkish lira to a certain extent due to loss in the value of USD in international markets that occurred because of the restored foreign exchange reserves and the collapse of the Bretton Woods system. However, USD started to gain value against the Lira as of 1974 year-end in parallel with the increase in inflation rates. Throughout the period gas prices increased, inflation weakened the competitive power of exchange rate prices and the international economy experienced adverse conditions. Not only the foreign trade balance but also the current account balance continuously deteriorated, all of which giving rise to a crisis in the balance of payments by the end of 1970. Consequently, the Turkish lira was devaluated against the USD first before April

1979 by 30%, next in July of the same year by 88%, which finally equaled 1 USD to 47.5 Lira.

So far as exchange rate policies are concerned it is possible to say that managed floating exchange rates dominated the period between 1970- 1980 despite the high rates of devaluation (Özçam, 2004: 6-9).

1.1.2. 1980-2000 Period

Devaluations in 1979 were no remedy to problems with respect to balance of payments and general discourse of the economy. In 1980, a series of decisions was made to implement a stabilization program called "24 January Decisions". The program included a tight monetary policy backed up with a series of public finance measures to reduce the demand pressure on inflation and a realistic and flexible exchange rate regime including other export encouraging incentives. It is possible to say that an open economy and liberalization process started in this period. It became possible to fully enforce the measures resorted only after the military intervention on September 12, 1980. Upon implementation of decisions, the lira was devaluated against the dollar at a rate of 33% which was followed by periodic adjustments of smaller amounts. Real value of Lira was continuously eroded until 1989 with the daily adjustments starting from 1981. In the meanwhile, inter-bank foreign exchange market started operations under the control of the Turkish Central Bank in August 1988. On the other hand, with the aim of increasing market contribution in determining the exchange rates, sessions were hold to set the inter-bank foreign exchange rates with the participation of banks, private finance institutions and firms entitled to make foreign exchange transactions.

24 January Decisions brought a prolonged recovery in foreign trade and balance of current account as well as the balance of current transactions, yet the inflation, which inclined downwards for a few years resumed an increasing trend (Özçam, 2004: 9).

As a process for liberalization commenced after 1980s, the foreign exchange regime and capital movements were also significantly liberalized. There are two important arrangements to mention within this process: One is the Resolution No:30 that gained effect in July 1984 in relation to Law regarding the Protection of the Value of Turkish Lira and second is the Resolution No:32 adopted in August 1989 to abolish Resolution No: 30. It is possible to say that Resolution No: 30 highly liberalized the foreign exchange regime and the foreign investment legislation whereas Resolution No: 32 completed this liberation process.

Towards the end of 1982, commercial banks became entitled to hold foreign exchange positions. The purpose of this measure was to allow for foreign exchange transfers either from abroad or parallel markets to the banking system and to prevent capital flows. On July 7, 1984 – Decree No: 30 greatly liberalized the foreign exchange rate regime. The measures taken in conjunction with this decree can be outlined as follows (CBRT, 2002: 11-12):

- *Restrictions on importing Turkish lira banknotes, coins and other means of payments were removed although exporting of Turkish lira items was subject to the Government's permission.*
- *Residents were permitted to hold foreign currency, foreign exchange deposits and to make payments via foreign exchange.*
- *The Central Bank was authorized to import and export gold bullion. Banks were also authorized to sell gold bullion in the domestic market.*
- *Banks were allowed to accept foreign currency deposits from residents, to keep foreign currency abroad and to engage in foreign exchange transactions.*
- *Importing and exporting all kinds of securities were allowed. The sale of securities denominated in foreign currency issued in Turkey to non-residents was allowed.*
- *Non-residents were allowed to purchase real estate and real rights in Turkey, by converting foreign exchange and transferring all proceeds through a bank.*
- *Non-residents were allowed to invest, engage in commercial activities, purchase shares, and engage in partnerships, open branch offices, representative offices and agencies by bringing required capital in foreign exchange.*
- *Banks gained freedom to fix their own exchange rates within a narrow band around the exchange rate declared by the Central Bank.*

- *Consequently, banks were allowed to fix their exchange rates for their commercial, non-commercial and interbank transactions freely by June 29th, 1985.*

It would not be wrong to assert that market conditions increasingly influenced the setting of exchange rates as of 1990, yet managed floating exchange rate regime remained effective. As of 1990 Central Bank of the Republic of Turkey declared monetary programs and ardently tried to adhere to pre-determined monetary targets. The additional impact of the Gulf War in 1991 and the onset of funding increased public deficits with the Central Bank Resources resulted in monetary expansion, which made it rather difficult to manage the balance sheet of the Central Bank with such liquidity. In 1993, appreciated real value of lira seriously increased the deficits in both the foreign trade and the current accounts, which in response gave rise to increased demand for foreign exchange as a result of the sustained pressure on interest rates. Thus, a major financial crisis emerged in April 1994. Before the crisis exploded, Turkish lira was devaluated by 14% on January 26, 1994, and in the months to follow daily devaluations continued on an increasing basis. Although some measures were announced on April 5 with an aim to limit the power of Treasury to use the Central Bank resources, in days immediately following the announcement Lira became subject to a devaluation of more than 70%.

The significant depreciation in the real value of lira all along 1994 allowed an important recovery in foreign trade and current account balance. In the following period, however, this favourable influence diminished in parallel with the reduced devaluation. Despite the apparent view that a flexible exchange rate regime was in force, the Central Bank increased its control over the exchange rates as of 1995 and followed a policy that targeted stability in the real value of lira. The strategy was based on the aim of "devaluation at a rate of inflation" and predetermined targets of exchange rates were announced on a monthly basis in the beginning, then the nominal devaluation was kept under control according to the targeted inflation which also formed the basis of the monetary policies. In this period, the Central Bank controlled its domestic assets by the

way of limiting public loans and strengthened its foreign exchange reserves. In response to a preference of meeting public finance requirements via borrowing in a high inflationary environment, the Central Bank established stability both in foreign exchange and interest rates in order to assure the efficient response of markets to public requirements. The liquidity being under tight control gave rise to high rates of interest in the monetary market (Özçam, 2004: 10-11).

1.1.3. After 2000
1.1.3.1. Crawling Peg: December 1999-February 2001

The impacts of the South-eastern Asian crisis in 1997 and Russian Crisis in 1998 were very low on Turkish financial markets and foreign exchange rates. The limited impact was due to sufficient amount of foreign exchange reserves and the capacity of the Central Bank to meet both the Turkish lira and the foreign currency liquidity demands without any restraints in amounts. In 1999, as the adverse effects of international crisis added to the severe cost of two big earthquake catastrophes in the country, the problems reached to an unbearable point which the majority of which were structural in nature and rather caused by public deficits having roots from the past. The three-party Coalition government established after the elections in April 1999 signed a three-year stand-by agreement with the IMF in December 1999 in order to overcome the major economic hardships and with an aim to provide foreign financial funds. The core target of the stand-by agreement was set as the reduction of inflation which became chronic in the 60-80% band. In order to achieve this goal, many structural reforms and a specially designed monetary and foreign exchange policy were determined. It is possible to define this monetary and exchange rate policy implemented then as the crawling peg that has allows for increase in a certain period of time where the sustained inflation coming from the past is considered to a certain extent (20%) in advance and which worked on the basis of a currency board. With this agreement, the value of the foreign currency basket of 1 dollar + 0.77 Euro was to be announced 1.5 years a head and that the Central Bank was to buy or sell the amount of foreign currency demanded by the market out of these

pre-announced values. For the year 2000, rates of increase foreseen in Consumer Price Index and Wholesale Price Index were 25% and 20%, respectively whereas the parallel exchange rate increase for the basket of 1 dollar+ 0.77 euro was set as 20%.

Until 2000 mid-year the government remained very determined to realize the structural reforms foreseen by the stand-by agreement and this attitude produced a positive atmosphere in the general discourse of the economy having its reflections also on the financial markets. Especially in the public finance sector the performance was more than expected. However starting from the second half of the year there were various interruptions in various fields and a dramatic deterioration emerged when it was mid-November 2000. Although the problem was apparently the liquidity shortage, there were other structural reasons that underlied such shortage.

The inflation which failed to drop by the desired rate, high oil prices and the pressure on current account balance created by the weak Euro, high funding requirements by public banks, slowing down in privatization and other structural reforms were among the other primary causes (Özçam, 2004: 11-12).

1.1.3.2. Free Floating Exchange Rate Regime: February 2001- …

Following the financial crisis crashed first in November 2000 and then in February 2001, the crawling peg regime was abandoned and exchange rates were allowed for free floating. In the beginning, Turkish lira was depreciated by more than 40% against the US dollar, and then the devaluation continued. As a matter of fact, the real pre-crisis value appreciation in the Lira was around 10%, but the amount of devaluation was much higher. Such a situation happened rather due to the risk premium demanded against the serious uncertainties. The New Economic Program declared on May 15, 2001 announced that the floating exchange rate regime was to be maintained and that no market intervention was to be made by the Central Bank except for cases of excessive fluctuations. With the new economic program the Central Bank continued to

adopt free floating exchange rate regime under which it implemented implicit inflation targeting through the control of short term interest rates as the monetary policy tool. The authorities have declared that the implementation which is still in practice would turn into explicit inflation targeting upon the occurrence of available conditions (Özçam, 2004: 12).

