NEAR EAST UNVERSITY

Institute of Social Sciences

Department of Banking and Finance

# Macroeconomic Variables and the Stock Market: Evidance from Turkey

In Accordance With the Regulations of the Graduate School of Social Science

MASTER THESIS

Ahmad ABU AlRUB

Nicosia

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**Supervisor: Assist. Prof. Dr. Turgut Türsoy**

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## DECLARATION

I hereby declare that all information obtained in this document and submitted in accordance with the rules of academic and ethical behavior. I would also like to announce that, as required by these rules and behavior, which I mentioned in full and all the materials referenced and results that are not original to this study.

**Name, Last Name:** Ahmad. ABU ALRUB

**Signature** **……..**

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## DEDICATION

This thesis is dedicated to my beloved parents, and brothers whom made me strong when I was weak, whom gave me faith, whom held me up and never let me fall, whom stood by me all this time, whom gave me force in the most difficult days of my life.

## ABSTRACT

The purpose of this research is to empirically investigate the long-run and short-run relationship between macroeconomic variables and a whole share price index in Turkey. This relationship analyzed by applying Vector Autoregressions (VARs) methodology for the period span from January 2002 to December 2013. Also, this study investigates the effect of the new monetary policy change in Turkey during the period of study by using dummy variables.

The empirical findings suggest that, there is long-run relationship between Turkish stock price index (TSPI) and a set of macroeconomic variables namely; Index of Industrial production (IIP), Short-term interest rate (SINT), Money supply (M2), and Exchange rate (EXC). Also, VECM Granger causality test applied to investigate the direction of causality. With the test results, it could be state that there are unidirectional Granger cause from TSPI to IIP and M2, and there is unidirectional Granger cause from EXC to TSPI. The impulse response finding reveals that response of TSPI to a shock from EXC is significant and negative in the $2^{th}$ period. But, the response of TSPI to shock from IIP is significant and positive in the $8^{th}$ period. Also, the results from variance decomposition test indicate that the TSPI has a robust response to both EXC and IIP. In other words, there are significant role of macroeconomic variables such as EXC in explaining the variation in Turkish stock prices.



**Keywords:** Turkish stock price, macroeconomic, vector autoregression (VAR).

# ÖZET

Bu tezin amacı, Türkiye'nin tüm hisse senedi fiyat endeksi ile makroekonomik değişkenler arasındaki uzun dorıemli ve kisa dönemli ilişkilerin ampirik olarak incelenmesidir. Bu ilişkilerin incelenmesinde Vektör Otoregresif modelleme kullanılarak Ocak 2002 ile Aralik 2013 arasındaki dönem incelenmiştir. Ayrıca bu çalışmada, kukla degişkenler kullanılarak Türkiye'deki yeri para politikası değişiminin etkiside çalışmanın kapsadığı dönemde incelenmiştir.

Ampirik bulgular, Türkiye hisse senedi fiyat endeksi ile makroekonomik değişkenler arasında uzun dönemli bir ilişkinin olduğunu ortaya koymaktadır. Söz konusu bu makroekonomik degişkenler ise endustriyel üretim endeksi (IIP), kısa dönemli faiz (SINT), para arzı (M2) ve döviz kurudur (EXC). Ayrıca çalışmada, Vektör Hata Düzeltme modeli Granger nedensellık testi uygulanarak değişkenler arasında nedensellik doğrultuları araştırılmıştır. Test sonuçlarına göre hisse senedi fiyat endeksinin tek taraflı olarak endustriyel üretim ve para arzı üzerinde, ve döviz kurunun ise hisse senedi fiyatı üzerinde tek taraflı etkileri bulunmuştur. Dürtü Yanıtı sonuçlarına göre ise döviz kurundan hisse senedi fiyatlarına yönelik darbe ikinci dönemde anlamlı ve negatif bulunmuştur. Buna karşın, hisse senetleri fıyatlarının endüstriyel üretim endeksinden gelen darbeye ise sekizinci periyotta anlamlı ve pozitif bir reaksiyon göstermiştir. Ayrıca, Değişirlik ayrıştırması sonuçlarına göre ise hisse seneti fiyatının döviz kuruna ve endüstriyel üretim endeksine anlamlı bir tepki göstermiştir. Bir başka değişle, Türkiye hisse senetleri fiyatının açıklanmasında para politikasi degişkenlerinin örneğin döviz kurunun onemli bir rol oynamıştır.

**Anahtar kelimeler**: Türkiye hisse senedi fiyatı, makroekonomik değişkenler, vektör otoregresif.

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### Appendix

## LIST OF ABBREVIATIONS

**ADF:** Augmented Dickey-Fuller.

**AIC:** Akaike Information Criterion.

**APT:** Arbitrage price theory.

**C&R:** Chen and Roll.

**CAPM:** Capital asset price model.

**CBRT:** Central Bank Republic of Turkey.

**CDs:** Certificates of Deposits.

**CRR:** Chen, Roll and Ross**.**

**CU:** Customs Union.

**DCF**: Discount Cash Flow.

**EMH:** Efficient Market Hypothesis.

**EU:** European Union.

**EUR:** Euro.

**EXC:** Exchange Rate.

**F&F:** Fama and French.

**FPE:** Final Prediction Error.

**GDP:** Gross Domestic Product.

**GGM:** Gordon Growth Model.

**GNP:** Gross National Product.

**HQ:** Hannan Quinn Information Criterion.

**IFS:** International Financial Statistics.

**IIP:** Index of Industrial Productions.

**IMF:** International Monetary Fund.

**IRF:** Impulse Response Function.

**ISE:** Istanbul Stock Exchange.

**LR:** likelihood Ratio.

**M2:** Money Supply.

**MPT:** Modern Portfolio Theory.

**NASDAQ**: National Association of Securities Dealers Automated Quotations.

**PP:** Phillips-Perron.

**PVM:** Present Value Model.

**SC:** Schwarz Information Criterion.

**SD:** Standard Deviation.

**SDIF:** Saving Deposit Insurance Fund.

**SINT:** Sort-term Interest Rate.

**USD:** United States Dollar.

**VAR:** Vector Autoregrssion.

**VECM:** Vector Error Correction Model.

**WDI:** World Development Bank.

# CHAPTER ONE

## 1. Introduction

Researchers and policymakers have paid a considerable attention of investigating the linkage between stock prices and macroeconomic variables. Stock market has a pivotal role in the growth of the industry and commerce of the country that eventually affects the economy of the country to great extent. The theoretical framework has been explained the relationship between stock market and macroeconomic factors, through Present Value Model (PVM) that formulated by Smith (1925), primary discount model to the later advance of the Gordon Growth Model GGM was formulated by Gordon (1962), Capital Asset Pricing Model (CAPM), and Arbitrage Pricing Theory (APT) which formulated by Sharpe (1964) and Ross (1976) respectively. This has been provided an interpretation of the changes in the macroeconomic factors that might have affect into stock prices. These models elucidate the anticipated and unanticipated of any new information that related with macroeconomic variables, which might have effects on stock prices from its impact on discount rate or the expected future dividends.

On the other hand, these models are giving an understanding of determinates of macroeconomic variables which are extremely valuable for policymakers and investors. Because of the continue pursuit by individuals and institutions to be able to work towards achieving the profits, and mitigate the risk exposure to face any policy or macroeconomic changes. In terms of investors are seeking to reduce the risk exposure. As results of any possible implications on the macroeconomic that may affect the value of stock prices in various sectors. Thereby, policymakers require a precise comprehension of the relations between stock market and macroeconomic is that to formulate a valuable policies which are contributing enhance stock market development and then economic growth, (Yartey, 2008). This is due to the empirical studies which have shown the development in stock markets and that have crucial role for promoting economic growth in emerging markets, (Kose et al, 2006; Deb and Mukherjee, 2008). This study analyses the long-run and short-run effect of a set of macroeconomic variables namely; Index of Industrial production (IIP), Short-term interest rate (SINT),

Money supply (M2), and Exchange rate (EXC) and the whole Turkish share price index, for the period span from January 2002 to December 2013. The current study with contribute to the literatures that investigate the Turkish stock market in different ways. Firstly, the analyzed period has witnessed new monetary policy. Secondly, the study has analyzed the whole Turkish stock price index.

### 1.2 Identification of the Problem

Stock market is an important part of the economy of a country. The stock market plays a pivotal role in the growth of the industry and commerce of the country that eventually affects the economy of the country to a great extent. Moreover, capital market is a market where security prices are rapidly adjusted when a new information reach to the market. Recently many economists have analyzed the efficiency of capital markets, most of these researches had been focused on the relationship between stock market and macroeconomic variables, stock markets is seen as a very significant component of any economy. Furthermore, it plays a vital role in the mobilization of capital in many of the emerging economies. The main objective of the study is to analyze dynamic linkage between stock markets (share price index) in Turkey and four macroeconomic variables namely, Index of Industrial production (IIP), Short-term interest rate (SINT), Money supply (M2), and Exchange rate (EXC). Thereby, the study attempt to address monetary transmission mechanism via stock price channel and temporal stability of their interaction. In addition, the study seeks to examine the existence of cointegration between stock market and macroeconomic variables, and the extent of their cointegration. Moreover, Identify some basic economic variables that should public policy take in consideration.

### 1.3 Motivation and Contribution

The importance behind this study is that the Turkish stock market has unique features, such as it's one of the leading emerging markets, and it show a different pattern of stock market movement either from developed countries or other emerging markets. Turkey stock market, showed a remarkable growth in the number of listed companies, market capitalization and trading volume over short time period. At the end 2013, the numbers

of listed companies are grown to be 401 comparisons with 317 in the year 2008. $119 billion market capitalization in 2008 grown to reach $308.7 billion in 2013. The year 2008 has $261 billion annual trading volume grown to be $ 389.1 billion in the year 2013.

On the other hand, emerging stock markets have been identified as being at least partially segmented from global capital market. Hence, attempt to analyze the effect of macroeconomic variables that includes monetary policy instruments on the whole Turkish stock price index. As a result of changes in monetary policy during the tested period, it assumed that the variables of interest may have effect over Turkish stock market, on both short and long-run.

### 1.4 Research Methodology

The study proposes dynamic linkage and interaction between the stock market (share price index) and four macroeconomic variables including Index of Industrial production (IIP), Short-term interest rate (SINT), Money supply (M2), and Exchange rate (EXC). This study also uses E-view program techniques to finalize the research. Then, present estimation result on the interaction among the variable for a whole sample, by standard vector autoregrssions (VARs), cointegration, vector error correction model (VECM). To investigates both short and long-run relationship. Impulse response function and the variance decomposition are to examine the responds of the variable to its own innovation over time. A time span chosen for this study from Jan 2002 to Dec 2013 uses monthly data.

### 1.5 Structure of the Thesis

Specifically, this research is composed of seven chapters included the introduction and the conclusion within each chapter. After the introduction chapter, the remainder of this research is organized as follow:

**Chapter 2**; analyze the history and development of Turkish market. Also, it shed some light on the Turkish economy performance during the last three decades including the main events (crises) and the monetary policies that Turkish economy passed through.

**Chapter 3**; provide and discusses the theory of asset pricing through time. Also, it discussed the financial techniques that used to explain stock prices behavior. The basis of modern portfolio theory is the CAPM, APT and Present Value Models, which start from primary discount models to the later advances of the Gordon Growth Model.

**Chapter 4**; discusses the empirical finding of the research that explain the stock price behavior. Studies which investigate the effect of macro variables on stock market are applied in developing, developed countries and emerging markets.

**Chapter 5**; the aim of this chapter is to discuss the variables econometric methodology that used to investigate the effect of macroeconomic variables on stock prices.

**Chapter 6**; the aim of this chapter is applying econometric techniques and discuss the result.

**Chapter 7**; set out the main conclusions from this empirical research. At the same time it lights and provides some recommendations for further research.

# CHAPTER TWO

## 2. Turkish Economy Overview

### 2.1 Introduction

The aim of this chapter is to present an overview of the Turkish economy during 1980-2013. Also, this chapter presents a historical review of the developments stages in Turkish economy.

In this context, the research shed some lights on the real economy, the crises (cause and consequences), monetary policies applied during the tested period, and the stabilization programs that economy passed through. This chapter organized as follow; section 2.2 discusses the performance of the Turkish economy during the last three decades. Also, it shed some lights on real economy, external sector, fiscal sector and money sector. Section 2.3 discusses the historical development in the Turkish economy and focuses mainly on the restructuring period.

### 2.2 Performance of the Turkish Economy (1980-2013)

#### 2.2.1 The Turkish Economy During 1980's

Turkish economy was showing dynamic and growing performance despite the economic crushes that Turkey suffered in this period. It was a pattern of traditional agricultural, modern industry and commerce. The Turkish economy four decades ago was an agricultural economy. Recession that hit the Turkish economy during the late 1970's as a result of the problem in balance of payment has forced the government to adopt a new industrialization strategy which made it able to adjust this problem. During the 1970's and 1980's the Turkish economy had experienced a relatively high inflation coupled with unsuccessful disinflation attempts. The average inflation rate was 29 percent in the 1970's, 35-40 percent in the early 1980's and 60-65 percent in the late 1980's. This inflation put pressure on the government to take an action to control this continuously increase in the inflation rate. As a result, the government declared its intention to liberalize the economy and to pursue an export led growth policy. This new policy had

helped in reducing the inflation rate during the first half of 1980's (Ertuğrul and Selçuk, 2001).

In the early 1980's, the Turkish economy passed through a new strategy, export led growth strategy and it was successful. The average annual growth rate of Gross Domestic Product (GDP) was 5.8 percent between the years 1981-1987. Moreover, during this period the economy did not experienced any recession, making Turkey a model in the annual reports of international financial institutions, such as IMF.