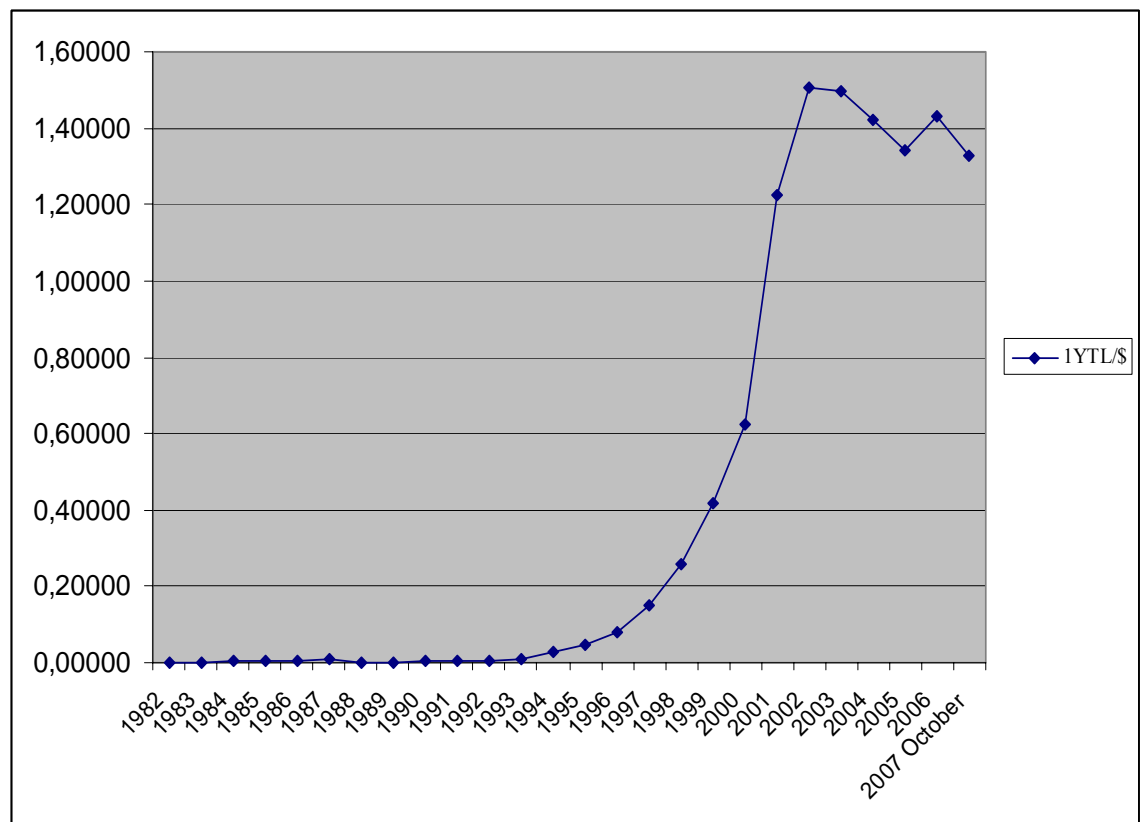Figure:1 Nominal Exchange Rate Trend in Turkey (YTL/$)

Figure 1 summarizes the nominal exchange rate trend in Turkey during the period 1982-2007. The exchange rate shows an upward trend after the financial liberalization. The impact of devaluations after the 1994 and 2001 financial crises and foreign shocks in late 1990's also supports this trend. But, after the recent crisis the

nominal exchange rate shows a downward trend due to the capital inflows triggered by the macroeconomic stability.

1.2. HISTORY OF THE STOCK EXCHANGE MARKET IN TURKEY

The Turkish securities market first became organized in the late 19th century. In the aftermath of the Crimean War, the first securities market – 'Dersaadet Securities Exchange' – was set up in the year 1866. Dersaadet Exchange enabled foreign investor's access to the high returns available within the Ottoman Empire. This exchange was renamed as 'The Istanbul Securities and Foreign Exchange Bourse' by an act of parliament in 1929 following the establishment of the Turkish Republic (ISE, 2007).

Although the history of financial markets in Turkey dates back to the Ottoman Empire, it was only as of 1980s that a healthy and systematic structure could be established with respect to financial systems. The onset of stagnation era in Ottomans gave rise to first official foreign dept in 1854 and the bonds issued started to be transacted over the counter market. Before that however the minority groups which had cultural ties with Europe and the Turkish Muslims who were influenced by the western culture were already making sales and purchase of foreign stocks and bonds via the brokerage of Galata Bankers. In the years that followed the Empire made various specific arrangements in relation to secondary markets, yet they remained inactive and functioned only in a capacity to represent the European exchange markets.

In the early days of the young Republic, the financial system was based on a liberal economy and the banking sector was supported for financial growth. But, the results achieved were far from the anticipated success. Thus, after 1930s a development strategy based on state socialism was adopted. Although remarkable efforts were spent throughout the 1950s to resume a liberal economy, this did not last too long. As of 1960s, state socialism came on the forefront again and 5-year development plans were carried out. With the announcement of Republic many attempts were made to rearrange

secondary markets. However, no significant results could be obtained due to the lack of a sufficiently developed private sector. In 1970s, the presence of private sector companies was gradually felt which resulted in vitalized transaction volumes in primary and secondary markets. Despite this, it is possible to describe the financial system up until 1980s to be dependent of banking transactions realized with respect to deposits – credit flows.

Adverse economic circumstances felt world wide in 1970s also had a great impact on the Turkish economy and impaired the country severely at a macro-economic level. Following the stability programs implemented both in 1978 and 1979; a comprehensive stability program was put in practice in 1980 which foresaw incentives for exports based essentially on a tight monetary policy accompanied by realistic and flexible exchange rates. It is also possible to say that a process of open economy and liberalization started. In the years between 1979-1981 firms called "bankers" emerged within the financial system. They essentially collected money from the public upon commitments to provide high yields with back-purchase agreements executed in return for bonds and certificates of deposit and they invested the collected sums in various fields. Since their investments some time later became less profitable than expected, the bankers became insolvent. Lack of relevant official regulations adding much to the condition of insolvency resulted in major financial crises (Özçam, 1999: 2–3).

In the first half of the 1980's, there was a clear improvement in the capital markets in Turkey as a new legislative framework was introduced and institutions to oversee capital movements were established. The 'Capital Market Law (CML)' came into force in 1981. The following year, the 'Capital Markets Board (CMB)' was set up in order to supervise and regulate the Turkish securities market (ISE, 2007).

The stock exchange market in Turkey essentially started to function effectively after the enactment of Capital Market Law and the consequent establishment of Istanbul Stock Exchange Market (Özçam, 2005: 5).

The CMB has an array of duties whose chief aim is to ensure free and fair functioning of the markets and to protect the rights of investors. The list of its priorities depends on the current state of the economy and the degree of development present in the market. In spite of this flexibility, the major priority is fixed: to strive towards the development of capital markets and so to facilitate the allocation of finance in the country while at the same time making sure that investors remain protected. On the other hand, fairness, efficiency and transparency in the Turkish capital markets and an improvement in their international competitiveness are its intention.

The CMB has three chief areas of responsibility, which are as follows – primary markets, secondary markets and financial intermediation. In the course of its duties, the CMB follows the rules set down by the CML with regards to insider trading and manipulation. This is a necessary function in order to maintain the integrity of the market (CMB, 2007).

The code governing the Turkish capital markets is made up of three major legislations and in particular the Capital Market Law. The other two are the Decree with force of Law No: 91 which apply to the securities exchange and the Turkish Commercial Code (CMB, 2007). In 1984, Decree No: 91 in the effect of Law was put into force and secondary markets became subject to a new arrangement. On December 26, 1985 Istanbul Stock Exchange Market became active and on January 3, 1986 stock exchange transactions were carried out for the first time.

As a process for liberalization commenced after 1980s, the foreign exchange regime and capital movements were also significantly liberalized. There are two important arrangements to mention within this process. First one is the Resolution No:30 that gained effect in July 1984 in relation to Law regarding the Protection of the Value of Turkish Lira; second one is the Resolution No:32 adopted in August 1989 to abolish Resolution No: 30. It is possible to say that Resolution No: 30 highly liberalized the

foreign exchange regime and the foreign investment legislation whereas Resolution No: 32 completed this liberation process.

Capital accounts were partially liberalized by these decrees and full liberalization was reached in 1989 upon the enactment of Decree No. 32. Official Gazette on August 11, 1989. With this Decree and amendments on it, capital movements were fully liberalized and the major steps for convertibility were taken. The main points of Decree No: 32 were as follows (CBRT, 2002: 16–17):

- *The residents can buy foreign exchange without any limitation from the banks and special finance institutions and they are not subject to any restrictions for keeping foreign exchange.*
- *Foreign exchange corresponding to any services rendered by residents for non-residents could be brought into the country.*
- *It is free for non-residents to buy and sell all the securities listed at the Stock Exchange and the securities issued upon the permission of the Capital Markets Board.*
- *It is free for residents to purchase and sell through banks and special finance institutions, the securities quoted at the foreign stock exchange, and treasury and government bonds which are denominated in the currencies bought and sold by the Central Bank and to transfer abroad their purchase value.*
- *Turkish residents are free to issue, to introduce and to sell securities abroad. Residents are free to bring securities to Turkey and to take them out with them.*
- *The proceeds of sales and liquidation of foreign capital may be transferred freely out of the country by the banks and special finance institutions.*
- *Obtaining foreign credits is liberalized.*
- *Non-residents are allowed to open Turkish lira accounts and to transfer principal and interests accruing to these accounts in Turkish lira or foreign exchange.*
- *Blockage on real estate sales is removed and transfer of sales income is liberalized.*
- *Non-residents are allowed to buy and transfer foreign exchange and send Turkish lira abroad without any limitation.*
- *The banks and private financial institutions are obliged to give information about the transfers exceeding 500,000 US dollars or its equivalent of foreign exchange, except import, export and invisible transfers.*
- *Turkish residents are free to establish liaison offices, representations etc. abroad.*

As time passed, the development of the stock market mirrored the developments in the country with its rapid growth in market capitalization, transaction volume, the number of listed companies and the foreign investors in ISE.

Figure: 2 Istanbul Stock Exchange (ISE) Daily Average Transaction Volume (Million $)
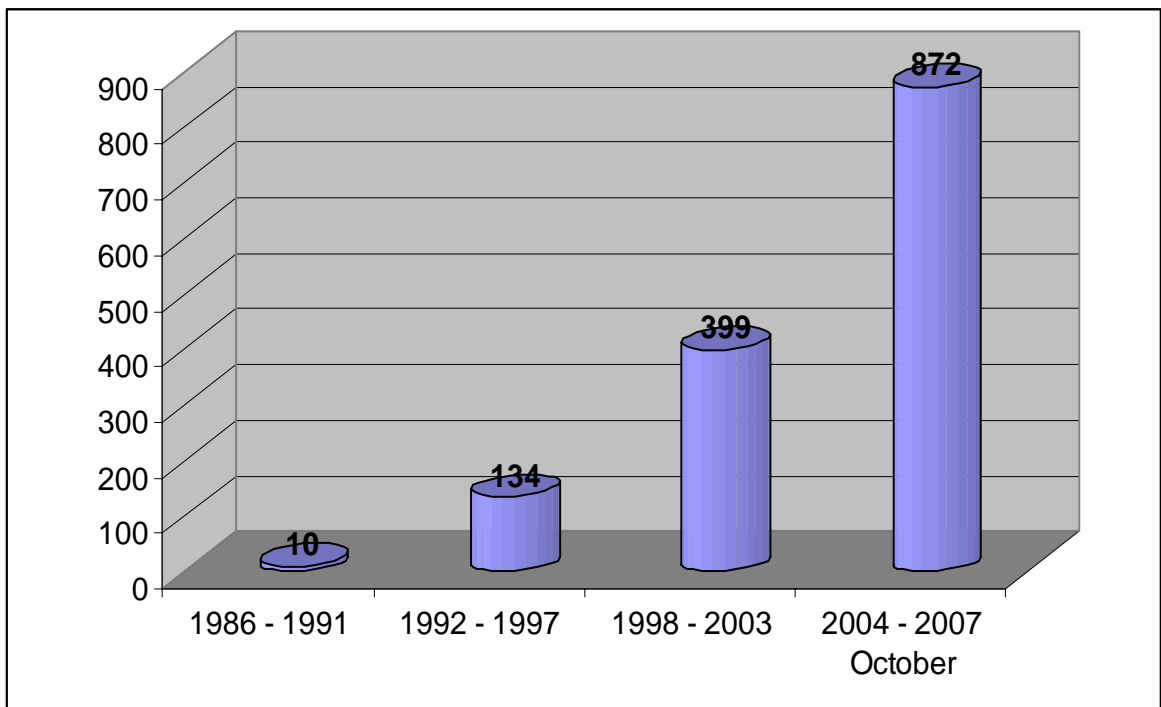
In the period between 1986-1991, an average daily transaction volume of 10 million dollars was realized whereas it was 134 million dollars, 399 million dollars throughout the consecutive 5-year periods and 872 million dollars in the period between 2004-2007 (Figure 2).

Figure: 3 Istanbul Stock Exchange (ISE) Annual Transaction Volume (Million $)
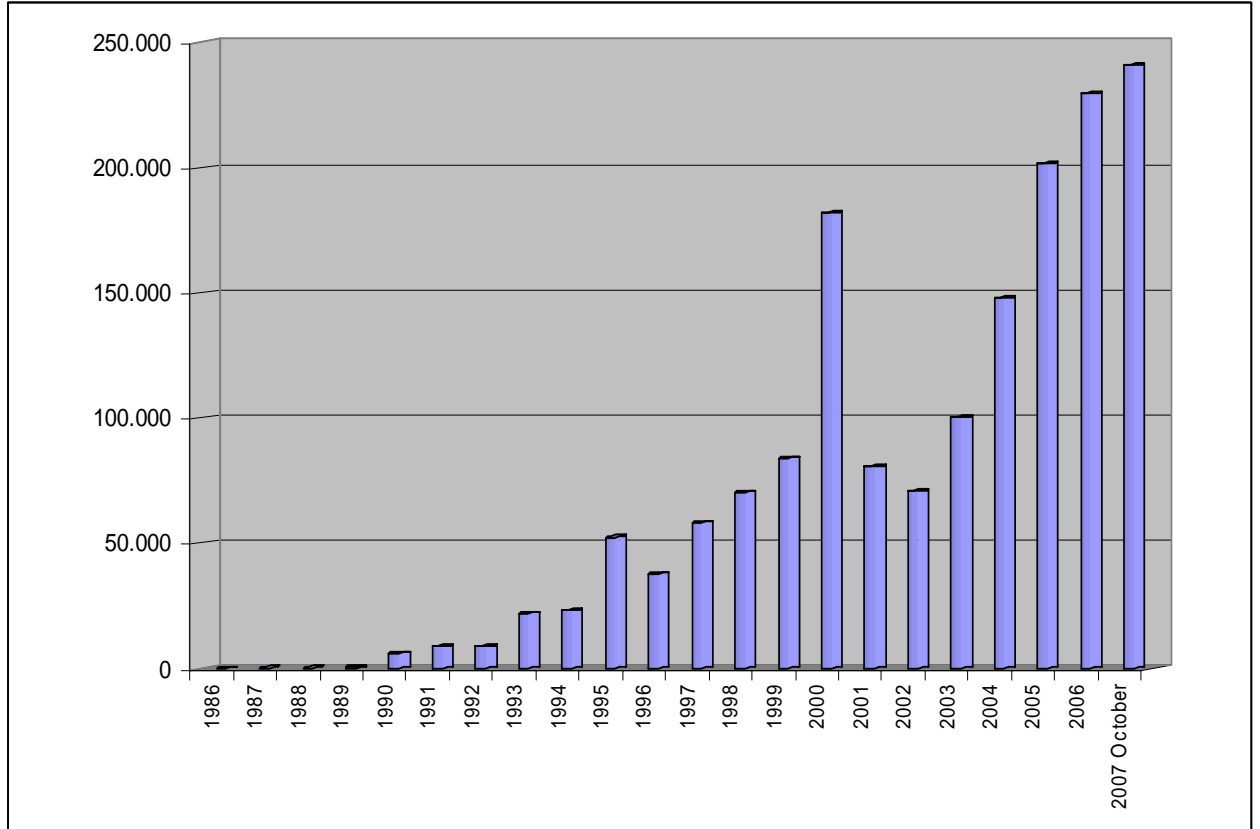
The annual transaction volume on dollar basis was at high levels in 2000. However, economic conditions were disturbed after 2000 and the subsequent devaluation put a downward pressure on dollar based transaction volume. After economic conditions have improved, the stock exchange market transaction volume followed an ascending trend and reached nearly a volume of 241 billion dollars by the end of October, 2007 (Figure 3).

Figure: 4 Istanbul Stock Exchange (ISE) Daily Average Number of Contracts ('000)
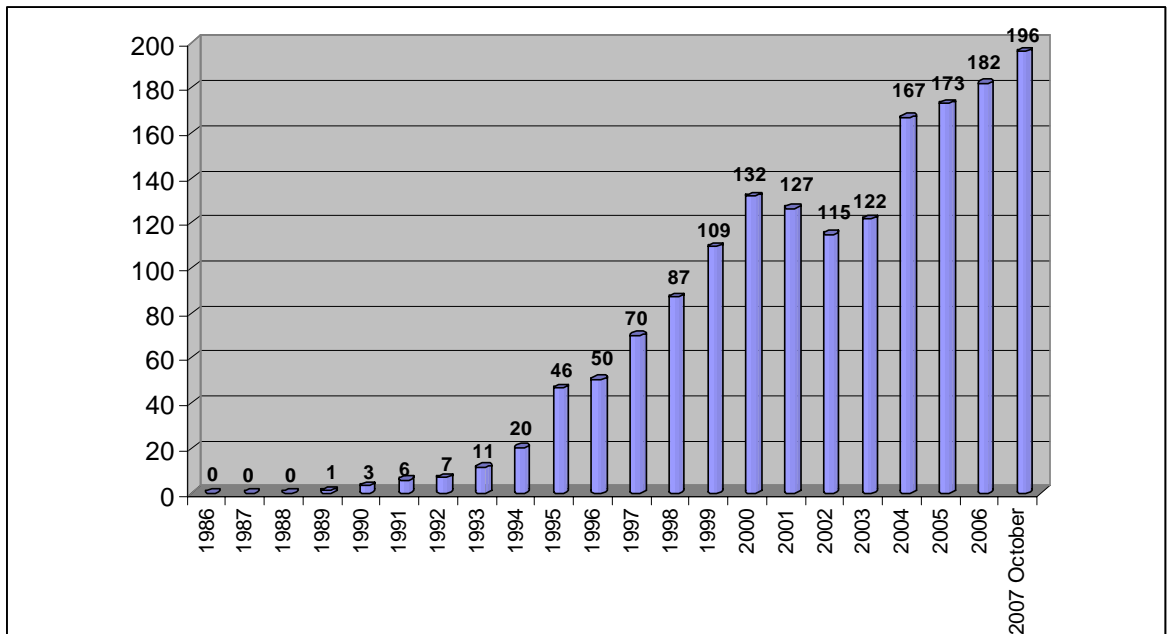
Despite the economic crisis in 2001, the average number of contracts executed daily in ISE was 115 thousand in 2002. The number was 196 thousand by the end of October, 2007 owing to recovery in macroeconomic indicators within 2007 (Figure 4).