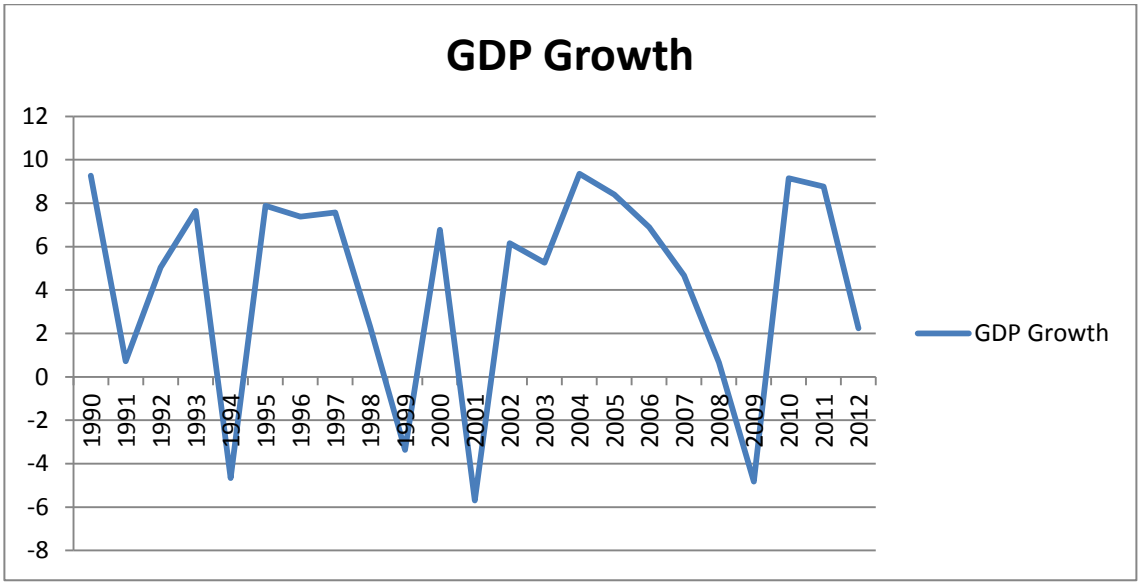
Also, "the real increase in industrial value added was above the GDP growth rate, it averaged 8.1 percent, during the same period. With the introduction of a comprehensive stabilization programs in January 1980, an outward oriented development strategy was accepted and external balance became a major concern of governments as protracted current account imbalances make the government more sensitive about the sustainability of external imbalance" (Ertuğrul and Selçuk, 2001).

After the liberalization program, Turkey starts looking for economic allies. Specifically, in 1987 Turkey applied for the European Union (EU) membership. The European Committee responded in December 1987 by confirming Ankara's (association agreement) eventual membership, but also by deferring the matters to more favorable talks.

### 2.2.2 The Real Economy

During the 1988, the economy experienced a new phase and the growth performance has been inactive. The annual GDP growth falls down by 2.1 percent comparing with the previous period (1980-1987). Also, the annual average growth rate of industrial value was slightly higher at 4.4 percent. The model economy during the beginning of 1980's became a textbook case of "boom-bust" growth performance with a relatively lower average growth rate and high volatility in the 1990's. The deterioration in the economy could be due to unsuccessful disinflationary efforts and debt financing policies of the government. Policy makers, put effort to slow down the depreciation rate of the Turkish Lira, in part to control the inflation, but mainly to be able to borrow easily from the domestic markets (Ertuğrul and Selçuk, 2001).

Graph 2.1: Growth Rate of the Gross Domestic Product (GDP)




Source: World Bank, World Development Indicators (WDI).

The instability in the GDP growth has been a major obstacle for the economy. GDP instability triggered the uncertainty and the risk premium in the economy, in which played a negative role on long term production, investment and spending in a healthy and natural way. With regard to the fluctuation in economic growth during 1990's there were three recessions (crises 1994, 1999, 2001) that hit the Turkish economy.

The 1994 crises were preceded by substantial increase (appreciation) in the real exchange rate. This crisis was driven by the government policy which aimed at decreasing the nominal interest rates in order to take interest payment under control. In another words, it aimed to increase the amount of credit transferred from the Central Bank to the treasury, so that the treasury would rely less on domestic borrowing. The critical decision on the part of the government was to place out the Treasury auctions. In real, this policy would bolster the government's main aim to save on interest rate and to increase maturity of credit. Due to this, shortly, the Central Bank credit to the Treasury reached as high as 30 percent of the net foreign assets of Central Bank (Celasun, 1998). When the treasury cancelled several auctions, the liquidity pumped by the Central Bank into the system allowed commercial banks with large open positions. Meanwhile, private consumers also sought foreign currency as a precaution. Both developments resulted in substantial loss of the Central Bank foreign reserve. Following the Standard and Poor's

(S&P) and Moody's credit rating scores in response to the Turkish economy deteriorating macroeconomic indicators, foreign capital left the country overnight which led to the 1994 liquidity crises.

Right after the April 1994 crises, a stabilization program was announced by the government; the IMF approved a standby agreement of US $ 742 million, extended over a 14 months horizon and strongly urged the rapid implementation of the structural reform measures. The government was to reform the tax and social security system; to speed up privatization and to restrict the mechanisms whereby the Treasury could utilize the Central Bank to finance the public deficit (Gungen, 2010).

After the stabilization program, the strong economic recovery which began in the second quarter of 1995 continued into the third quarter where GNP rose by 10% on the same period of 1994. This performance was particular impressive in view of the slower rate of decline in the third quarter of 1994 than the second quarter. The industrial sector again engine the growth in the third quarter 1995, rising by 17.9%, only a modest slowing from the previous quarter of 20.3%. The agricultural sector turned in responsible performance with growth of 3.9% while construction sector contracted by 1.6% these two sectors were less affected by last year's downturn and as a result had less catching up to do than industry.

In light of the strong economic recovery after the 1994 crises, European Parliament took the decision in December 1995 to finalize the Customs agreement while the final stage of Customs Union (CU) was entered into force in January 1996.

### 2.2.3 The External Balance and Fiscal Sector

The export led growth policy was successful at the beginning of its implementation because of the depreciation of the Turkish lira (approximately 40 percent) and several tax incentives to exports. Toward the late 1980's, specifically 1989, the Turkish lira were appreciated by 22 percent, in which has an adverse effect on the total export level. While total imports jumped up. The external deficit-GDP ratio increased to 2 percent in 1989 and to 4 percent in 1990 despite the slight decrease in the 1991 and 1992, the external deficit reached to approximately 6 percent of the GDP in 1993. Toward the end

of 1993, both fiscal policy and external balance situation was not sustainable. In 1994, the Turkish lira was devaluated twice, in January and in April due to the lower rating of Turkey's sovereign debt by international credit rating agencies. As a result of this devaluation of the Turkish lira, the export volume increased while total imports continued to increase as well. Due to this, the external balance records a positive 1 percent of GDP between the second and fourth quarter of 1994, the Turkish lira appreciated in real terms significantly and the corrective nature of the devaluation during the first quarter of the year disappeared. The external deficit records 5 percent of GDP in 1995 and approximately 6 percent in the following two years. Also, the external deficit for the year 1998 and 1999 were relatively low because of the extremely high real interest rates. Moreover, during the 1980's the FDI was extremely low, then there was a surge in FDI records $800 million in 1992 compared to $ 100 million in 1987.

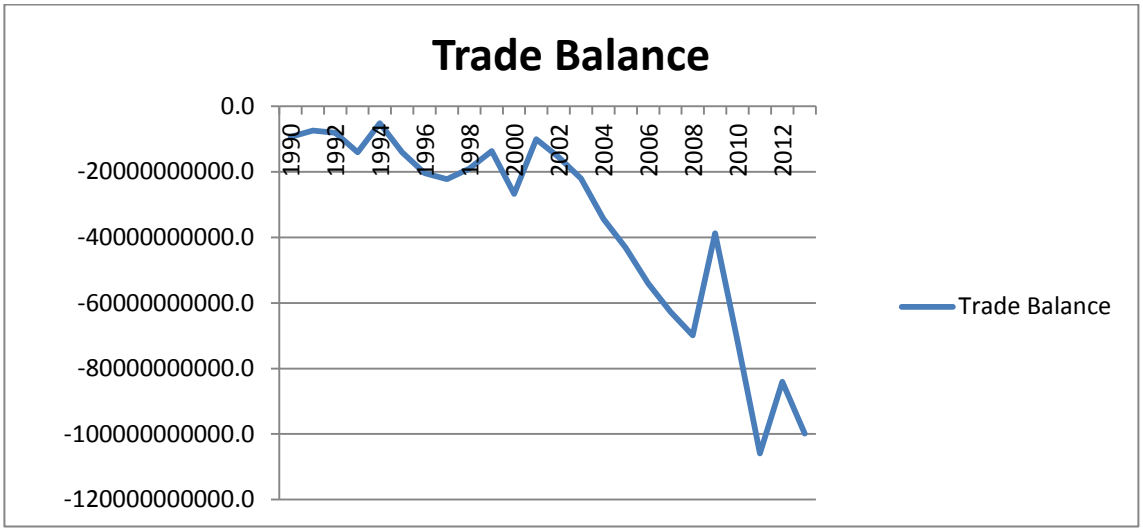
The FDI record an average of $600 million between the years 1993-1998 and then become low in the following two years as a result of long term capital outflows, particularly investment made by domestic resident abroad. Also, the outstanding external debt was $ 79.6 billion in 1996 and $ 106.9 billion in 2000 which indicates an increase of 34 percent within four years. In the last ten years, Turkish current account deficit increased significantly and records over 5% of GDP in 2009. This high deficit reflects structural issues related to the country's trade composition, heavy dependent on imported energy and low saving rates. In other words, Turkey exports are highly dependent on imports as does its domestic manufacturing. Due to this close and positive relation between exports and imports, it's difficult for Turkey to rely on exports to lower its current account deficit.

Also, after the 1996, when Turkey becomes a member of Customs Union, the trade share with the European countries has been about 50 percent of its overall trade volume since the 1980s. Being a member of Customs Union it's contributed to the increasing volume of trade of Turkey coupled with a decline in income elasticity's of trade[1].
However, Turkey's export to the EU has become more responsive to the real exchange rate misalignments during the Customs Union period. The further step attempted in the

[1] www.stats.oecd.org

relation between Turkey and the EU was in December 1999 during Helsinki summit, when the Turkish position had been revised and the status of a candidate country being accord.

Graph 2.2: Trade Balance, Export minus Import of Goods and Services (Billon US $)




Source: international financial statistics (IFS).

In 2003, the government borrowing helps to fund the current account deficit. Net inflows of capital through the banking system played an important part in financing current account deficit. Also, in 2005, capital inflows had continued to compensate richly for large current account deficit. Specifically, in the first half of 2005 net capital inflows amounted to $19.4 billion. Also, net foreign borrowing by banks and the private sector accounted for $ 12 billion of capital inflows. Net capital inflows continue to finance the current account deficit. FDI including real estate added up to $ 1 billion and net borrowing by corporate sector amounted to $ 2.1 billion. In 2007, net capital inflows excluding official reserve amounted of $33.4 billion. The main sources of these inflows were from net borrowing by non-banking sector ($19.7 billion) net FDI ($13.5 billion) and net foreign investments in stock exchange ($4.4 billion). By 2009, the current account deficit declined comparing with the previous years. The decline was almost entirely attributable to the narrowing merchandise trade deficit.

During 1998, after reaching a high level of foreign exchange reserve which was $26.7 billion, the Central Bank of Turkey used approximately $4.3 billion of foreign reserve in

the second half to defend the Lira as foreign investors fled Turkey. The Central Bank successfully maintained the real value of the Lira, which was expected to be depreciated in line with wholesale price index.

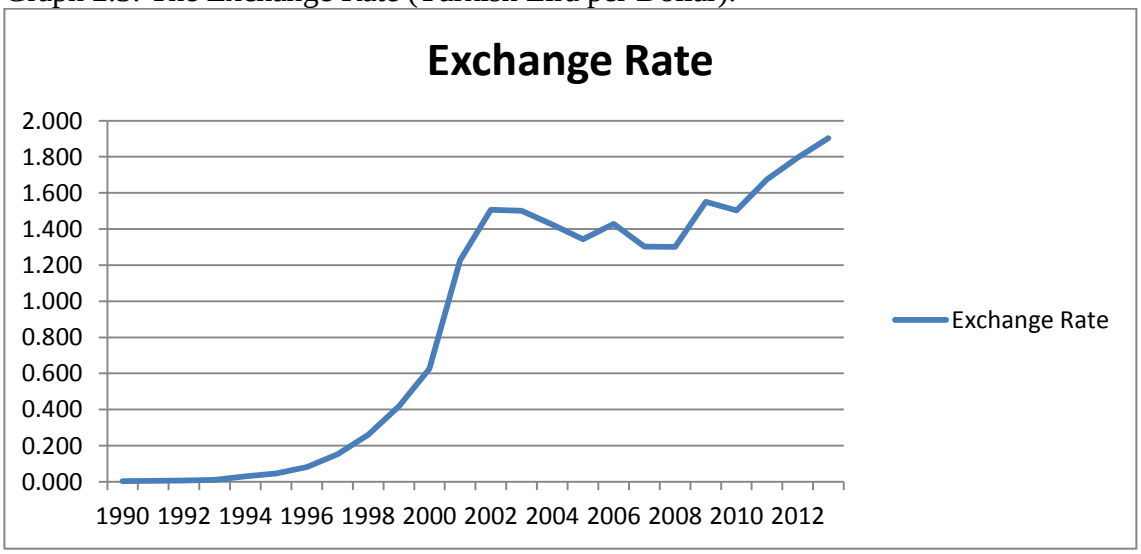
In 1999, two disastrous earthquakes hit the industrial heart land causing Turkey to suffer its worst contraction in several decades. Turkey public account during the first half of 1999 showed a sharp deterioration compare with 1998 due to the sluggish tax revenue as a result of weak economic growth, the high cost of servicing the public debt and high public sector pay increase. The deficit amounted to $14 billion compared with $4.9 billion in the same period in 1998. Due to this increase, annual inflation has continued to edge upwards in recent months, reversing a long decline.