Figure: 5 Number of Companies Traded in Istanbul Stock Exchange (ISE)
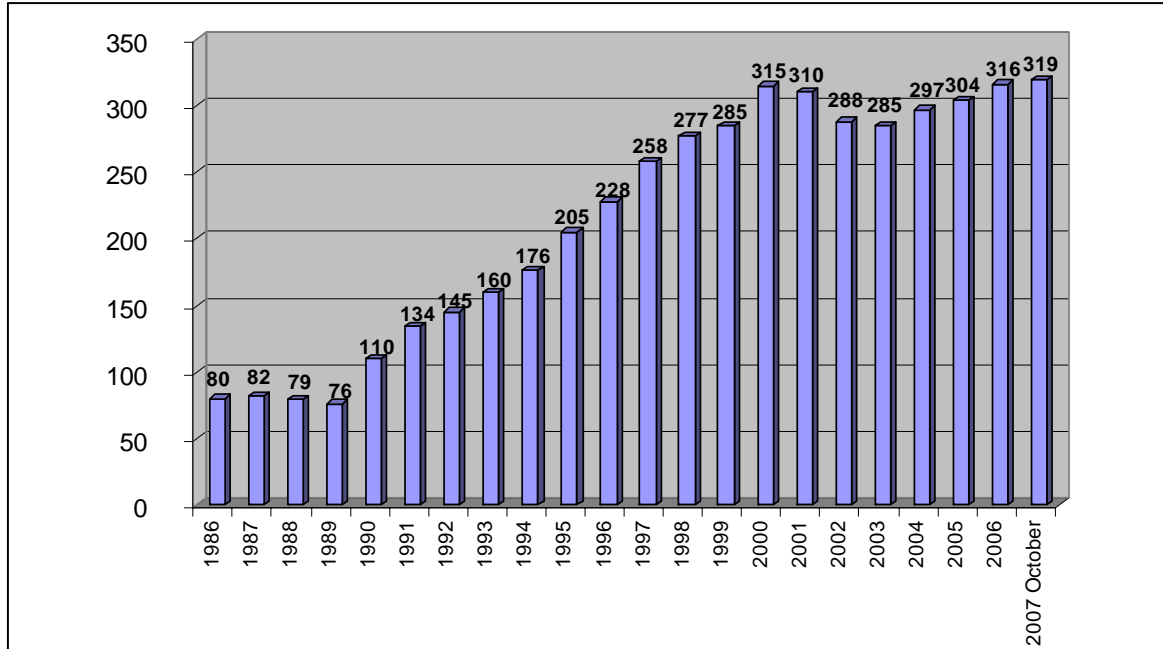
The number of companies transacted in ISE has followed a stable upward trend on an annual basis despite the two severe financial crises occurred in 1994 and 2001 (Figure 5).

Figure: 6 Istanbul Stock Exchange (ISE) Market Value (Million YTL–Million $)
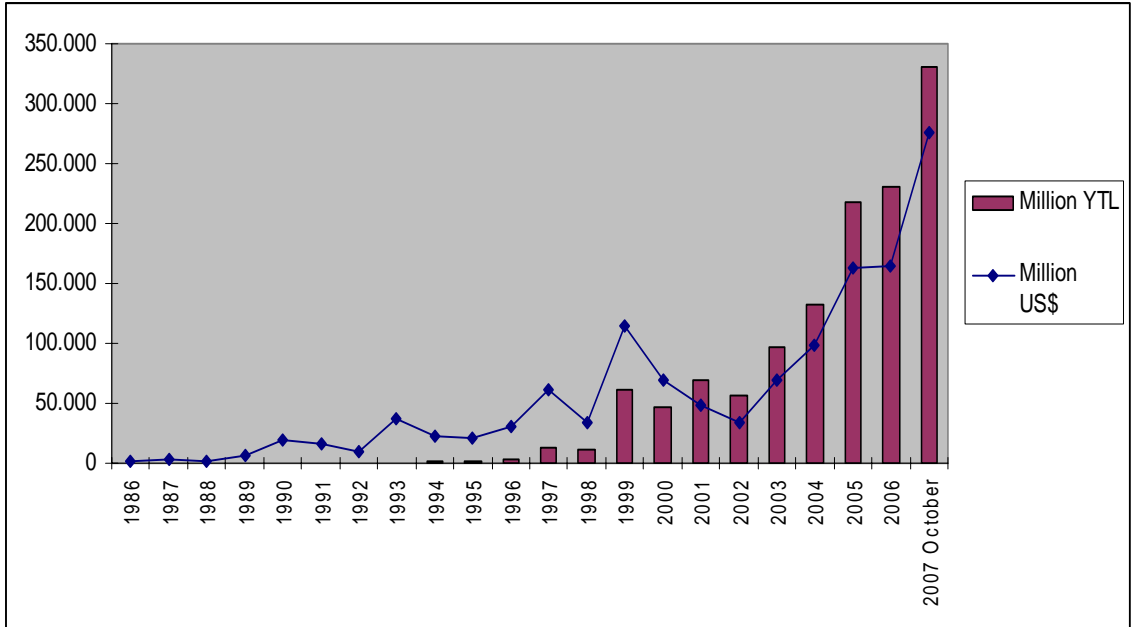
In 1999, ISE market value was 120 billion dollars. Dollar value of ISE rallied upon the economic revitalization in 2003 which was in a downward trend due to 2001 crises and devaluation of TL against the Dollar. Its market value reached 276 billion USD as of October, 2007. In 2007, ISE reached the highest market value of its times with such an amount (Figure 6).

Figure: 7 Foreign Investors in Istanbul Stock Exchange (Million $)
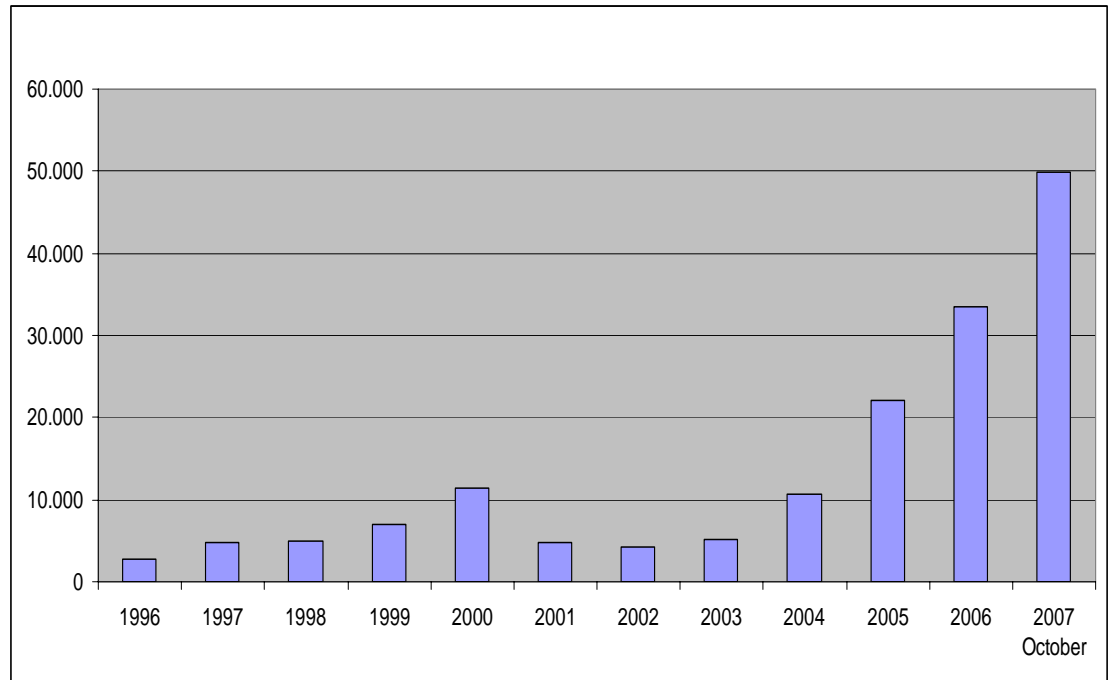
There is still immense interest by the foreign investors to ISE. Foreign investors have acquired nearly half of the public offerings by the Companies transacted on ISE (Figure 7)[2].

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[2] Since the ratios of the stocks kept in custody pertaining to foreigners are the daily values after 2005, monthly averages are taken and as the same data was on TL basis, it has been first converted to USD, and then processed to form the tables.