In the first quarter of 2000, the economy had a negative growth in GDP. This continuous negative growth of the GDP can be largely but not only due to the damage caused by the earthquake on August 17$^{th}$ in the industrial area. Due to the political conflict after the telecommunication privatization, the Turkish government performance in meeting the IMF standby requirement through 2000 was dissatisfactory. Also, the banking sector showed a bad signal and some banks were transferred to the Saving Deposit Insurance Fund (SDIF).

Toward the end of the year 2000, the Turkish banking sector showed a sign of liquidity shortage. To cover the liquidity problem, Banks start to sell its government securities in which led to sharp increase in the interest rates in the secondary markets. Foreign currency demand increased as a result of the collateral problem. The Central Bank, in order to overcome this problem, decide to pump liquidity in the market through open market operation, but this liquidity was converted to foreign exchange and left the country in which leaving the Central Bank with drained reserve and market with high interest rate. The IMF extended credit to Turkey in the amount of $7.5 billion in the form of supplemented reserve facility and to prevented the collapse of the crawling peg regime (Uygur, 2001). Meanwhile, the Treasury secured additional credits from international markets, and the IMF. Although the Turkish market were stabilized with the new credit and the IMF support the liquidation of banks and transfer the other to SDIF was an indicator that the economy on the verge of collapse.

Consequently, the IMF raised concerns about the sustainability of the program and put pressure on the Turkish government to abandon the crawling peg regime. The Treasury reported serious difficulties in securing foreign credit in the face of out flows of foreign capital. As a result on February 21, the Turkish government, Central Bank and the Treasury officials as well as public bank presidents discuss the switch from crawling peg to free float exchange rate and it's been approved. Under the new regime, base money functioned as a nominal anchor rather than the exchange rate anchor which implemented only 14 months. Since the exchange rate stabilization is essential for the price stabilization, intervention to the foreign exchange market designed to prevent extreme volatility and to accumulate foreign reserve. In this context, financial stability and floating exchange rate regime, monetary policy expected to have very active role.

Graph 2.3: The Exchange Rate (Turkish Lira per Dollar).




Source: international financial statistics (IFS).

After 2001 crises, Turkish economy has entered an era of growth and structural reforms. A comprehensive reforms program which encompassed an floating exchange regime, financial sector, supervision and privatization led to significant economic growth with an annual GDP growth of 6.8% between 2002 - 2008, compared to annual average GDP growth of 4% in the 1990s (Nathanson and Brand, 2011). These reforms put effort on reducing the inflation rate (inflation targeting).

After the crises, the Central Bank started to implement floating exchange rate regime. Although the year 2002 was the first year of free floating exchange rate regime and it was completely new and unknown for all market participants, the intervention was quite rare and it was limited to extremely volatile movements that were not justifiable through fundamentals including market sentiments. The Central Bank at January 2002 announced that it would be gradually abandon its intermediary rate in the foreign exchange and foreign currency markets. Via this policy, it was intended that the under taking of transactions risks by the market participants would lead to price formation mechanism that fully reflected the risk perceptions. After applying the floating exchange rate some events left an impact on foreign exchange rate in Turkey. The Central Bank announced that foreign exchange deposits in term of USD were supplied to eliminate the shortage in foreign exchange markets and interest rates on foreign exchange deposits were decreased from 12% to 8%. While it was announced that foreign currency banknote demand in the banking sector would be satisfied through foreign exchange and banknote markets. By doing so, it prevented a potential market turmoil that could have endangered price stability (Yuksel, 2008).

The monetary policy committee of the Central Bank was formed in the first half of the 2000's and they indicate that implicit inflation targeting program was successful, bringing inflation down to single digits. Although the exchange rate is free float, the Central Bank will also be concerned that any future interest rate cut might prompt companies and households to hold more foreign exchange, leading to depreciation of the Lira and further inflationary pressure. The Central Bank plans to adopt fully-fledged policy of inflation targeting in 2002. Inflation targeting is generally effective only when inflation is already relatively low and the markets are convinced of the Central Bank independence.

## 2.3 Restructuring Period (2002- 2007)

The last crises terminated the country's long lasting experience with some form of managed exchange rate and free floating regime become inevitable. Foreign exchange risk was at the end left to the markets putting in place incentives for responsible investment decisions that would prevent excessive risk taking (Yuksel,, 2008). The needs for new economic stabilization programs and reforms have been raised. Wise fiscal and monetary policies in line with structural reforms in the new economic program, aimed to formulate a well-placed economy on the track of structural sustained low-inflationary growth. In other words, the essential goal was to make the economy more elastic to adverse shocks, less volatile to crises, more equitable in income distribution, and more conductive to foreign and domestic investment.

The agenda of the new order was full of reforms, including the jump-starting of privatization. The new programs include the extensive re-capitalization of the banks as well as re-structuring of state-owned banks. The priority was given to enhancing the role of private sector. Consequently, a decision was taken to drive-out state involvement from production and manufacturing to pave the way for private sector.

After the 2001 crises, the policymaker was given the opportunity to pay more attention on the microeconomic problem which fueled the crises. The increasing pressure of competition and the need to develop an extensive set of risk controls became expected problems for banks, following the macroeconomic problems which arise in the late 1990's and early 2000's. Due to this, a stabilization program was set for the banking sector including, like; sustaining profitability under heightened global volatility, managing foreign exchange risk under a floating exchange rate regime when private sector was heavily indebted in foreign currency and at least expand locally to compete among challenges for banks, to meet the new economic conditions.

## 2.4 History of Borsa Istanbul (BIST)

The Borsa Istanbul (BIST) was established in early 1986. The BIST is the only securities exchange in Turkey established to provide trading in equities, bonds, bills, revenue sharing certificates, private sector bonds, foreign securities and real estate certificates as

well as international securities. The BIST was governed by an executive Council composed of five members elected by general assembly. One of the five appointed as the chairman and chief executive officer of the BIST by the government on Oct 25, 1997. The other four members: Development banks, commercial banks and brokerage houses. BIST as a professional organization, it enjoys a high degree of self-regulation. Its revenue is generated from fees charged on transactions, listing procedures and miscellaneous services. The profit of the ISE are retained to meet the expenses or to undertake investments and are not distributed to any third parties. The BIST has its own budget.

The origin of an organized securities market in Turkey has its roots in the second half of the 19th century. Also created a medium for European investors who were seeking higher return in the vast ottoman markets, following the proclamation of the Turkish Republic on the ruins of the Ottoman Empire; a new law was enacted in 1992 to recognize the fledging capital markets under the new name of "Istanbul securities and foreign exchange Bourse".

At the early phase of 1980's are a market improvement in Turkish capital markets, both in regard to the legislative framework and the institutions required to set the stage for sound capital movements. In 1981, the "Capital Market Law" was erected. One year later, the main regulatory body responsible for the supervision of regulation of the Turkish securities market, the capital market Board based in Ankara, was established. A new decree was issued in Oct 1983 foreseeing the setting up of securities exchange in Turkey. In October 1984, the "Regulations for the establishment and functions of securities exchange" was published in official gazette. The regulations concerning operational procedures were approved in the subsequent extraordinary meeting of the general assembly of the Istanbul Stock Exchange was formally inaugurated at the end of 1985[2].

[2] http://www.borsaistanbul.com/en

## 2.5 Conclusion

This chapter aims to shed some light on the Turkish economy during the last 30 years. During this period, the Turkish economy faced three crushes, and in order to made-up with this crushes several fiscal and monetary policy were taken. The 2001 crises was fueled by the financial sector, banks were closed or transferred to SDIF. After this period the Turkish policy makers found it essential to take an action. They paid efforts to control the inflation rate, and keep it with a single digit and the new exchange rate regime is a free floating exchange rate. Also, restructuring process led to several policies; they put effort to restructure the banking sector since it was the fuel of the 2001 crises.

# CHAPTER THREE

## 3. Theoretical Framework

### 3.1 Introduction

The economics and finance has been supplied many theories that examine the relationship among stock market and macroeconomic factors. Among these theories is Efficient Market Hypothesis (EMH) to highlight the implication about the nature of stock price, and also for investor whom looking for higher risk adjusted return, that advocates that stock market prices are fully and rationally all relevant information. Hence, previous information is useless to make prediction about future asset prices. Thence, new relevant information is only used to examine stock market movement (Fama, 1965). After that, the Capital Assets Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) are discussed. As well as, a comparison between each other will be illustrated. Present Value Models and their progress are discussed; begin with the primary discount models to the later advances of the Gordon Growth Model. Also this chapter illustrates the dynamic linkage among stock market and economic activity.

### 3.2 The Theoretical linkage Between Stock market And Macroeconomic Variables

This linkage between the macroeconomic variables and stock prices is well documented in financial and economic literature. Literature, such as that by (Sharpe, 1964), (Lintner, 1965), (Mossin, 1973), (Ross, 1976) and (Gordon, 1962), has supplied a theoretical basis by which stocks might be valued. Whereby, simplifying the assumptions, based on which many of these models are derived and based, present key weaknesses. These weaknesses become increasingly obvious in the implementation and practical application of the model in reality. However, from a theoretical standpoint, these models present a basic theoretical foundation on which stock market movement may be recognized to the influences of the macro-economy.

### 3.2.1 Theory of Efficient Market Hypothesis (EMH)

The main idea of Efficient Market Hypothesis that introduced by (Fama, 1965, 1970), is based on assets prices immediately reflect all available information at any time that stock prices has been given, such as abnormal profits cannot be produced regardless of the investments utilized, the EMH can be examined the broad implication. Through participants in the stock market it's not be able to reach an abnormal profits in any case of level of information they might possess, on the other hand, from an investor's perspective. Any perfect capital market, investors can't continuously beat the market. This is related with the financial criteria that the maximum price that the investors are willing to pay is the face value of future cash flow, is usually evaluate by a discount rate. Hence, it represents the uncertainty associated with the investment, considering all related available information.

Moreover, the EMH has become a debate of discussion due to circumstances where market prices have failed to reflect information. From an economic point of view, an efficient stock market will appear through the efficient allocation of economic resources. For example, if the share prices of a financially weak company are not priced correctly, will not be used new saving inside the financially weak industry. From the EMH, the benchmark of asset price fluctuation fairly reflects underlying economic fundamentals. Livich, (2001) argues that may the market will be disrupt through policymaker's intervention, lead it to be inefficient. Moolman and du Toit, (2005) suggests that in the short run are investor they have ability to earn higher risk adjusted return, due to the intrinsic value of stock markets in different sectors, in fundamental analysis be not equally affected by macroeconomic changes. In such case the form of EMH usually is not used as strict fact it used as guidelines (Fama, 1991).

### 3.2.2 Capital Asset Pricing Model (CAPM)

The Capital Asset Pricing Model (CAPM) was introduced by Treynor (1961), William Sharpe (1963-1964), Lintner (1965) and Mossin (1973) independently, constructing on the earlier work of Harry Markowitz on diversification and modern portfolio theory. CAPM describes how investors determine expected returns, and thereby asset prices of

risky assets, based upon their instability relative to the market as a whole. Just like Markowitz's Modern Portfolio Theory model, the CAPM is based upon several simplifying assumptions that make the model more desirable from a mathematical standpoint.

CAPM assumptions[3]:

1. Investors are risk averse, individuals who maximize the expected utility at their end of period wealth.
2. Investors have homogenous expectation about assets return.
3. Assets return is distributed by the normal distributions.
4. There exists a risk free asset at a constant rate, the risk free rate.
5. There are a definite number of assets and their quantities are fixed within the one period world.
6. All assets are perfectly divisible and priced in perfectly competitive markets.
7. Assets market is frictionless and information's costless and simultaneously available to all investors.
8. There are no market imperfections such as taxes. Regulations on short selling.

The conclusions following from the assumptions are consequently:

1. There is borrowing and lending at a risk-free rate, which is the same for all investors.
2. Each investor's portfolio of risky assets has the same composition as all other investors.
3. The market portfolio is efficient for all investors; the unique mutual fund of all risky assets exactly suits the needs of all investors.
4. Since the market portfolio is efficient, any other portfolio of risky assets is inferior.

Derivation of CAPM One of the most important problems of modern financial economics is the quantification of the tradeoff between risk and expected return. Although common sense suggests that risky investments such as the stock markets will generally yield higher returns than investments free of risk, it was only with the

[3] Sharpe at el (2001).

development of the Capital Asset Pricing Model (CAPM) that economists were able to quantify risk and the reward for bearing it (Campbell et al, 1997).

The CAPM is a simple linear model that is expressed in terms of expected return and expected risk. The CAPM was the work of a financial economist; William Sharp set out in 1970 "portfolio theory and capital market" his model short with the idea that individual investments contain two types of risk:

1. Systematic risk (market risk): also called non diversifiable risk, these are market risk that cannot be diversified away by investing in a portfolio like (recessions, war and inflation).
2. Unsystematic risk (diversifiable risk): also known as specific risk, this risk is specific to individual stocks and can be diversified away as the investor increase the number of stocks in his or her portfolio, in technical terms that is not correlated with general market moves.
3. The concept of total risk can be attached to the empirical return by assuming that any assets is a linear function of market plus a random "ε" term, which is independent of the market.

$$\check{\mathrm{R}}_j = B_j \check{\mathrm{R}}_m + \acute{\varepsilon}_i$$

Where

$\check{\mathrm{R}}_j$ : Total risk.