CHAPTER 2
LITERATURE REVIEW

The dynamic interrelationships between exchange rates and stock markets have produced an extensive empirical literature. Although in the finance literature many studies report correlations between foreign exchange rates and stock market variables, the nature of the data used and the size of the time period chosen have caused the findings of this study to be different. Correlations between stock and foreign exchange markets have been investigated by several authors. In this part, the empirical studies are divided and explained on the basis of level and volatility of stock and foreign exchange markets. Finally, studies including Turkey are also reviewed.

2.1. EMPIRICAL STUDIES ON THE LEVEL OF STOCK MARKET AND FOREIGN EXCHANGE MARKET

Frank and Young (1972) showed that there was no significant interaction. In the course of their work, the Rhomberg model was used as it provided the most suitable framework for analysis. They noted the reactions to recent exchange-rate realignments of the equity securities of low-intensity multinational firms, high-intensity multinational firms, and the stock market in general. Their results indicate that management should not act upon an expectation of a uniform or definitive pattern of reaction that depends on the extent of a firm's international activities. In addition, at times close to exchange rate realignment, there is an increase in the variability of the share price of multinational firms. This indicates that it would be unwise to make any decisions to raise capital equity at such a time.

Aggarwal (1981) argue that exchange rate fluctuations led to profit or losses in the balance sheets of multinationals which in turn led to a change in their stock market price. In other words, exchange rates brought about stock price changes. In support of

this, Aggarwal showed a positive correlation between effective exchange rate of the US dollar and changes in indices of US stock prices for the period 1974-78.

Soenen and Hennigan (1988) employed monthly data on stock prices and effective exchange rates for the period 1980-1986. They find a strong negative relationship between the value of the U.S. dollar and the change in stock prices. However, when they analyzed the above relationship for a different period, they reported a statistical significant negative impact of revaluation on stock prices.

Ajayi and Mougoue (1996) analyzed the relationship between stock prices and exchange rates in eight advanced economies (Canada, France, Germany, Italy, Japan, the Netherlands, the United Kingdom and the United States). They studied data for the period April 1985-July 1991. Significant short-run and long-run feedback relations between the two variables for eight industrial economies were noted by use of an error correction model. In particular, their work indicates that a raise in stock prices has a negative short-run and a positive long-run effect on the value of domestic currency whilst currency depreciation has negative short- and long-run effects on the stock market.

Ajayi, Friedman and Mehdian (1998) analyzed foreign exchange and stock market data from several highly industrialized countries (Canada, Germany, France, Italy, Japan, the UK and the US) between the dates April 1985 to August 1991 and eight developing countries from Asia between the dates December 1987 and September 1991. They asserted that in some countries (Indonesia and the Philippines) stock market changes lead to changes in the currency market whilst in other countries (Korea) the opposite is true. Moreover, no significant link was observed in Hong Kong, Singapore, Thailand or Malaysia. In Taiwan, however, bi-directional causality or feedback was noted. Additionally, contemporaneous adjustments are significant in only three of these eight countries. In developed countries, they found significant contemporaneous effects.

Strong feedback relations between Hong Kong, Malaysia, Thailand and Taiwan were observed by Granger, Huang and Yang (2000). By using the daily data from the period January 3rd 1986 to June 16th 1998, they note that their results were in accordance with the traditional approach in Korea and the portfolio approach in the Philippines.

No significant long-run relationship between stock prices and exchange rates in G-7 countries, using both the Engle-Granger and Johansen's cointegration tests were found in Nieh and Lee (2001). Daily data from the period October 1st 1993 to February 15th 1996 was used. Ambiguous and significant, short-run relationships for these countries were observed. In spite of this, in some countries, both stock indexes and exchange rates may be used to forecast the future paths of these variables. For example, they noted that currency depreciation stimulates Canadian and UK stock markets with a one-day time delay and that increases in stock prices cause currency depreciation in Italy and Japan, again with a one-day time delay.

Nath and Samanta (2003) examined the dynamic connections between the foreign exchange and stock markets for India during the Asian crisis of 1997-98. By use of daily data from March 1993 to December 2002, they observed that returns in these two markets are unrelated, although over the last few years, the returns from stock market have had a causal influence upon returns from the exchange rate with some indication of a minor effect in the opposite direction as well. These findings have led to significant issues with respect to the exchange rate and stock price causal relationship. In India, although stock market investment is not a major proportion of household savings as compared to other forms of financial assets, it may have a major effect on exchange rate movement. The findings, however, are still in their early stages and further research is needed in order to properly understand this subject.

Stavarek (2004) analyzed the qualities of the causal relationship between stock prices and effective exchange rates in four of the original EU-member countries (Austria, France, Germany, and the UK), four of the newer EU-member countries

(Czech Republic, Hungary, Poland, and Slovakia) and in the USA. He investigated both the long-run and short run causalities between these variables basing his study on monthly data. By means of cointegration analysis, vector error correction modeling and standard Granger causality test, he investigated if stock prices and exchange rates are connected to each other or not and in which direction this connection occurs. The findings indicate a far more significant causality in countries with developed capital and foreign exchange markets (i.e. the original EU-member countries and the USA) than in the newer EU-members. More evidence also indicates that this causality was more pronounced both long-run and short-run during the period 1993-2003 than it had been during 1970-1992. Causalities appear to be predominantly mono directional running from stock prices to exchange rates.

Hashimoto and Ito (2004) examined the co-movement of the exchange rates and the stock prices in terms of contagion between eight countries in the Asian region at the time of the Asian currency crisis, 1997-1999. A friction model and a Tobit model were employed to analyze the effect of a negative shock in one asset price to others. The contrast between countries slightly affected and those strongly affected was studied; categories of large declines in the exchange rates (or stock prices) are made differentiated; and whether the stock prices were increasing or decreasing was established. It was noted that, among others, there was generally, the contagion between the exchange rates and stock prices; that the Hong Kong stock prices were prone to contagious effects from a fall in the Asian currencies; and that Indonesian, Korean and Thai currency depreciation and Hong Kong stock price falls had impacts on other currencies and stock prices in the region during the crisis period.

Dimitrova (2005) studied if there is a link between the stock market and exchange rates that might explain fluctuations in US and UK market. Specifically, he focuses on the United States and the United Kingdom over the period January 1990 through August 2004. He tests for Granger causality to see whether there is empirical evidence for joint causality between stock prices and exchange rates. The empirical

results were somewhat weak. He finds support for the hypothesis that a depreciation of the currency may depress the stock market—the stock market will react with a less than one percent decline to a one percent depreciation of the exchange rate. This also implies that an appreciating exchange rate boosts the stock market.

Lean, Narayan and Smyth (2006) examine the relationship between exchange rates and stock prices in eight Asian countries using cointegration and Granger causality tests over the period 1991 to 2005. They find little evidence of cointegration. Their results for individual countries suggest that the only country for which exchange rates and stock prices are cointegrated over the entire period is Korea where there is weak long-run uni-directional Granger causality running from exchange rates to stock prices. They conclude that for the eight countries exchange rates and stock prices primarily have only a contemporaneous effect on each other that is reflected in the short-run intertemporal co-movements between these financial variables. They find that changes in exchange rates and stock prices generally only have a contemporaneous effect on each other reflected in short-run intertemporal co-movements between these financial variables.

Diamandis (2006) analyzed the long-term relationships and short-term dynamics between stock prices and exchange rates in addition to the channels through which exogenous shocks influence these markets. Monthly data between the years 1980- 2005 for four South American countries, Argentina, Brazil, Chile and Mexico was used. This analysis was performed by cointegration analysis and multivariate Granger causality tests. The chief results suggest that there is a positive relation between stock and foreign exchange markets in these economies and also that the US stock market behaves as a channel for these links. Additionally, it was noted that these links are independent of foreign exchange restrictions. By the application of stability tests proposed by Hansen and Johansen (1993), it was revealed that the dimension of the cointegration space is sample dependent while the estimated coefficients do not exhibit instability in recursive estimations.

Azman-Saini *et. al.* (2006) provide new insights on the subject with their work on stock prices and exchange rates in Malaysia. Using data from January 1993 to August 1998, the findings reveal that there is a bi directional causality for the period before the crisis. In terms of informational efficient market hypothesis, this result indicates that both stock and foreign exchange markets are not efficient as information gained from one market can be used to forecast the movement of other market. The results for the crisis period indicate that there is uni-directional causality from exchange rates to stock prices.

Tastan (2006) examined the interaction between stock market returns and changes in nominal exchange rates. In this study, a bivariate GARCH framework is used to uncover the dynamic relationship between Euro and two stock market indexes in the US: namely the Dow-Jones Industrial Average Index and Standart & Poors (S&P) 500 Index. This research revealed that although the unconditional correlation coefficient between Euro and stock market indexes is quite low and negative in the sample, there is significant variation in the conditional correlations over time. The study shows that whilst the conditional volatility of each variable is chiefly dependant on its own shocks, each shock is important for conditional covariance and correlation coefficients.

Tahir and Ghani (2004) analyzed the relationship between stock prices and exchange rates in Bahrain by using monthly data for the period January 1992- October 2002. They employed co-integration and ECM models and Granger causality tests in order to determine the causal relationship between stock prices and exchange rates. The empirical findings indicate that there is long-run bi-directional causal relationship between stock prices and exchange rates (British Pond & Japanese Yen) and only uni-directional, from stock prices to exchange rate, causal relationship between them. However, no proof was found to indicate uni or bi-directional causality between stock prices and exchange rate (German Mark) in short-run or long-run. In general, there is evidence to suggest that there is goods market approach of exchange rate determination.

Muhammad and Rasheed (2001) attempted to determine if stock prices and exchange rates are related to each other or not. They looked at the long-run and short-run connections between these variables. Monthly data on four South Asian countries, including Pakistan, India, Bangladesh and Sri-Lanka, was employed covering the time period January 1994 to December 2000. By means of cointegration, vector error correction modeling technique and standard Granger causality tests, the long-run and short-run association between stock prices and exchange rates were examined. The findings of this research indicate no short-run association between the given variables for all four countries. Additionally, there is no long-run relationship between stock prices and exchange rates for Pakistan and India. In contrast to this, Bangladesh and Sri Lanka appear to possess bi-directional causality between these two financial variables.

2.2. EMPIRICAL STUDIES ON THE VOLATILITY OF STOCK MARKET AND FOREIGN EXCHANGE MARKET

Despite the examination of the linkages and interactions between exchange rates and stock prices, only a limited body of research has attempted to analyze the possibility that the transmission of volatility or a volatility spillover effect can exist between the stock and foreign exchange markets. An examination of the volatility spillover process also enhances the understanding of information transmission between stock prices and exchange rates. The recent economic globalization and integration of world financial markets, fueled by the development of information technology, increases the international transmission of returns and volatilities among financial markets.

Yang and Doong (2004) examined the intertemporal interaction between stock prices and exchange rates for the G-7 countries. They used data based upon end of week (Friday) closing exchange rates and stock market indices for the G-7 countries. 1045 observations were used covering a sample time from 01/05/1979 to 01/01/1999. They employed the empirical methodology which is the multivariate extension of the EGARCH model. The interaction between movements in stock prices and future

exchange rates in the G-7 was confirmed, but they claim the relationship is uni-directional since changes in exchange rates exert a less direct effect on stock prices. In spite of this, Yang and Doong propose that the two markets are integrated. Exchange rates and stock prices are more integrated in developed markets in comparison to Emerging Markets where little or no association is detectable.

Qayyum and Kemal (2006) worked on the volatility spillover between the stock market and the foreign exchange market in Pakistan. For long term relationship, the Engle Granger two step procedures were employed and the volatility spillover is analyzed by means of bivariate EGARCH method. The estimated results from cointegration analysis indicate that no long run relationship between the two markets exists. Returns in one market depend upon the volatility of other market. Especially, stock market returns are affected by the returns in addition to the volatility of foreign exchange market. In contrast to this, returns in the foreign exchange market are mean reverting and they are affected by the volatility of stock market returns. A clear relationship between the volatility of foreign exchange market and the volatility of returns in stock market exists. It indicates that there exists a volatility spillover between the markets in Pakistan.

Mun (2004) analyzed the model for the contribution of exchange rate fluctuations and studied the extent of the influence of exchange rate fluctuations on stock market volatility and cross-market correlations. The conclusion of this work shows that if there is high foreign exchange rate variability, this will lead to more local stock market volatility but to a reduced level of volatility for the US stock market. In other words, the degree to which the stock market volatility is affected by foreign exchange variability is more for local markets than for the US market, owing to the fact that there is a greater correlation between exchange rate changes and the local equity market returns than the US market returns.

Mishra, Swain and Malhotra (2007) conducted work on volatility spillovers between the Indian stock and foreign exchange markets. They used data from Datastream and from the time period 10th October 1994 to 30th December 2005, there were 2,929 observations for each series in total. Their findings show implies that a bidirectional volatility spillover between the Indian stock market and the foreign exchange market exists except for the cases of S&P CNX NIFTY and S&P CNX 500. This result also indicates that both the markets move in parallel with one another and this relationship between these two markets is long term. These findings of significant bidirectional volatility spillover reveal that there is a movement of information (transmission) between these two markets and a level of integration between these markets.

Williams and Liao (2006) employed a multivariate GARCH model that allows for interdependencies amongst returns and a time varying variance-covariance structure in order to estimate conditional price discovery and volatility transmission processes in the BRIC countries. Their study showed that there was a degree of predictability in asset prices although they significantly lagged currency movements and local stock market movements. In contrast to this, it was found that negative news had a greater effect on volatility and that an asymmetric model framework is necessary.

Badrinath and Apte (2005) studied the stock market, the foreign exchange market and the call money market in India by means of a multivariate EGARCH models which facilitate the study of asymmetric responses in order to find evidence of volatility spillovers. The findings show that an asymmetric volatility spillover across these markets exists. Additionally, the findings show that the information assimilation across markets did not travel quickly or that contagion led to the spillovers.

Apte (2001) examined the connection between stock market volatility and that of the nominal exchange rate in India. By means of the EGARCH specification proposed by Nelson (1991), they worked on the question of whether changes in the volatility of

the stock market caused volatility in the foreign exchange market and vice versa. The findings of this study indicate evidence of a spillover from stock return surprises into the conditional variance of exchange rate returns. In that case of one stock index (Nifty), it was shown that exchange rate return surprises reduce the conditional variance of exchange rate returns, this is even more pronounced if the surprise is negative. Evidence also exists to suggest a spillover effect from innovations in exchange rate returns into the conditional variance of stock returns. This effect is again asymmetric. In contrast to this, the findings for the other stock index (Sensex) revealed that whereas a spillover effect from exchange rate returns innovations to the stock market exists, it has a symmetric nature and also, no evidence of any spillover effects from stock returns innovations to the conditional variance of exchange rate returns was present.

Apergıs and Rezıtıs (2001) studied the effects of cross-market volatility spillover across New York and London foreign exchange and equity markets. They employed several daily data-sets, each corresponding to a different time of day, and the generalized autoregressive conditional heteroscedasticity approach, the empirical analysis found volatility spillover effects from the foreign exchange market in London and New York to the equity market in New York and London, respectively. However, their findings did not reveal any volatility spillover effects from the equity markets to the foreign exchange markets across New York and London.

Kanas (2002) examined the case of whether the volatility of stock returns of the home country in three industrialized countries, namely the US, UK and Japan determines the volatility of Exchange rate changes. This research employed end of day stock values in local currency for the US (Dow Jones Industrial Average), UK (FT All Share Price Index) and Japan (Nikkei 225) between the dates 1 January 1986 to 28 February 1998, which gave 3173 observations in total. This research used an EGARCH model to analyze the conditional volatility of exchange rate changes and stock returns. It was seen that the volatility of home stock returns greatly affects the volatility of exchange rate changes in all three countries.

Hakim and McAleer (2006) examined the average and volatility spillovers for bond, stock and foreign exchange rate markets in the following countries: Australia, Japan, New Zealand, Singapore and USA. By means of the VARMA(1,1)-AGARCH(1,1) model of Hoti et al. (2002), an estimate was ascribed to the variables. Strong evidence to suggest mean spillovers from exchange rates to both stock and bond markets, and from both stock and bond markets to exchange rates was revealed. Although no country was more dominant, the USA had the strongest influence over the other countries. The spillovers were of similar size, with mixed signs.

Assoé (2001) examined the data collected from 16 markets, 5 of them developed and 11 of them emerging markets (including India) for signs of spillovers across domestic stock markets, foreign exchange markets and a foreign stock market (USA). They used S&P/IFC indices and weekly return data for the emerging markets apart from Singapore, and they used Stream indices for Singapore and the 5 developed markets. They used the S&P 500 index for the US market. A leptokurtic and non-normal return distribution, with a mean weekly return of 1.15% was noted for India market. It was noted that the linkage between India's stock markets and foreign exchange markets were the weakest of all the countries studied exhibiting an unconditional correlation of 0.005. It can be seen by looking at the maximum likelihood estimates of the parameters describing conditional means indicate that past returns have a major effect upon current returns for the stock market and the foreign exchange market as well. Negative mean spillovers are noted from the stock markets to the foreign exchange markets, but these spillovers from the stock markets to the foreign exchange markets were not significant in term of value which was very small when compared to the effect of exchange rate fluctuations on the stock market.

Hung, Jiang and Chiu (2007) examined jump intensity and volatility of Taiwan stock and foreign exchange markets over a Presidential election period by means of jump-diffusion models, including the ARJI model and the GARCH-jump model, to. The jump intensity of both markets was seen to be enhanced by the presidential election

events and the jump-induced variance is greater than diffusion-induced variance. Owing to the intervention of the Central Bank in the foreign exchange market during this period, the findings show that jump intensity and volatility of jump size are more moderate.

Kanas (2000) analyzed the volatility spillovers between stock returns and exchange rate changes for six developed countries (the US, the UK, Japan, Germany, Canada and France.) Daily closing stock prices denominated in local currency for related countries between the dates 1 January, 1986 and 28 February, 1998 was used. Each country's exchange rate series is a trade-weighted exchange rate. Evidence was found of volatility spillovers from stock returns to exchange rate changes in all of countries apart from Germany. As the effect of 'bad' stock market news on the exchange rate is the same as the effect of 'good' news, this means that all the stock return spillovers are symmetric. Moreover, post the time of the October 1987 crash, the degree of significance of the volatility spillovers seems to have increased.