$B_j \check{\mathrm{R}}_m$ : Market risk.

The variance of total risk can be written as:

$$\sigma^2{}_j = b_j^2 \sigma^2{}_m + \sigma^2{}_\varepsilon$$

Where

$b_j^2 \sigma^2{}_m$ : Systematic Risk.

$\sigma^2{}_\varepsilon$ : Nonsystematic risk.

Modern portfolio theory shows that specific risk (unique risk) can be removed through diversification, the trouble is that diversification still does not solve the problem of systematic risk, even a portfolio at all shares in the stock market cannot eliminate that risk ( constructing portfolios just eliminate the unsystematic risk).

The CAPM assume portfolio that is mean-variance-efficient and lay on the efficient frontier is equal to the market portfolio as well. The effect of that, are that the related among risk and expected return for an efficient portfolio must also hold for the market portfolio. Hence, the CAPM might be stated as follows:

$$E(Ri) = Rf + \beta im[E(Rm)-Rf] \quad i=1,....N$$

*Where,*

E(Ri): Expected return on asset i

Rf: Risk-free rate of return

E(Rm): Expected return of the market portfolio

Bim: Beta of the asset market

But the CAPM formula takes into account the assets sensitivity to non-diversifiable risk, (systematic risk) in a number often referred to as (β), it measures a stocks relative volatility, that is, it show how much the stocks market as whole jumps up and down. It represents the relationship market and stock return.

### 3.2.3 Arbitrage Pricing Theory (APT)

In general, the theory of assets pricing, explain how to assets are priced given the associated risk. The Arbitrage Pricing Theory formulated by Ross (1976), has been an alternative to assets price theory. APT is considered a general form of Sharp's (1964) CAPM. While the CAPM suggests that through a single common factor can obtain asset prices or expected return. But APT that suggests they are obtained by multiple macroeconomic factor. APT can be expressed as:

$$E(R_i) = Rf + \beta_{j1}\lambda_1 + \beta_{j2}\lambda_2 + \cdots + \beta_{jk}\lambda_k$$

Where,

$E(R_i)$: Expected return on asset i.

$Rf$: Risk free rate on return.

$\beta_{j1}$: Coefficient represents the sensitivity of asset j to risk factor K.

$\lambda_k$: Represents the risk premium for factor K.

The APT assumes that there are *n* factors, which cause asset returns to systematically deviate from their expected values. The theory does not specify how large the number *n* is, nor does it identify the factors. It simply assumes that these *n* factors cause returns to vary together. Examples of such factors include inflation, GDP growth, and interest rates etc. The impact will differ across assets. Under the assumptions of APT, there are *n* sources of systematic risk, where there is only one source in CAPM (the covariance (beta) of the asset with the market portfolio).

There are two empirically testable versions of the APT. The statistical APT first tested by Roll and Ross (1980) involves identifying priced common risk factor. This version of the APT is also known as the factor loading model because the independent repressors are generated through the statistical computer package. The macro-variable version of the APT introduced by Chen, Roll and Ross (1986) involves identifying the macro-variables which influence stock returns.

A major advantage of the macro-variable APT is that its results have economic interpretations comparing to the unknown risk factors in the statistical APT. However, the multi-collinearity among the macro-variable time series is a disadvantage of the macro-variable APT considering the orthogonal factor loadings in the statistical APT.

There are several empirical studies that have included different macroeconomic factor, are based on the stock market which they studied. In this study, four macroeconomic factors will be taken in consideration to analyze their impact on the Turkey stock market. Even though analysts can predetermine some economic factor, their selection must be based upon reasonable theory (Chen et at, 1986).

### 3.2.4 Supplemental Examination for the Two Models

APT has a number of advantages counter to the CAPM is not restrictive in their requirements on the individual portfolio. Allows multiple sources of risk as it gives us an explanation of what that stock returns move, APT demands that investors look to the sources of risk and those who may be reasonable estimate factor sensitivities. Indeed, even practitioners and academics cannot agree on the identity of the risk factors, and to estimate betas should live more noise.

The APT came out as a testable alternative, but its testability is an open question as well. Some would argue that models should not be judged on the basis of the accuracy of their assumptions, but rather on the basis of their predictive power. The CAPM creates a single prediction, the efficiency of the market portfolio, which has been argued to be non-testable.

The power of the APT in predicting future stock returns falls short of ad hoc expected return factor models. The problem may well be that the arbitrage process presumed in the APT is difficult; If not impossible to implement on a practical basis. The APT calls for arbitraging away nonlinearity in the relationship between expected returns and the factor betas. We arbitrage by creating riskless stock portfolios with differential expected returns. However, you will find that it is impossible to create riskless portfolios comprised exclusively of risky securities such as common stocks.

In one important respect, both models exhibit a similar vulnerability. In the case of both models, we are looking for a benchmark for purposes of comparing the expose performance of portfolio managers, and the extent returns on real and financial investments. In the case of the CAPM, we can never determine the extent to which deviations from the security market line benchmark are due to something real or are due to obvious inadequacies in our proxies for the market portfolio. In the case of the APT, since theory gives us no direction as to the choice of factors, we cannot determine whether deviations from an APT benchmark are due to something real or merely due to inadequacies in our choice of factors. As we know that the APT really makes no predictions about what the factors are. Given the freedom to select factors without restriction, it can be argued that you can literally make the performance of a portfolio anything you want it to be. In the case of the CAPM, you can never know whether portfolio performance is due to management skill or to the fact that you have an inaccurate index of the true market portfolio. Another problem with CAPM that hedging motive does not enter in it, and therefore people hold the same portfolio of risky assets. In reality people might have different tastes and, it may make sense for them to hold different portfolios. The CAPM says that investors will price securities according to the contribution each makes to the risk of their overall portfolios.

## 3.3 Present Vale Models

### 3.3.1 Discount Cash Flow Model

The Present Value Model (PMV) or Discount Cash Flow Model, was formulated by (Smith, 1925), is consider as an alternative theory to capital asset pricing. The model emphasize that the current value of capital asset is based upon to its expected future cash flow (dividend), also these cash flow attribute to the future discount rate.

The factor that, which affected on expected profit, therefore, dividend or cash flow of the capital asset, theoretically would be may change its present value. The PVM provides a theoretical foundation linking between macro-economy and stock prices (Ahmed, 2008). PVM can be expressed as:

$$P\mathrm{i},\mathrm{t} = \sum_{n=1}^{\infty} \frac{E(Di, t+n)}{(1+Ki)^n}$$

Where,

$P\mathrm{i},\mathrm{t}$: The current price of the asset at time t.

$D_{i,t+n}$: The future discounted cash flows.

(1+Ki): The discount factor with Ki, (being applicable discount rate).

The formula states that the current price of a capital asset is equal to the sum of the future cash flow of that asset, discounted to time t. The gain from the capital realized when the sales of asset are listed, since they are also based on the present value of the future cash flows or dividend, (Moolman and du Toit, 2005).

Moreover, the linkage among the macroeconomic factor and stock price more obvious, since any factor affecting whether the future dividend or the discount rate or both, will be affected the current price of the stock. For instance, with the assumption of discount rate and dividend streams has been fixed into the future. Hence, if dividends a highly dependent on profit, and the profit strongly affected by prevailing economic condition, thus the discount rate is likely to vary since, it based on three factor that are likely to vary, namely: the real risk-free rate, the expected rate of inflation and risk premium, (Moolman and du Toit, 2005).

### 3.4 Gordon Growth Model (GGM)

The Gordon Growth Model was introduced by Gordon (1962) is depend on the PVM, but the adjusted was conducted by addition of a growth factor for dividends instead of fixed dividend. In this case, dividends are allowed to steady rate into the future or grow at constant and rate into the future. GGM can be expressed as:

$$p_{\circ} = \frac{DPS}{Ke - g}$$

Where,

$p_{\circ}$ = Represent the current price of a share.

D = Represent the expected future dividend yield.

$K_e$ = Represent required rate of return.

g = is the constant growth rate of the asset.

Moreover, with GGM the current price of an asset is based on the expected dividend of the asset, and that through divided the difference among the required rate of return and the growth rate of the asset.

The model is useful for determined the value of stock, nonetheless, under a few assumption. Those dividends are assumed to continue at a constant rate forever, as long as; the dividends are expected to grow at constant rate for an extended period of time. However, the growth rate is assumed to be less than the required return on equity Ke, Myron Gordon has been demonstrated that is a reasonable assumption. In theory, if the growth rate were faster than the rate demanded by holder of the firm's equity, in the long run the firm would grow impossibly large, dramatically will be affected on the whole market. Importantly, the model highlight on the diverse factors that might impact a stock's price, but also the channels in which macroeconomic forces might impact stock prices.

#### 3.4.1 Gordon Growth Model (Two Stages)

Has been expanded GGM to model has two stage that as a result of fluctuations in the dividends for over two periods. Thus, the first stage of the model has taken into account the period that has high dividends in the growth, while the second stage has been taken

the period that has lower dividend in the growth, but stable growth (Damodaran, 2011). The GGM has been adjusted as follows:

$$p_{\circ} = \sum_{t=1}^{t=n} \frac{DPS_t}{(1 + K_{e,hg})^t} + \frac{P_n}{(1 + K_{e,hg})^n}$$

Where,

$P_n = \frac{DPS_{n+1}}{(K_{e,st} - g_n)}$

$p_{\circ}$: represented the price of asset at t=0.

$DPS_t$: represented the expected dividends per asset in year t.

$K_{e,hg}$: represented required rate of return during period of high growth.

$P_n$: represented the price of the asset at the end of year n.

$g_n$: Constant growth rate after year n.

The formula suggests that the present value of the capital asset be the result of discounted value of dividend over the initial period that has high growth, in addition to the discounted value of the initial price of the asset over the period that has stable growth.

The limitation of the model, which is focused on how to identify the length of period that has high growth, in this case during the period that has high growth, cause an increase in the present value of the capital asset. It follows that, after this period it is supposed a period has lower stable growth. Therefore, after the initial period that has high growth the period of stable growth follows immediately (Damodaran, 2011).

### 3.4.2 Gordon Growth model (Three Stages).

Gordon Growth Model (Three Stage) has been discussed three periods of growth, which are the period that has stable high growth, declining growth period and the period that has lower stable growth. As well as, the GGM (three Stages) does not lay any constraint over assumption a required rate of return and the dividend payout ratio. The formula stated as:

$$P_0 = \sum_{t=1}^{t=n1} \frac{EPS_0 * (1+g_a)^t * PO_a}{(1+K_{e,hg})^t} + \sum_{t=n1+1}^{t=2n} \frac{DPS_t}{(1+K_{e,t})} + \frac{EPS_{n2} * (1+g_n) * PO_n}{(K_{e,st} - g_n)(1+r)^n}$$

Where,

$P_0$: Asset price at t=0.

$EPS_0$: Expected earnings per asset in year t.

$DPS_t$: Expected dividends per asset in year t.

$g_a$: High growth stage.

$g_n$: Stable growth stage.

$PO_a$: Dividend payout ratio during high growth rate.

$PO_n$: Dividend payout ratio during stable growth rate.

$K_{e,hg}$: Required rate of return during high growth rate.

$K_{e,t}$: Required rate of return during transition stage.

$K_{e,st}$: Required rate of return during stable growth stage.

The formula shows it's contains in investigation the asset prices at the initial time where t=0. Obviously, that contains in each component, the required rate of return ($K_e$) related with the expected growth rate in each stage ($g$). In the GGM (three Stages) has eliminated numerous of the problems that related with previous issues of the GGM. GGM (three Stages) was provided more flexibility, in the periods that have unsystematic growth. While, empirically it consider more advance than the previous issues, due to it take a large number of factors are required, might influence a stocks. But in the other hand, extent of the impact of macroeconomic forces on stock prices.

### 3.5 Conclusion

This chapter shows several theoretical models that have been developed to emphasize capital asset prices, or in this study, stock prices. Begin with the Efficient Market Hypothesis was particular as being a pivotal part of stock pricing theory, due to the entanglement it had with not only how investors and policymaker's a like viewed for stock pricing, but also the influences it may have with regard to asset return.

After that, the Capital Asset Pricing Model, it was considered as an asset pricing model, as explained before. The assumption of CAPM, its application to portfolio theory, had

driven to the derivation of a quantifiable measure of market risk. Therefore, the CAPM suggested a mean by which the risk associated with holding single assets might be estimated, related with the market risk, and so its expected return could be determined. However, due to upon its assumptions; the practicality of the model was controversial, which led the discussion to the development of Arbitrage Pricing Theory.

While the CAPM is a simple model that is based on sound reasoning of the assumption that underlie the models are unrealistic. The APT, despite not subject to the same strict assumptions as in CAPM, offers a major advantage over the CAPM: ability of APT to select more than one source of risk for capital assets. So the APT was displayed as multi-risk asset pricing model.

The major shortcomings of both the CAPM and APT presented as a prelude of a standby set of asset pricing model, precisely Present Value Models or Discounted Cash Flow models. In these model is the basic idea that the present value of a capital asset is equal to its future cash flow, or the stocks dividends, discounted to the present. The present value has modes provided the grounds on which the Gordon Growth Model, evolved to remedy the shortcomings in each previous models. Has become clear in each of the discussed present value model was the rate at which cash flows were allowed to grow with regard to dividend growth over time.

The next chapter shows the empirical literature related with macroeconomic factors, and the links that may be related with stock prices.

# CHAPTER FOUR

## 4. Empirical Literature

### 4.1 Introduction

This study will investigate the empirical evidence on the diverse linkages that found between macroeconomic factors and stock market. The empirical evidence on the macroeconomic determinants of stock market falls into two categories, one investigate the effect of macroeconomic factors on stock returns, and the other investigate the effect of macroeconomic factors on stock prices. This chapter examines the literature that center on the dynamic interaction between macroeconomic factors and stock prices, and price indexes.

Chapter consists of the following sections; section 4.1 highlights the dynamic relationship between a set of macroeconomic factors and stock markets that conducted in developing, developed countries and emerging markets. Section 4.2 discusses the empirical literatures that analyze macroeconomic level data and stock market specifically in the Turkey stock market. Section 4.4 is the conclusion.

### 4.2 Studies related to Developed, Developing Countries and Emerging Markets

This section exposes the related studies for the Developed, Developing Countries and Emerging Markets one by one and sees their results that have been achieved.

Rajen (1997) investigated the long run and short run relationship between macroeconomic factors namely: money supply (M1 and M2), aggregate foreign exchange reserve and exchange rate and share price index for Singapore stock market. By using cointegration and causality techniques, for the period span from October 1984 to April 1993 (monthly data), the result shows that share price index is cointegrated with money supply (M1 and M2) and foreign exchange reserves. But there is no cointegration was found between share price index and exchange rate, since they don't exhibit short run association relationship.

Apergis and Eletheriou, (2001) investigate the relationship between stock price general index (1990 = 100) and (inflation rate, interest rate) for Athens (Greece) for the period span from January 1988 to December 1999 on monthly base. By applying APT model, the empirical evidence shows that stock price has more sensitive with inflation rather than interest rate movement, since the stock price has negative relationship with inflation.

Ewing, (2002) examined the relationship between the NASDAQ financial 100 index and several macroeconomic factors from January 1988 to September 2000, via applying generalized impulse response analysis. The findings reveal that a monetary policy shock reduce financial sector returns having a significant initial impact effect which continues to affect return for around two months. Also, unexpected changes in economic growth have a positive initial impact effect, but exhibit no persistence. Inflation shock has a negatively and statistically significant initial impact effect which lasts for up to one month after the shock time.

Maghayereh (2003) empirically examined the relationship between Jordanian stock price and a set of macroeconomic factors namely: money supply (M1), interest rate, domestic foreign reserve, inflation rate and industrial production index, for the period span from January 1987 to December 2000. By applying Johansen cointegration and Vector Error Correction Model (VECM) techniques, the result indicates that there is long run relationship between stock price index and all macroeconomic factors.

Ibrahim and Hassanuddeen (2003) analyzed the dynamic linkage between stock prices and four macroeconomic variables; industrial production, money supply, consumer price index and exchange rate, for the period spans from Jan 1977 to 1998 in Malaysia. The findings suggests that the presence of long term relationship between three variables and the stock prices and substantial short run interactions among them. Particularly, it documents positive short run and long run relationships between industrial production and consumer price index variables and the stock price. Also, the result documents the disappearance of the immediate positive liquidity effects of the money supply shock and understandable interactions between the stock price and the exchange rate over time.

Paul and Mallik (2003) investigated the relationship between macroeconomic factors and stock price in the banking and finance sector in Australia via applying cointegration test and estimating an error correction model to examine the long run relationship for the period spans from 1980Q1 to 1999Q1. The study reveals that the bank and finance sector stock prices are cointegrated with all three macroeconomic variables inflation, interest rate, and real gross domestic product. The interest rate has a negative effect, whereas growth of gross domestic product has a positive effect on stock price. Inflation has no significant effect on stock prices, which supports Fama`s proxy hypothesis.

Maysam et al (2004) examine the long-run equilibrium relationships between selected macroeconomic variables and the Singapore stock market index (STI), also with the finance index, the property index, and the hotel index for the period of Jan 1989 to December 2001 on monthly base. The findings conclude that the Singapore`s stock market and property index form co integration relationship with changes in the short and long-run interest rate, industrial production, price levels, exchange rate and money supply.

Menike (2006) examined the explanatory power of macroeconomic factors on stock price within emerging Sri Lanka stock market. For the period of 1991-2002 on monthly base, by using multivariate regression, was using four macroeconomic factors namely: money supply (M2), exchange rate, inflation rate and nominal interest rate. The findings reveal that the money supply (M2) has positive significant relationship with stock price; further inflation rate and exchange rate are negatively significant relationship with stock price.

Adrangi and Chatrath (2007) empirically introduced the dynamic linkage between stock market and inflation rate and seasonally adjusted industrial production index as proxy for real economic activity. For Brazil stock market, by using Johansen and Juselius cointegration test for the period span January 1986 to July 1997 (monthly data). The result shows that there is long run association between stock prices, general price level and real economic activity. Further, the findings reveal that there is a negative relation between stock return and unexpected inflation.

Hassan and Ergun (2008) investigate the dynamic linkage between stock market KLCI and monetary policy; money supply (M1, M2) and interest rate evidence from Malaysian for period span from January 2000 to May 2008 on monthly base. By applying Johansen co-integration techniques within structural break. The result indicates that there is a long run relationship between KLCI and monetary policy. Further, there is short run relationship KLCI and monetary policy.

Coleman and Teety (2008) empirically investigated the effect of set of macroeconomic variables namely; inflation, real exchange rate, treasury bill lending rate and dummy variables to cover the structural effect of the listing of Ashanti gold fields company on the market, on the stock performance of Ghana during the period spans from 1991 - 2005. The findings reveal that Treasury bill rate has positively but statistically weak effect on the performance of stock market while lending rate negatively effect on business in Ghana. Exchange rate has a positive relationship and inflation shows a negative relationship with the stock market performance.

Rahman and Uddin (2009) examined the dynamic linkage between all share price index and exchange rate, in three emerging market of South Asia namely: Bangladesh, India and Pakistan. Covering the period of all monthly data, were used from January 2003 to June 2008. The findings reveal that there is no cointegration relationship between price indices and exchange rate by using Johansen procedure.

Rahman et al (2009) explored the interaction between set of macroeconomic variables; industrial production, money supply, real exchange rate, monthly reserves and treasury bill 3 month rate, and stock prices for Malaysia by applying VAR framework. The result shows that changes in Malaysian stock market index to perform a cointegrating relationship with changes in money supply, interest rate, exchange rate, reserve and industrial production index. Also, all six variables test shows significant contribution to the cointegrating relationship and Malaysian stock market has strong dynamic interaction with reserve and industrial production index comparing with the rest of the variables.

Pilinkus (2009) investigate the relationship between macroeconomic factors and the Lithuanian price index (OMX, Vilnius), for the period span December 1999 to March 2008 on monthly base. Were used 40 macroeconomic factors to describe the health of Lithuanian economy, by using Granger Causality techniques, the result has been shows that there is statistical causality between OMX price index and macroeconomic factors namely: consumer goods and money supply (M1 and M2).

Raymond (2009) empirically examined the long run and short run relationship between the set of macroeconomic factors namely: money supply (M2, M3), interest rate, and exchange rate and inflation rate and stock price (JSE index) in Jamaica. By applying time series analysis Vector Error Correction Model (VECM) and Johansen co-integration, for the period span from January 1997 to December 2007 on monthly base. The findings reveal that the long run relationship between macroeconomic factors and JSE index, also indicate that its positively influenced among JSE index and inflation rate, money supply (M3) and negatively by exchange rate interest rate and money supply (M2). Further, the result shows that short run relationship, between JSE index and macroeconomic factors are interest rate and money supply (M2, M3). Finally, shows that the shocks for all factors affected on stock price by applying impulse response procedure.

Humpe and Macmillan, (2009) investigate the dynamic relationship between stock price and macroeconomic variables such as: money supply, long term interest rate, inflation rate and industrial production index as a comparison between US and Japan stock market, for the period span from January 1965 to June 2005. By using Johansen cointegration test, the findings reveals that there is positively influence between US stock price and industrial production index and negatively by inflation rate and long term interest rate, also there is no significant influence between US stock price and money supply. Further the result shows that there is positively relation between Japanese stock price and industrial production index, but negatively by money supply. On the other hand, it suggests that there is negatively relation among industrial production index to interest rate and inflation rate.

Trivedi and Behera (2012) examined the dynamic relationship between stock price of Bombay (BSE-Sensex) and a set of macroeconomic factors namely: index of industrial production, wholesale price index, interest rate (3 month T-bill rate), money supply M3, foreign institutional investment and Morgan Stanley capital international. For the period span from April 2000 to December 2013 on monthly base, by applying Vector Autoregressive (VAR) techniques. The findings reveal that there is a long run relationship, between stock price and macroeconomic factors. Further, the impulse response shows that positively association with IIP, increase in money supply (M3), increase in FIIs and rise in MSCI world index.

Issahaku and Ustarz (2013) investigate the dynamic relationship between stock price in Ghana and macroeconomic variables are selected namely: exchange rate, money supply, inflation rate and foreign direct investment for the period span January 1995 to December 2010 on monthly base. By applying Vector Error Correction Model (VECM) to determine the long run and short run relationship among the selected variables, the findings reveals that there is long run relationship between stock price and a set of macroeconomic variables are inflation rare, money supply and foreign direct investment. Further, there is short run association between stock price and macroeconomic variables are interest rate, inflation rate and money supply.

### 4.5 Empirical Evidence In Turkey

Recently emerging stock markets have been of great position to the worldwide investment community. According to the International Finance Corporation (IFC) all markets in developing countries are treated as emerging. The World Bank defines developing countries to have per capita GNP below 7620 U.S dollars in 1990 prices. Under these definitions the Borsa Istanbul, BIST is an emerging market of a developing country namely Turkey. The ISE is the only securities exchange in Turkey established to provide trading in equities, bonds and bills, revenue sharing certificates as well as international securities.

Muradoglu et al (2001) investigated the long term relationship between stock price and monetary variables in Turkey stock market for the period January 1988 April 1995 on

daily base. The study tested the cointegration between stock price represented by ISE composite index and overnight interest rates, several definitions of money supply (M1, M2), money in circulation, foreign exchange rate of US dollar, German mark, British Sterling and Japanese Yen. They stated that the result regarding whole research period display no cointegration relationship between stock price and any of the variables or groups of variables of concern.

Paul and Malik (2003) examined the impact of monetary policy on stock returns of Turkey for the period span from Jan 1987- Sep 2000. They tested industrial production index, growth rate of money supply as proxy of monetary policy and consumer price index. The findings stated that a shock to growth rate money supply contain significant information for predicting variance in the future forecast error of stock returns. Inflation and growth in industrial production also play a key role in determination of variance of stock returns.

Kasman (2003) empirically introduced the dynamic linkage between the aggregate stock price indices and exchange rate evidence from Turkey. By applying time series techniques, the sample have been determined accordance the sectors namely: Financial sector index and Production sector index are start from January 2, 1991, Service sector index start from January 4, 1997. Also, national index 100 starts from November 4, 1990. Last day for all indices are November 29, 2002. The findings reveals that there is a long run relationship between stock indices and exchange rate, also the result shows that there is causality linkage from exchange rate to industry sector.

Erdem et al (2005) examined the volatility spillover from inflation, interest rate, exchange rate, money supply and industrial production to Istanbul Stock Exchange's stock prices index. The study analyzed the period span from January 1991 to January 2004. The findings reveal that there is significant unidirectional spillover from macroeconomic variables to stock prices indexes except for services index. Also, the findings show that there is a positive volatility spillover from exchange rate to both ISE 100 and industrial indices.

Kaplan (2008) Investigate the relationship between stock market performance, real economic activity and the dynamic response of real economic activity to the shocks in stock price in the Turkish economy for the period of 1987- 2006 on quarterly base. The study showed the existence of a long-run relationship between real economic activity and the stock prices.

Erbaykal et al (2008) investigated the relationship between stock price (ISE 100 Index) and real macroeconomic variables as; consumption expenditure, industrial production, employment level, fixed investment and consumer price index, covering the period January 1989 to February 2006. The findings reveal that a negative relationship between stock price and inflation as Fama (1981) proxy. Moreover, the other macroeconomic variables have a positive relationship with the stock price. While, industrial production index, employment level and fixed investment are statistically significant.

Kandir (2008) investigated the role of macroeconomic factors in exploring Turkish stock returns for the period of July 1997 to June 2005 on monthly base by applying multiple regression models. The study test seven macroeconomic variables namely: growth rate of industrial production, change in consumer price index, growth rate of M1, growth rate of crude oil price, changes in the exchange rate, interest rate and world market index return all against non-financial firms. The study stated that exchange rate, interest rate and world market return have an effect on all portfolio returns, while inflation rate is significant for three portfolios out of the twelve tested ones. On the other hand, industrial production, money supply and oil price don't have any significant effect on stock returns.

Ozbay (2009) investigated the casual relationship between stock price (Index 30) and macroeconomic factors as; interest rate, inflation, and exchange rate, money supply and real economy covering the period of January 1998 to December 2008 of ISE. The findings reveal that overnight interest rate, consumer price index, current deficit as percentage of GDP and foreign sales do granger-cause stock prices. Moreover, it indicates that stock prices do grangers cause money supply (M1, M2, and M2Y), exchange rate, overnight interest rate, purchase price index negatively and foreign transactions positively determine the stock price in Turkey. While, industrial production

is indicated as neither the result variable nor the cause variable of stock price movements.

Zugul and Sahin (2009) investigated whether there is a relationship between ISE 100 index and macroeconomic variables as; exchange rate, money supply (M1), deposits interest rate and inflation for the period spans from January 2004 to December 2008. The findings revealed that money supply, exchange rate and interest rate have a negative relationship with stock return index. On the other hand, the findings reveal a positive relationship between inflation rate and ISE 100 index for the analyzed period.