Wu (2005) put forward a study of the relationships between global economies by means of examining the regional financial markets of Asian countries both before and after the Asian financial crisis in 1997, for the purposes of studying the dynamic relationship between stock returns and exchange rate changes. The bivariate EGARCH and EGARCH-X models were employed to study the interrelationship of stock markets and foreign exchange markets. The empirical findings indicate that there is a bi-directional relationship between the volatility of stock returns and exchange rate changes after the crisis in the Asian countries. Moreover, if one compares the volatility transmission at the time of the crisis period to that of the recovery period, it can be seen that the effect of spillover has grown in significance after the crisis, which suggests that transmission mechanism has grown in strength in this recovery period.

2.3. EMPIRICAL STUDIES ON TURKISH STOCK MARKET AND FOREIGN EXCHANGE MARKET

Kasman (2003) examined empirically the connection between stock prices and exchange rates by using high-frequency data of exchange rates and aggregate stock indices of Turkey. By means of time-series techniques, this work suggested that there is a long-run stable relationship between stock indices and exchange rates.

Kasman (2004) performed to determine the relationship between conditional stock market volatility and macroeconomic volatility using monthly data for Turkey from 1986 to 2003. The macroeconomic variables used include industrial production, the money supply M1, inflation, an exchange rate variable, namely the Turkish Lira / the US Dollar and oil prices. Conditional monthly volatility is measured from GARCH estimations. The results show that volatility of money supply has a strong predictive power for stock market volatility while stock market volatility has a predictive power for exchange rates and inflation volatility. Tests of joint and simultaneous explanatory power of macroeconomic volatilities indicate that only volatility of industrial production and exchange rates have significant effect on stock market volatility and 6% of the changes in aggregate stock volatility might be related to macroeconomic volatility.

Yücel and Kurt (2003) analyzed the foreign exchange exposure of Turkish companies. Their work used a sample of 152 companies listed in Istanbul Stock Exchange. They performed two types of analysis. In one type, they used the Adler and Simon (1986) model to measure economic exposure of Turkish companies. In addition, they employed Jorian's approach where market return is included. There was a focus on individual firm value as opposed to a portfolio. Ordinary Least Squares Regression is employed in estimation. Their results show that, over the period under examination, 11.8 % of sample firms exhibited a positive and significant economic exposure. This was especially true for companies which exported where the proportion and mean exposure coefficient are greater in comparison with companies which do not export and the

overall sample. The findings when market return is added to the model do not give significant difference for the economic exposure of the companies.

Özçam (2004) essentially studies foreign exchange policies followed in Turkey and makes volatility projections for the period 1996-2003 as to foreign exchange rates, interest rates and stock prices while also examining volatility interactions via the models developed based on Generalized Autoregressive Conditional Heteroscedasticity-GARCH process. Increase in foreign exchange prices adversely affects the stock prices. In parallel to the control of the Central Bank over the foreign exchange rates until February 2001, volatility of rates was low and stable. With the adoption of free market policy in foreign exchange rates by the Central Bank as of February 2001, volatility of foreign exchange rates increased and started to sustain a level only a little lower than that of the stock rate volatility.

CHAPTER 3
ECONOMETRIC ANALYSIS

The aim of this part is testing the spillover effect between stock exchange volatility and foreign exchange volatility in Turkey. The results are of great importance in the context of the existent literature on emerging market stock and foreign exchange markets and provide directions for portfolio managers and policy makers.

A good understanding of the determinants, which shape the first and second moments of the conditional distribution of stock return as well as exchange rate return, is crucial for efficient portfolio management strategies. Among those determinants, exchange rates have received particular attention due to the importance of currency management strategies in highly integrated financial markets and the implication of exchange rate fluctuations for company profitability.

3.1. METHODOLOGY

Generalized Autoregressive Conditionally Heteroscedastic model (GARCH) and Exponential Generalized Autoregressive Conditionally Heteroscedastic model (EGARCH) are taken into consideration in order to analyze the transmission of volatility or volatility spillover effects between the stock and foreign exchange markets. The GARCH model allows the conditional variance to be dependent upon previous own lags apart from the past innovation. Through GARCH model, it is possible to interpret the current fitted variance as a weighted function of long-term average value information about volatility during the previous period as well as the fitted variance from the model during the previous period.

In GARCH models, restrictions are to be placed on the parameters to keep the conditional volatility positive. This could create problems from the estimation point of view. One of the primary restrictions of GARCH model is that they enforce a symmetric

response of volatility to positive and negative shocks. This arises due to the conditional variance being a function of the magnitudes of the lagged residuals and not their signs.[3] However; it has been argued that a negative shock to financial time series is likely to cause volatility to rise by more than a positive shock of the same magnitude. The EGARCH or Exponential GARCH model was proposed by Nelson (1991) and uses natural log of the conditional variance to address this drawback of GARCH model. EGARCH allows for an explicit testing of volatility spillover without imposing additional restrictions.

The price and volatility spillover effect between the stock and foreign exchange markets and the degree of integration as well as significant interrelationships can be interpreted in at least two ways. First, a causal relationship may exist such that the volatility in one market induces volatility in the other through a lead-lag relationship. This is possible because the trading hours of the two markets are not common. Second, common international factors could influence the volatility in both the markets, thereby giving rise to an apparent causal relationship between the markets. To model the volatility spillover between the stock and foreign exchange markets; we evaluate different orders of AR-GARCH and AR-EGARCH models. Since AR(1)-GARCH(1,1) model for stock returns and AR(2)-EGARCH(1,1) model for exchange rate returns are well fitted to these series, we use the AR(1)-GARCH(1,1) and the AR(2)-EGARCH(1,1) models. We examine the volatility spillover by generating the residuals from a specific model and for a particular market and then these residuals to the volatility equation of the other market. If the coefficient of the residual is significant, this confirms the presence of volatility spillover. AR(1) and AR(2) equation as well as both GARCH(1,1) and EGARCH(1,1) spillover equation can be specified as follows:

$$AR(1): y_t = c + \tau\, y_{t-1} + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma_t^2) \tag{1}$$

$$AR(1): y_t = c + \tau\, y_{t-1} + \beta y_{t-1} + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma_t^2) \tag{2}$$

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[3] In other words, by squaring the lagged error in the conditional volatility equation, the sign is lost.

Where is the return of both stock indices as well as exchange rates at time period t, c is the intercept, y_{t-1} is the previous period return at the time period $t-1$, y_{t-2} is the return for the time period $t-2$ and ε_t is the white noise error term. Return on daily stock prices and exchange rates are a function of previous period returns on stock indices and exchange rates plus an error term.

GARCH (1, 1) Spillover Equation

$$h_{t(Stock\ Indices)} = \omega_0 + \beta_1 \varepsilon_{t-1}^2 + \alpha_1 h_{t-1} + \Psi(sqresid_{erate}) \tag{3}$$

Where $\omega_0 > 0$, $\beta_1 \geq 0$, $\alpha_1 \geq 0$. In Equations (3), h_t is the conditional variance of stock indices, which is a function of mean ω_0. News about volatility from the previous period is measured as the lag of the squared residual from the mean equation (ε_{t-1}^2), last period's forecast variance (h_{t-1}) and the squared residual of exchange rate and stock indices, respectively in both the above equations. In the GARCH (1, 1) spillover equation, we use the squared residual of another market (ψ) instead of residual on their level, which is used as a proxy for shock in other markets, because in case of GARCH, we make sure that volatility is positive.

EGARCH (1,1) **Spillover Equation:**

$$\ln h_{t(Erate)} = \omega_0 + \beta_1 \ln h_{t-1} + \alpha_1 \left| \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \right| + \phi \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \Psi(resid_{stock\ indices}) \tag{4}$$

The above equations represent the EGARCH (1, 1) model. In this equation, log h_t is the log of variance, which automatically restricts the volatility to be positive. ω_0 is the constant level of volatility. $\beta_1 \ln h_{t-1}$ explains the consistence, because this is a function of volatility. The coefficient α_1 measures reaction of volatility to change in news. We take the residual modulus that measures the relation with respect to positive news. The coefficient ϕ explains the relationship of volatility to both positive and negative news, because we are not taking modulus. The coefficient ψ represents the volatility spillover coefficient. In Equation (4), residuals are generated from the EGARCH model of stock indices. In the above EGARCH (1,1) model, only residuals of stock markets have been taken into consideration instead of squared residual, since EGARCH, by definition, ensures that volatility is positive.

3.2. DATA DESCRIPTION

The data set consists of daily return values of the ISE-100 and nominal exchange rate. The data were taken from the electronic data delivery system of the Central Bank of the Republic of Turkey (CBRT). Table 1 reports the summary statistics of the variables used in the study.

Table 1 shows descriptive statistics of the variables used in the study. The kurtosis coefficient, a measure of thickness of the tail of the distribution, is quite high in the case of all the variables. A Gaussian (normal) distribution has kurtosis equal to three, and, hence, this implies that the assumption of Gaussianity cannot be made for the

distribution of the concerned variables. The measures for kurtosis show that the return series are highly leptokurtic with respect to the normal distribution, particularly in the foreign exchange market. Not surprisingly, because emerging market economies such as Turkey, Exchange rate return may have excess risk and also excess vulnerability.

In addition to kurtosis, a noticeable feature of financial time series is skewness. Istanbul stock exchange exhibits negative skewness while that foreign exchange exhibits positive skewness. So, we can say that large negative movements in stock markets are not usually matched by equally large positive movements. Inversely, large positive movements in exchange rates are not usually matched by equally large negative movements.