Çağli and Halaş (2010) investigate the relationship between stock price index (ISE-100) and a set of macroeconomic variables namely: exchange rate, GDP, industrial production index, inflation rate, money supply (M2), interest rate and oil price. By applying Gregory-Hansen test for the period span from January 1998 to December 2008. The result indicates that there is a long run relationship, between (industrial production index, GDP and oil price) and ISE100 for the tested period with a presence of structured break.

Buyuksalvarci (2010) analyzed the effects of macroeconomic variables on the Turkish stock exchange market in the Arbitrage Pricing Theory framework. He investigate seven macroeconomic variables consumer price index, money market interest rate, gold price, industrial production index, oil price, foreign exchange rate and money supply on the Turkish stock market ISE 100 index for the period spans from January 2003 to March 2010 via applying multiple regression model. The findings revealed that interest rate, industrial production index, oil price, foreign exchange rate have a negative effect on ISE 100 index return while money supply positively influences ISE 100 index return. On the other hand, inflation rate and gold price do not appear to have any significant effect on ISE 100 index.

Ahmet and Abdioglu (2010) empirically examined the linkage between stock price (ISE-100) evidence from Turkey and the set of macroeconomic variables namely: Foreign exchange rate, Gold price, Broad money supply, Industrial production index and Consumer price index. For the period span from March 2001 to June 2010 on monthly

base. By using long run Granger non-causality techniques, the result shows that there is long run causality from (ISE-100) to all macroeconomic variables selected in one direction.

Rjoub (2012) examine the dynamic relationship between exchange rates, US stock price as a world market and Turkish stock price index, for the period span from August 2001 to August 2008. By applying Vector Auteregression (VAR) framework, the finding reveals that there is long run relationship. Also Granger causality test indicate that there are bidirectional relationship between exchange rates and stock price. The impulse responses indicate that the shocks are temporary of Turkish stock price, exchange rates and US stock price.

All the related studies are summarized in the table 4.1 and 4.2.

### 4.4 Conclusion

Several empirical studies that were conducted from different countries have shown the important evidence of these studies that examined the dynamic linkage between a vast range of macroeconomic factors and their influence on stock prices. Whereas, the empirical evidence have been reviewed different markets such as developed and developing markets, emerging markets and specific to Turkey.

Table 4.1 outlined the common factors and the main result of the empirical studies that were conducted on some of different countries, also table 4.2 summarizes the empirical studies that had been conducted in Turkey. Money supply, inflation rate, industrial production and exchange rate are the popular factors used in the empirical studies. Whereas, the studies shows the important evidence of these factors with stock market changes, conclude that there was no consensus relationship between stock market and each factors, that indicate the sensitivity of results due to the difference in the periods, variables selection and methods used to countries.

Review the models that were commonly used to investigate the relationship between real economic activity and stock prices, such as the APT model, VAR framework, Johansen cointegration test, VECM, and Granger causality test. In this study, will be examine the

dynamic linkage between share price index and a set of macroeconomic factors and examine their influence on stock market in Turkey, based on some of the methods that was reviewed in the empirical studies. Next chapter review the macroeconomic factors selection and the validation of analytical framework.

Table 4.1: summary for studies related to developed, developing countries and emerging markets

| Study | Methods | Variables | Results | Countries |
|---|---|---|---|---|
| Rajen, (1997) | Johansen Co-integration test. | (Money supply (M1 and M2), aggregate foreign exchange reserve and exchange rate. | The result shows that share price index is co-integrated with money supply (M1 and M2) and foreign exchange reserves. There is no co-integration was found between share price index and exchange rate, since they don't exhibit short run association relationship. | Singapore |
| Apergis and Eletheriou, (2001) | Unit root test and APT model. | Inflation rate and interest rate. | The empirical evidence shows that share price has more sensitive with inflation rather than interest rate movement, since the stock price has negative relationship with inflation. | Athens (Greece) |
| Ewing, (2002) | Impulse response analysis. | GDP, inflation rate, interest rate and exchange rate. | Unexpected changes in economic growth have a positive initial impact effect but exhibit no persistence. Inflation shock has a negatively and statistically significant initial impact effect which lasts for up to one month after the shock time. | USA |
| Maghayreh, (2003) | Johansen cointegration and Vector Error Correction Model (VECM) techniques | Money supply M1, interest rate, domestic foreign reserve, inflation rate and industrial production index. | The result indicates that there is long run relationship, between stock price index and all macroeconomic factors. | Jordan |

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| Ibrahim and Hassanuddeen, (2003) | Vector autoregressions (VAR) and Vector Error Correction Model (VECM) model. Impulse response analysis. | Industrial production, money supply, consumer price index and exchange rate. | Positive short run and long run relationships between industrial production and consumer price index. The result documents the disappearance of the immediate positive liquidity effects of the money supply shock and understandable interactions between the stock price and the exchange rate over time. | Malaysia |
| Paul and Mallik, (2003) | Johansen Co-integration test. | Inflation, interest rate, and real gross domestic product. | - The study reveals that the bank and finance sector stock prices are co integrated with all three macroeconomic variables. - The interest rate has a negative effect, whereas gross domestic product growth has a positive effect on stock price. Inflation has no significant effect on stock prices, which supports Fama's proxy hypothesis. | Australia |
| Maysami, R, C et al (2004) | Vector autoregressions (VAR) and Vector Error Correction Model (VCEM) model. | Interest rate, industrial production, price levels, exchange rate and money supply. | The findings conclude that the Singapore`s stock market and property index form co integration relationship with changes in the short and long-run for all variables. | Singapore |
| Menike, (2006) | multivariate regression (APT) | money supply M2, exchange rate, inflation rate and nominal interest rate | The findings reveal that the money supply M2 has positive significant relationship with stock price; further inflation rate and exchange rate are negatively | Sri lanka |

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| | | | significant relationship with stock price. | |
| Adrangi and Chatrath, (2007) | Johansen and Juselius co-integration test | inflation rate and seasonally adjusted industrial production index as proxy for real economic activity | The result shows that there is long run association between stock prices, general price level and real economic activity. Further, the findings reveal that there is a negative relation between stock return and unexpected inflation. | Brazil |
| Hassan and Ergun, (2008) | Johansen co-integration techniques | money supply (M1, M2) and interest rate | The result indicates that there is a long run relationship between (KLCI) and monetary policy. Further, there is short run relationship (KLCI) and monetary policy. | Malaysia |
| Coleman and Teety, (2008) | Multivariate regression (APT) | Inflation, real exchange rate, treasury bill lending rate | The findings reveal that Treasury bill rate has positively but statistically weak effect on the performance of stock market while lending rate negatively effect on business in Ghana. Exchange rate has a positive relationship and inflation shows a negative relationship with the stock market performance. | Ghana |
| Rahman & Uddin, (2009) | Johansen co-integration test. | Exchange rate | The findings reveal that there is no co-integration relationship between price indices and exchange rate | South Asia: Bangladesh, India and Pakistan |
| Rahman et al, (2009) | Vector autoregession (VAR) model. | industrial production, money supply, real exchange rate, month end reserve | The result shows that changes in Malaysian stock market index to perform a co integrating relationship with changes in money supply, interest rate, exchange rate, | Malaysia |

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| | | and treasury bill 3 month rate | reserve and industrial production index. Also, all six variables test shows significant contribution to the co integrating relationship and stock market has strong dynamic interaction with reserve and industrial production index comparing with the rest of the variables. | |
| Pilinkus, (2009) | Granger Causality techniques. | 40 macroeconomic factors. | The result has been shows that there is statistical causality between OMX price index and macroeconomic factors namely: consumer goods and money supply (M1 and M2). | Lithuania |
| Raymond, (2009) | Vector Error Correction Model (VECM), Johansen co-integration and impulse response procedure | money supply (M2, M3), interest rate, exchange rate and inflation rate | -The findings reveal that the long run relationship between macroeconomic factors and JSE index, also indicate that its positively influenced among JSE index and inflation rate, money supply (M3) and negatively by exchange rate interest rate and money supply (M2).<br>-Indicate that it's positively - Influenced among JSE index and inflation rate, money supply (M3) and negatively by exchange rate interest rate and money supply (M2). Further, the result shows that short run relationship, between JSE index and macroeconomic factors are interest rate and money supply (M2, M3).<br>-The shocks for all factors affected on stock price. | Jamaica |
| Humpe and Macmillan, (2009) | Johansen cointegration test | money supply, long term interest rate, inflation rate and industrial | - Positively influence between (US) stock price and industrial production index and negatively by inflation rate and long term interest | US and Japan |

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| | | production index | rate.<br>- There is no significant influence between (US) stock price and money supply.<br>- The result shows that there is positively relation between Japanese stock price and industrial production index, but negatively by money supply. | |
| Trivedi and Behera, (2012) | Vector Autoregressive (VAR) model. | Index of industrial production, wholesale price index, interest. rate (3 month T-bill rate), money supply (M3), foreign institutional investment and Morgan Stanley capital international | The findings reveal that there is a long run relationship, between stock price (BSE-Sensex) and. macroeconomic factors. Further, the impulse response shows that positively association with IIP, increase in money supply (M3), increase in FIIs and rise in MSCI world index. | India |
| Issahaku and Ustarz, (2013) | Vector Error Correction Model (VECM) | exchange rate, money supply, inflation rate and foreign direct investment | The findings reveal that there is long run relationship between stock price and a set of macroeconomic variables are inflation rare, money supply and foreign direct investment. Further, there is short run association between stock price and macroeconomic variables are interest rate, inflation rate and money supply. | Ghana |

Table 4.2: Summary for empirical evidence in Turkey

| Study | Methods | Variables | Results | Country |
|---|---|---|---|---|
| Muradoglu et al, (2001) | Vector autoregressions (VAR) model Johansen co-integration. | Interest rates, money supply (M1, M2, money in circulation), foreign exchange rate. | They stated that the result regarding whole research period display no co integration relationship between stock price and any of the variables or groups of variables of concern. | Turkey |
| Sari and Malik, (2003) | Impulse response analysis. | industrial production index, growth rate of money supply as proxy of monetary policy and consumer price index | The findings stated that a shock to growth rate money supply. Inflation and growth in industrial production also play a key role in determination of variance of stock returns. | Turkey |
| Kasman, (2003) | Johansen co-integration and casualty test. | Exchange rate | The findings reveals that there is a long run relationship between stock price indices and exchange rate, also the result shows that there is causality linkage from exchange rate to industry sector. | Turkey |
| Erdem et al, (2005) | Casualty test | Inflation, interest rate, exchange rate, money supply and industrial production. | The findings reveal that there is significant unidirectional spillover from macroeconomic variables to stock prices indexes except for services index. Also, the findings show that there is a positive volatility spillover from exchange rate to both | Turkey |

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| | | | ISE 100 and industrial indices. | |
| Kaplan, M (2008) | Vector Error Correction Model (VCEM) and Impulse response analysis | real economic activity | The study showed the existence of a long-run relationship between real economic activity and the stock prices. | Turkey |
| Erbaykal et al, (2008) | Multivariate regression (APT) | consumption expenditure, industrial production, employment level, fixed investment and consumer price index | The findings reveal that a negative relationship between stock price (ISE-100 index) and inflation as Fama (1981) proxy. Moreover, the other macroeconomic variables have a positive relationship with the stock price. | Turkey |
| Kandir, (2008) | Multivariate regression (APT) | change in consumer price index, growth rate of M1, growth rate of crude oil price, changes in the exchange rate, interest rate | The study stated that exchange rate, interest rate and world market return have an effect on all portfolio returns, while inflation rate is significant for three portfolios out of the twelve tested ones. On the other hand, industrial production, money supply and oil price don't have any significant effect on stock returns. | Turkey |
| Ozbay, (2009) | Casualty test | interest rate, inflation, exchange rate, money supply and real economy | Indicates that stock prices (Index 30) do grangers cause money supply (M1, M2, and M2Y), exchange rate, overnight interest rate, purchase price index negatively and foreign transactions positively determine the stock price. While, | Turkey |

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| | | | industrial production is indicated as neither the result variable nor the cause variable of stock price movements. | |
| Zugul and Sahin, (2009) | Multivariate regression (APT) | Exchange rate, money supply M1, deposit interest rate and inflation rate. | The findings revealed that money supply, exchange rate and interest rate have a negative relationship with stock return index. On the other hand, the findings reveal a positive relationship between inflation rate and ISE 100 index for the analyzed period. | Turkey |
| Çağli and Halaş, (2010) | Gregory-Hansen test | exchange rate, GDP, industrial production index, inflation rate, money supply (M2), interest rate and oil price | The result indicates that there is a long run relationship, between (industrial production index, GDP and oil price) and ISE100 for the tested period with a presence of structured break. | Turkey |
| Buyuksalvarci, (2010) | multivariate regression (APT) | consumer price index, money market interest rate, gold price, industrial production index, oil price, foreign exchange rate and money supply | The findings revealed that interest rate, industrial production index, oil price, foreign exchange rate have a negative effect on ISE 100 index return while money supply positively influences ISE 100 index return. | Turkey |
| Ahmet and Abdioglu, (2010) | Long run Granger non-causality techniques. | Foreign exchange rate, Gold price, Broad money supply, Industrial production | The result shows that there is long run causality from stock price (ISE-100) to all macroeconomic variables selected in one direction. | Turkey |

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|---|---|---|---|---|
| | | index and Consumer price index. | | |
| Rjoub, (2012) | Vector Auteregression (VAR) framework | exchange rates and US stock price as a world market | - the finding reveals that there is long run relationship<br>- Granger causality test indicate that there are bidirectional relationship between exchange rates and stock price<br>- The impulse responses indicate that the shocks are temporary of Turkish stock price, exchange rates and US stock price. | Turkey |

# CHAPTER FIVE

## 5. Variables and Econometric Methodology

### 5.1 Introduction

The aim of this chapter is to discuss the variables and econometric methodology that used to investigate the effect of macroeconomic variables on stock prices.

As we mentioned before, investigate precise events or economic factors that may effect on the asset prices that attributed to the EMH and APT. That allowed investigating a wide range of pertinent events at the economics level, whether macroeconomic or microeconomic of a stock market. Further, the present value model (PVM) or discounted cash flows (DCFs) of the expected return that have supported for the selected factors in most of relevant empirical studies. The previous chapter highlighted the importance of analyzing the effects of macroeconomic factors on stock prices in developed, developing countries and emerging market. This chapter discusses the methodology used in conducting this research; through investigate four macroeconomic factors namely: index of industrial production (IIP), Short-term interest rate (SINT), money supply (M2) and exchange rate (EXC) that may have a significant influence on the general share price index of the Turkish stock market. For the period span from January 2002 to December 2013, the picking of these factors upon literature that was previously discussed in the chapter 4.

### 5.2 Variable Selection and Validation

#### 5.2.1 General Turkish Share Prices Index

TSPI is the general price index for the Turkish Stock market, it consider the major Economic Indicator share indices are targeted all-share or price indices. A stock market's valuation reflects investors' confidence in it. Despite primarily designed as measurements of market performance for use by individual investors and investment fund managers, share price indices are also used as indicators of economic activity by business and government analysts. Through use the closing daily values for the monthly data, normally expressed as simple arithmetic averages of the daily data. What each share price index measures is determined by its construction; which measures the

changes in the market capitalization of the basket of shares calculated in the index. Also, the Index includes the dividend payments (assumes they are reinvested in the same stocks). A price index measures how the value of the stocks in the index is changing and inform the investors what the stock price is, i.e. how much money investors would gain as a result of investing in that basket of shares. Therefore, the TSPI reflects the performance of all listed companies, 401 companies, in the Turkish stock market. Hence, in this study we will examine the effect of the macroeconomic variables previously mentioned on the price index. Many empirical studies have been reviewed in the previous chapter, which indicate the dynamic relationships between price indices and the macroeconomic factors. For example, Çağli and Halaş (2010) indicate that there is a long run relationship between industrial production index, GDP and oil price and (ISE-100) index for the tested period. While Rajen (1997) reveals that there is no cointegration was found between Singapore share price index and exchange rate, since they don't exhibit short run association relationship. Thus, TSPI expected to provide better insight into the overall performance of the Turkish stock market in response to fundamental changes within the Turkish economy.

### 5.2.2 Index of Industrial Production (IIP)

The industrial production index is typically used as a proxy for the level of real economic activity through Measure of change in the volume of industrial production. The purpose of indicator (Monthly Production Index) is to measure and follow-up the short term developments and changes in industrial production; is a volume index and production is measured by physical output and measures change in physical output generated by industrial enterprises sector. The main source of information for the index is the monthly production survey, which covers approximately 80 percent of the value of industrial production and covers all the territory of Turkey without geographical breakdown.

Theoretically, it is expected that there is a positive relationship between the product market and the stock market. This positive relationship is attributed to higher revenue that firms generate during growth and therefore more return on the stock market. Studies like; Chen et al (1986), Choi et al (1992), Aretz et al (2010) among others, analyzed the

developed market and state a positive relationship between industrial production and stock market. Studies that investigate the effect of industrial production on Turkish stock market like; Tursoy et al (2008), Kandir (2008), Buyuksalvarci (2010) and others advocated a positive relationship. In light of this discussion, the researcher hypothesis a positive relationship between industrial production and stock price.

### 5.2.3 Short-term interest rate (SINT)

Based on rational expectations of economic theory assumes that the stock prices are determined upon the expected of future earnings. The direct influence on stock prices from the monetary policy it's come from the discount rate, but the indirect influences that affect on the uncertainty or the risk exposure that may be its effect in the market (Bjornland Hilde and Leitemo, 2009). In this case, if there is shock with negative interest rate, through increase in the real interest rate that would increase both of the expected the risk and required rate of return of the investment. Thereby, increase the cost of capital for the firms and it's causing decrease of its profits; it might consider as result to decrease the value of stock prices.

Bernanke (2003) explain the lower stock prices from the expectation of higher Short-term interest rate with the two respects. Firstly, an increase in the real interest rate would increase the required return on stocks and constrict the willing of investors to pay for these stocks; which would make other investments more attractive for investors, such as bonds. Secondly, the value of share or stock will be decline, as a result of estimation for the value of future dividends, through discount the dividends back to the present value. Thereby, the future dividend would be less valuable in today's dollars with higher interest rate.

This study uses the Short-term interest rate as proxy for Turkish economy to investigate the relationship among a Short-term interest rate and stock prices in Turkish economy. At the beginning of 2002 it was using two nominal anchors are inflation target and monetary target, that announced by CBRT, this mechanism in effect of full-fledged inflation target framework for monetary policy implementation until 2006. The Short-term interest rate has been become the major policy tools of the monetary policy to avoid the inflation (Civcir, 2009).

### 5.2.4 Money Supply (M2)

Theoretically the relationship between money supply and stock market can be positive or negative. It has been investigated that the impact of money supply on stock prices and has been widely discussed in the economic studies. Despite, that found a strong relationship between stock market prices and money supply. However, it is still controversial, the money supply may effect on stock prices that through its impact the present value of cash flows by its effect on discount rate.

Fridman and Schwartz (1963) through the modern quantity theory of money suggest that there is directly proportional relationship between money supply and the price level. Thereby, that indicates any exogenous shock, that increase the money supply changes the equilibrium situation of money with respect to other assets that included in the portfolio. Thus, lead to adjust the proportion of asset holders in the portfolio taking the form of money balance. As a result, this adjustment changes the demand for other assets that compete with money balances such as equity shares. Therefore, an increase in money supply would increase an excess supply of money balances which leads to an excess demand for shares. Hence, share prices are expected to rise.

Moreover, Bernank and Kuttner (2005) has been clarifies that the price of stock is a function of its monetary value and the expected risk associated with holding the stock. As a result, a stock is considered to be attractive if its monetary value is high or the expected risk of the stock is low. Therefore, the money supply would increase the real interest rate, in this case the increase in the discount rates due to the increase the real interest rate which lead to decrease the value of stock. Another explanation advocates of the relationship between share prices and the changes in the money supply, if the increase in money supply lead up to inflation as well as contributes to inflation uncertainty. Thus, it may have a negative influence on the stock prices. As we mentioned previously, reviewed different empirical studies that has been conducted in Turkey stock market in a vary time spans, such as empirical study that indicate there is a negative relationship between money supply and (ISE-100) index[4]. While the

[4] (Zugul and Sahin, 2009).

Buyuksalvarci (2010) that indicate the money supply have positivity influence on (ISE-100) index.

Containment of the money supply in the study might contribute to the existing empirical literature in regards to the relationship between changes in the money supply and share prices in an emerging stock market such as the Turkish stock market. Therefore, we will use proxy M2 for the money supply in the Turkish economy. The component of monetary aggregate (M2) which is include M1 its components (currency in circulation + demand deposits "current and foreign currency") plus time deposits (commercial, saving and other deposits) with deposits money banks and certificates of deposits (CDs). Examining this proxy is expected to give a comprehensive view of the role that the monetary aggregate M2 plays in explaining movements in the Turkish stock market.

### 5.2.5 Exchange Rate (EXC)

There are different theoretical approaches to examine the relationship between the exchange rate and stock prices; exchange rate is the price of one currency in term of other currency. Investigate the exchange rates and stock prices linkage has received a considerable attention of researchers and policy makers in the last 20 years. This growing attention appears after following the generalized floating of the major currencies in the early 1973. The importance of exchange rates in influencing domestic prices, including stock prices, has been brightened. The research of this area has mainly focused on the causality determination between stock prices and exchange rates in developed countries and developing countries such as that study indicate that there are bidirectional relationship between exchange rates and ISE price index, Rjoub, (2012). There are some theoretical backgrounds of the dynamic relationship between stock price and exchange rate in the literature. The classical economic theory suggests two approaches about the relationship between the stock prices and exchange rates; these are the traditional approach and portfolio approach. The traditional approach (flow, micro)[5]; focus on the current account movements affect international competitiveness and the trade balance position, thereby, influencing real income and output of the country, which in turn affects current and future cash flows of companies and stock prices. This theory

[5] (Dornbusch and Fisher, 1980).

claims that the depreciation of the domestic currency makes local firms more competitive, leading to an increase in their export and consequently higher stock price.

The portfolio oriented approach (Stock, macro), of exchange rates, view exchange rate as equity the supply and demand for assets such as bonds and stocks. According to portfolio approach, exchange rates are determined by the market mechanism just like all the other commodities. Portfolio approach implies that stock prices leads to exchange rates and they are negatively related. There are different literatures that examined the relationship among exchange rate and stock market that has been conducted in developed, developing and emerging markets which are; Coleman and Teety (2008) found a positive relationship between exchange rate and Ghana stock market. While Bukuksalvarci (2010) reveals a negative relationship between exchange rate and (ISE-100). Containment of the exchange rate in this study might contribute a better understanding of how exchange rate affect on stock prices within open economy such as the Turkish economy.

Table 5.1: Sources and Definition of the Variables

| Variables Symbol | Definition | Source |
|---|---|---|
| Turkish Share Price Index (TSPI) | (TSPI)All share price index, the general share price index of the Turkish stock market and expressed as follow: $\Delta TSPI_t = TSPI_t - TSPI_{t-1}$ | www.stats.oecd.org IFS, Code 62…ZF |
| Index of Industrial Production (IIP) | The industrial production index , this variable serves as a proxy for the level of real economic activity through Measure of change in the volume of industrial production | IFS, Code 66..ZF |
| Short-run interest rate (SINT) | Tree-month Turkish interbank offered rate, which is the rate of interest at which bank offer to the lend money to one another in the Turkish money market and expressed as follow: $\Delta SINT_t = SINT_t - SINT_{t-1}$ | IFS, Code 60..FZF |

| | | |
|---|---|---|
| Money Supply (M2) | Money supply (M2) this variable serves as a proxy in the Turkish economy, expressed as follow:<br>M1=Currency in circulation + Demand deposits (TRY, FX).<br>M2= M1 + Time deposits (TRY, FX).<br>$\Delta Mi_t = Mi_t - Mi_{t-1}$, where i=1, 2 | IFS,Code 59MBCZFF |
| Exchange Rate (EXC) | Real effective exchange rate of the Turkish Lira is the weighted average of the real exchange rate of the home currency (Turkish Lira). This variable is reflect the change in exchange rate for Turkish currency, is expressed as follow:<br>$\Delta EXC_t = \Delta REER_t - \Delta REER_{t-1}$ | IFS, Code 456NECZF |

Note: All series are monthly data transform to natural logarithms except for (EXC).

### 5.3 Econometric Methodology

Econometric methods that we will present in this dissertation, the first section provides a brief overview of the empirical methods of unit root tests are applied to investigate whether the data series of interest are stationary or not at level and VAR models such as the Johansen, (1988) test, Vector Error Correction Model (VECM), causality tests, variance decompositions and impulse response functions.

#### 5.3.1 Unit Root Test

First of all, preliminary examination of the nature of the data series should be analyzed. As a first step, the unit root tests are applied to investigate whether the data series of interest are stationary or not at level. For this purpose the study applies three types of unit root tests to generalize an idea about the nature of the series. The study follows the literature in testing the unit root by employing the Augmented Dickey Fuller ADF test in the general form:

$$\Delta Y_t = \alpha_\circ + \alpha_1 T + \gamma Y_{t-1} + \sum_{n=1}^{p} \beta_i \, \Delta Y_{t-i} + \varepsilon_t$$

Where, Y is represented the variables, Δ and T are the difference and the time trend respectively. P is represented the lagged value, $\varepsilon_t$ is represented the white noise residual. The study implements the Augmented Dicky Fuller ADF and Philip Perron PP tests with and without the trend, for the PP unit root test we expressed as follow:

$$\Delta Y_t = \alpha_\circ + \alpha_1 t + \gamma Y_{t-1} + \varepsilon_t$$

The variables and parameters are the same as the ADF unit root test in which they are defined. Null hypothesis of unit root tests of ADF and PP that mean the series has a unit root when $\gamma = 0$, that against the alternative hypothesis of stationary, which implies the time series is non-stationary.

Moreover, the traditional unit root hypothesis has been investigated that the effects from the current shocks just have a temporary effect. Therefore, the long-run movement in the series is unchanged by such shocks. Nelson and Plosser (1982) argue the implication under the unit root hypothesis is that permanent effects on the long-run of macroeconomic series form the random shocks, which is that the fluctuation it does not transitory. The most macroeconomic series are not distinguish by a unit root, but that the continuous from the infrequent and the large shocks. Thus, after the small and frequent shocks the economy come back to deterministic trend[6]. Hence, Zivot-Andrews (1992), unit root test with structural break that verifying the each possible break data by using different dummy variables; we expressed the formula as follow:

$$X_t = \alpha_0 + \alpha_1 DU_t + d(DTB)_t + \gamma DT_t + Bt + \rho X_{t-1} + \sum_{i=1}^{p} \varphi_i \Delta X_{t-1} + \varepsilon_t$$

Where, dummy $DU_t$ represent a change in the level $DU_t$ =1 if (t>TB) and zero otherwise, the slope dummy $DT_t$ is represented the change in the slope of the trend function, dummy $DTB$=1 if t=TB+1 and zero otherwise, and TB is represented the break data. This formula expressed the time series that has both intercept and trend.