Table 1. The Data Descriptions of the Macroeconomic Variables

Variables	ise	exc
Mean	0.001788	0.001423
Median	0.001598	0.001228
Maximum	0.177736	0.334733
Minimum	-0.199785	-0.125637
Std. Dev.	0.029100	0.011708
Skewness	-0.056559	10.39181
Kurtosis	6.201006	299.2282
Jarque-Bera	2118.533	18209815
Observations	4956	4956
Period	04.01.1988-18.01.2008	04.01.1988-18.01.2008

Note: ise and exc represent the closing price index of Istanbul Stock Exchange National-100 (January, 1986=1) and nominal exchange rate, respectively.

This finding is further strengthened by Jarque-Bera test for normality which in our case returns very high values much greater than for a normal distribution[4] and, therefore, we reject the null hypothesis of normality at any conventional confidence levels. Because J-B values, critical values at % 5 exceeds to 5.991, it can be seen that the returns are not normally distributed. These series have leptokurtotic distribution.

Many macroeconomic time series contain unit roots dominated by stochastic trends. Unit roots are important in examining the stationarity of a time series because a non-stationary regressor invalidates many standard empirical results. The presence of a stochastic trend is determined by testing the presence of unit roots in time series data. In this study, Augmented Dickey–Fuller (ADF) tests have used to test for unit root. Logarithmic differences are taken of the macroeconomic variables. Table 2 reports the unit root test results for the level and the first difference of the variables. Table 2 presents results for the financial time series. The results indicate that we can reject stationarity for the level and first differences of the variables since ADF test statistics are greater than critical values. Thus, all time series are I(0).

Table 2. Unit Root Test: ADF

	Level		First Difference	
	Trend	No Trend	Trend	No Trend
rexc	-19.048 (12)	-18.476 (12)	-37.271 (12)	-37.275 (12)
rise	-19.820 (9)	-19.805(9)	-33.496(12)	-33.499(12)

Note: rexc, rise represent return series of nominal exchange rate and stock market index, respectively. Numbers in parenthesis are optimum number of lags determined according to AIC and critical values are based on (MacKinnon 1991); critical values are -3.50 (99%) and -4.056 (99%) with no trend and with trend, respectively.

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[4] The critical values for Jarque-Bera statistics, distributed χ_2^2, are 5.991 and 4.605 at %5 and %10, respectively.

3.3. EMPIRICAL RESULTS

We begin our empirical analysis with model selection for each series. We estimate different specifications of the $ARMA(p,q)$ with $p+q \leq 2$ for each return series. Two conventional model selection criteria, the Akaike's Information Criterion (AIC) and the Schwert's Information Criterion (SIC) are used to choose the best model that describes the data. The preferred model for each series is reported in Table 3. The results show that the AR(1) coefficient for stock return and AR(1) and AR(2) coefficients for exchange return are highly significant.

After fitting the AR(1) model for the stock return and the AR(2) model for the exchange rate return, the presence of autocorrelation among the residuals as well as squared residuals from the fitted model are tested. The results from Ljung Box Q statistics which are used to test the null hypothesis of 'No Autocorrelation' against the alternative of existence of autocorrelation are also reported in the Table 3. From the results, it is inferred that the null hypothesis is not rejected in case of residuals whereas it is strongly rejected in case of squared residuals. The presence of ARCH effect in the residuals from AR(1) models for stock return and AR(2) model for exchange rate return is tested by using Lagrange multiplier (LM) test. The results show that the null hypothesis of 'No ARCH effect' is strongly rejected in case of all the concerned variables. In other words, the ARCH statistics are highly significant, indicating the existence of ARCH effects in the standardized residuals.

Table 3: Estimation Results of the ARMA Models for Stock Returns and Exchange Rates

	ISE	EXC
Constant	0.001783 (0.0001)	0.001418 (0.0000)
AR(1)	0.107947 (0.0000)	0.2078 (0.0000)
AR(2)	—	- 0.2139 (0.0000)
Q(3)	1.408 (0.494)	0.1418 (0.706)
Q(4)	6.471 (0.091)	0.7197 (0.698)
Q(5)	6.673 (0.154)	1.5422 (0.673)
$Q^2(3)$	818.58 (0.000)	84.188 (0.000)
$Q^2(4)$	900.98 (0.000)	84.208 (0.000)
$Q^2(5)$	1057.8 (0.000)	84.442 (0.000)
LM	418.73 (0.000)	73.834 (0.000)

The existence of spillover effect is first tested for the exchange market to the stock market. The Table 4 represents the estimation results of the AR(1)-GARCH(1,1) model for the stock return. The results show that all the coefficients of GARCH equation for sensitivity index obey the restrictions inherent in the model in terms of their signs as well as magnitude $(\alpha + \beta \langle 1)$. The spillover effect (coefficient ψ) explained through the use of EGARCH model where the residuals have been extracted after estimating EGARCH for the exchange markets and the same has been used as a shock (as a proxy for volatility) spilling over to the stock market. With reference to equations 3 and 4, the coefficient ψ represents the volatility spillover parameter.

Table 4. Volatility Spillover: Stock Market
AR (1) – GARCH (1,1)

Coefficients	EXC $\rightarrow$ ISE
C	0.0015 (0.000)
τ	0.1153 (0.000)
ω_0	2.13E – 05 (0.000)
β_1	0.1404 (0.000)
α_1	0.8411 (0.000)
ψ	0.0011 (0.000)

The results in Table 5 show that spillover parameter is insignificant which leads us to conclude that there is not a spillover effect from exchange market to stock market. Table 5 reports the estimated results of AR(2)-EGARCH(1,1) model for the exchange market. The spillover in this case, GARCH(1,1) model where the residuals have been extracted after estimating the GARCH for the stock markets and has been used as a shock spilling over to the exchange market. From the results, we conclude that the volatility spillover parameter is significant. This leads us to conclude that there exists a volatility spillover from stock market to exchange market. The result of this study is consistent with Apte (2001) and Kanas (2000).

Table 5. Volatility Spillover: Exchange Market
AR (2) – EGARCH (1,1)

Coefficients	ISE→ EXC
C	0.0081 (0.000)
τ_1	- 0.0137 (0.1064)
τ_2	0.0065 (0.6021)
ω_0	- 2.6770 (0.000)
β_1	0.7911 (0.000)
α_1	0.9817 (0.000)
ϕ	0.4092 (0.000)
ψ	5.5423 (0.000)

CONCLUSION

Liberalization of financial markets, technological advances and globalization facilitate the international capital to change its location easily. Despite the fact that liberalization process started in industrialized countries, it transformed into an internationally dominant paradigm with the participation of many developing countries. The most important steps taken in the liberalization process are the elimination of restrictions on interest rates, allowing free market formation of foreign exchange rates and removal of the barriers for the effective operation of market mechanisms.

Liberalization process of financial markets in Turkey started with the onset of stability program on January 24, 1980. The program brought forward some fundamental changes in the economic development strategy. In place of the import substitution development strategy which was then dominating the economic policies in the country, the government adopted a strategy based on exports and targeted minimum governmental intervention in markets, adoption of flexible exchange rates, development of policies encouraging exports and establishment of price stability via lowering inflation.

Capital Market Law, gaining effect in 1981, targeted the regulation, support and audit of capital markets in Turkey so as to protect the rights and interests of those investors that are functioning through capital markets. The law has therefore been one of the major steps providing support for the development of stock exchange markets. The Capital Market Board was established in 1982 which was subject to Capital Market Law provisions, being entitled to regulate and control over the capital market conditions and operation mechanisms. As of this date, the brokerage activities of banks and other financial institutions in the capital market were subject to the control by the Capital Market Board and the provisions of the Capital Market Law. Furthermore, significant steps were taken to establish the liberalization of foreign exchange regime by Decision No: 32 which targeted the integration of the capital market with the global markets.

Convertibility of the Turkish lira was established creating a convenient environment for capital movements. As a result of the adopted policies, the quantity of foreign capital flowing into the country increased significantly. Since the foreign capital directed more towards the stock market, foreign exchange market and stock market have become interrelated.

The existing research which is very much centered on the developed markets generally supports the existence of interdependence in return and volatility of stock and foreign exchange markets. Especially financial and currency crises across emerging markets in last two decades led the researchers to study the nature of volatility spillovers between stock and foreign exchange markets. Understanding of the intermarket volatility is important for the pricing of securities within and across the markets for trading and hedging strategies as well as for formulation of regulatory policies in emerging markets that are getting integrated into the global economy.

In this study, the volatility spillover effect between Turkish stock market and foreign exchange market is analyzed. The goal is to determine if volatility surprises in one market influence the volatility of returns in the other market. The ARCH school of models such as GARCH (1,1) and EGARCH (1,1) is used for modeling spillovers between stock returns and exchange rate returns. It is found that the volatility in both markets is highly persistent and predictable on the basis of past innovations. The impact of these innovations is asymmetric.

It is also found evidence of unidirectional volatility spillover from stock market to foreign exchange market. This result suggests that there is an information flow (transmission) from stock market to foreign exchange market and investors can predict the behavior of one market by using the information of the other. Implication of these results is particularly important to managers, domestic and international investors for hedging and diversifying their portfolios since they can obtain more insights in the management of their portfolio affected by these two variables.

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