[6] (Perron, 1989)

### 5.3.2 Analysis Using VAR Model

#### 5.3.2.1 Johansen Cointegration Test and (VECM) Model

Many details of the economic time series, such as consumption and income, stock prices and dividends, shares theoretical long-run relationships. It is also generally accepted that this time-series data to develop over time, so that its mean value and variance are not constant (Nelson and Plosser, 1982). Based on this data may lead from non-stationary time series macroeconomists incorrectly conclude that two variables are related if they are not in reality; the Johansen cointegration test is a statistical method for testing cointegration. The Johansen cointegration approach is based on a VAR model of order to examine long-run relationships that can exist between the variables.

After checking the nature of the data series and before preceding the cointegration test, essential question to be answered when making up with Vector Auto Regressive estimation is the determining the optimal lag length. This question usually answered through checking different criterion as likelihood ratio (LR), Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan Quinn Information Criterion (HQ).

$$\gamma_t = A_1\gamma_{t-1} + A_2\gamma_{t-1} + \cdots + A_\rho\gamma_{t-\rho} + \varepsilon_t$$

Where *Ai*`s are (NxN) coefficient matrices and $\varepsilon_t$ is an unobservable i.i.d. zero mean independent white noise process.

After determining the optimal lag length in the VAR system, the researchers' precede the Johansen cointegration test. In determining the number of cointegrating vectors, researchers used degrees of freedom adjusted version of the maximum eigenvalue and trace statistics. The optimal lag length determined based on the following VAR model:

The trace statistics for the null hypothesis of $r$ cointegarting relation against the alternative of *n* cointegrating relations is computed as follow (Johansen, 1988):

$$\lambda_{trace} = -T\sum_{i=r+1}^{n} log\,(1-\hat{\lambda}i) \qquad r = 0,1,2,\ldots,n-1$$

Where $T$ is the number of observations and $\lambda$ is the (i-th) largest eigenvalue.

The maximum eigenvalue statistics tests the null hypothesis of $r$ cointegrating relations against the alternative of $r + 1$ cointegrating relations. The test statistics is determined using the following formula (Johansen, 1988):

$$\lambda_{max} = -Tlog(1 - \hat{\lambda}r + 1) \qquad r = 0,1,2,\dots,n-2,n-1$$

With the presence of cointegration relations, the VAR form is not the most convenient model setup. In that case it is useful to consider specific parameterizations which support the analysis of the cointegration structure (Lütkephl, 2005). The resulting from subtracting $\gamma_{t-1}$ from both sides and rearranging terms a model is known as Vector Error Correction Model VECM in the following form:

$$\Delta_{\gamma t} = \Pi_{\gamma t-1} + \Gamma\Delta_{\gamma t-1} + \cdots + \Gamma_{p-1}\Delta_{t-p+1} + u_t$$

Where $\Pi = -(I_K - A\dots.-A_P)$, and $\Gamma_i = -(A_{t+1}+\dots + A_P)$ for I = 1… P-1.

When the variables are non-stationary and are cointegrated, the adequate method to examine the issue of short run relationship is the VECM, which is equivalent to the VAR in the first differences with the addition of a vector cointegrating residuals.

#### 5.3.2.2 Causality Test

The causality test examines the predictive power between the variables whether including lag of one variable. That mean X causes Y, if Y could be better predicting via including the previous values of X in the model rather than using Y's. However, does not mean that any change in specific variable would cause changes in another variable, that investigate whether the predictability exist between the variables of interest. The causality test upon a VAR model in differences is appropriate, when there is no long-run relationship between variables that are integrated of the same order, i.e, X and Y~I (Enders, 2004). On the other hand, we can express the Granger causality in a more common VAR model that when we have more than two variables, we can implement as follow:

$$\Delta Z_t = \mu + \gamma_1\Delta Z_{t-1} + \cdots + \gamma_p\Delta Z_{t-p} + \varepsilon_t$$

Where, $\Delta Z_t$ the first difference for all the variables those are included in the model, $\gamma_p$ is represented the coefficient corresponding to the variables that included in the model up to lag p and $\varepsilon_t$ is represented the white noise error term for matrix. Furthermore, as we can implement the Granger test begins with the assessment of a VAR framework in differences:

$$\Delta X_t = \alpha_i + \sum_{i=1}^{p} \beta_i \, \Delta X_{t-i} + \sum_{j=1}^{p} \delta_j \, \Delta Y_{t-j} + \varepsilon_{1t}$$

$$\Delta Y_t = \gamma_i + \sum_{i=1}^{p} \vartheta_i \, \Delta X_{t-i} + \sum_{j=1}^{p} \mathrm{C}_j \, \Delta Y_{t-j} + \varepsilon_{2t}$$

Where, $\Delta X_t$ and $\Delta Y_t$ are represent the first difference of the time series, $\alpha_i$ and $\gamma_i$ are represent constant term, and $\varepsilon_{1t}$ and $\varepsilon_{2t}$ are the white noise error terms. Moreover, t and p are denoting the period span and the lag used in the model, respectively. When the variables are cointegration in long run, using a VECM rather than a VAR in differences will not result in any loss in long run information, has two channels of causation. The first channel is through the lagged exogenous variables' coefficients. The second channel of causation is captures adjustment of the system towards its long run equilibrium (Enders, 2004).

#### 5.3.2.3 Variance Decompositions and Impulse Response Functions

The Variance decomposition to tell how much of a change in a variable is due to its own shock and how much due to shocks to other variables, the Impulse response functions IRF to trace out the time path of the effect of structural shocks on the dependent variables of the model. It allows examining the behavior of current and future variables, as follows: the impact on the other variables in the system. IRF is a useful tool for determining the magnitude of time that has been affected by the impact of the variables on another variable in the system and direction. Thus, it allows track the impact of the various shocks on the variables contained in the VAR system. In the case of a model with two variables, can be written as shown:

$$\begin{bmatrix} Y_t \\ Z_t \end{bmatrix} = \begin{bmatrix} \bar{y} \\ \hat{Z} \end{bmatrix} + \sum_{i=0}^{\infty} \frac{A^i}{1 - b_{12} b_{21}} \begin{bmatrix} 1 & -b_{12} \\ -b_{21} & 1 \end{bmatrix} \begin{bmatrix} \varepsilon y_{t-i} \\ \varepsilon z_{t-i} \end{bmatrix}$$

$$\begin{bmatrix} Y_t \\ Z_t \end{bmatrix} = \begin{bmatrix} \bar{y} \\ \hat{Z} \end{bmatrix} + \sum_{i=0}^{\infty} \begin{bmatrix} \emptyset_{11}^{i} & \emptyset_{12}^{i} \\ \emptyset_{21}^{i} & \emptyset_{22}^{i} \end{bmatrix} \begin{bmatrix} \varepsilon y_{t-i} \\ \varepsilon z_{t-i} \end{bmatrix}, and$$

$$X_t = \mu + \sum_{i=0}^{\infty} \emptyset_i \ \varepsilon_{t-1}$$

Where $\theta i$ is IRF disorders; thus, the IRF is found by reading the coefficients in the representation of the moving average process. If the innovations $\varepsilon_{t-i}$ are both contemporaneously uncorrelated, the interpretation of the impulse response is direct. For example, the innovation $\varepsilon_i$ is simply a shock to the endogenous variable in the system.

The variance decompositions and impulse responses are resulting from the primary estimates of the VAR model can be affected likely that any adjustment to the order in which the variables are go into in the system can produce different results. Therefore, there is a need to enforce some constraints when estimating the VAR model to determine the IRFs. In this concern, a common approach is the variance decomposition. Decomposition cope the problem of simultaneous relationships between the innovations error terms inside the estimated VAR model by determining the structural shocks likely that the covariance matrix of the estimated residuals is lower triangular. More strictly, this means that the decomposition features all the effect to the variable that derives first to the objective variables in the VAR system.

## 5.4 Conclusion

This chapter shows the econometric methods that were used in the study. Empirical techniques investigated the long-run and the short-run relationship, and the interaction between a set of macroeconomic variables and the Turkish stock price index. The chapter presented a brief background on the empirical methods of VAR model. Such as, the Johansen cointigration test, causality test, impulse response and the variance decomposition.

# CHAPTER SIX

## 6. Empirical Results and Discussion

### 6.1 Introduction

This chapter shows the results of the econometrics analysis applied in analyzing the data. Firstly, it reviewed the nature of time series data through unit root test and the long-run relationship after determined the optimal lag length that implies white noise residuals, and then applied the Johansen cointegration test. Secondly, investigate the short-run relationship by applying causality test and investigate the impulse response and the variance decomposition.

### 6.2 Long-Run Analysis

As previously mentioned, by using the Johansen cointegration test is to conduct the long-run analysis. Typically, there is three steps are accompaniment within applying Johansen cointegration test. Firstly, investigate whether all the selected variables are integrated of the same order within the model, and that through applying unit root tests. Secondly, verifying whether that the estimated residuals it doesn't have serial autocorrelation, accordingly which can be used by determine the optimal lag length to the VAR model. Thirdly, applying the VAR system to estimate the cointegration between the variables with a view to determine the order of cointegration, that according for the trace and max eigenvalue statistics, (Enders, 2004).

#### 6.2.1 Unit Root Test Results

The results of the ADF and P&P tests that to investigate the nature of time series are reported in table 6.1 and 6.2. It has been argued that almost macroeconomic time series used have a unit root[7]. The absence of the unit root that help to determine a certain characteristics of the underlying data sequence generating process. In case there is no unit root (stationary), so the series fluctuates around a constant long-run average that mean the series has a finite variance and it doesn't based on time. Further, series are non-stationary that implies they have no desire to return to long-run peremptory path and

[7] (Nelson and Plosser, 1982).

variance, contrast depend on the time. Suffering the series that non-stationary a series of random shocks, and therefore lasting effects follow a random walk.

Table 6.1: Unit Root Test at the Level

| Variables | lag | ADF | | P&P | |
|---|---|---|---|---|---|
| | | A | B | A | B |
| LTSPI | 4 | -1.673168 | -2.397132 | -1.172152 | -1.978977 |
| LIIP | 2 | -1.055161 | -.272689 | -1.768969 | -5.103479* |
| LSINT | 1 | -0.858423 | -2.345133 | -0.833629 | -2.404171 |
| LM2 | 1 | -2.080251 | -.0898024 | -2.153017 | -1.018928 |
| EXC | 1 | -0.867835 | -1.849345 | -0.939813 | -1.807191 |

*, **, and *** significant level at 1%, 5%, and 10% respectively, based on the test critical values. (A & B) with; intercept and intercept and trend respectively.

Table 6.2: Unit Root Test at the First Difference

| Variables | lag | ADF | | P&P | |
|---|---|---|---|---|---|
| | | A | B | A | B |
| ΔLTSPI | 4 | -4.697026* | -4.786364* | -9.940043* | -9.930279* |
| ΔLIIP | 2 | -6.399013* | -6.356584* | -26.91952* | -26.88268* |
| ΔLSINT | 1 | -8.609779* | -8.577739* | -12.29244* | -12.29244* |
| ΔLM2 | 1 | -8.357698* | -8.641015* | -12.67153* | -12.93304* |
| ΔEXC | 1 | -9.241379* | -9.294908* | -11.38650* | -11.43283* |

*, **, and *** significant level at 1%, 5%, and 10% respectively, based on the test critical values. (A & B) with; intercept and intercept and trend respectively.

If the time series are non-stationary series where the first differences of the series are stationary that implies the series contain a unit root. To test for the presence of unit root test of the most commonly used methods are the Augmented Dickey Fuller ADF tests, (1979) and Phillips and Perron (1988). As mentioned before, we can apply the ADF model to determine whether the time series are affected by temporary or permanent shocks, which is concerned to estimate the optimal lag to ensure that the residuals $\varepsilon_t$ are white noise; that means the residual is uncorrelated with $\varepsilon_s$ for $t \neq s$, which implies has constant variance and zero mean. The finding reveals as shown in table 6.1 the time series are non-stationary at the level by using ADF tests are confirmed by the results of P&P unit root test, according to couldn't reject the null hypothesis, that the time series

have a unit root at significant level at 1%, 5% and 10% based on the critical values with intercept and intercept and trend respectively. Furthermore, the result shows that the time series are stationary at the first difference, reject the null hypothesis the time series have a unit root at significant level at 1%, 5% and 10% upon the critical values with intercept and intercept and trend respectively, that implies the time series has a finite variance and it doesn't depend on time in the first difference (as shown in table 6.2).

Zivot-Andrews (1992) unit root test, investigate that whether the time series are stationary with structural break or it has a unit root with structural break and determined the structural break point. The most macroeconomic series are not distinguish by a unit root, but that the continuous from the infrequent and the large shocks. Therefore, after the small and frequent shocks the economy come back to deterministic trend (Perron, 1989).

Table 6.3: Zivot-Andrews (1992) Unit Root Test

| Variables | Lag | Structural Break with Intercept & Trend | Structure Break Point |
|---|---|---|---|
| LIIP | 2 | -4.490991* | 2008 M08 |
| LSINT | 1 | -3.411936** | 2006 M12 |
| LM2 | 1 | -15.79965* | 2005 M12 |
| EXC | 1 | -4.561260** | 2008 M10 |

*, **, and *** significant level at 1%, 5%, and 10% respectively rejecting the null hypothesis, has a unit root with a structural break in both the intercept and trend.

The conclusion from the Zivot-Andrews by using the formula that examined before; with intercept and trend. Table 6.3 investigate the nature of the time series and determined the structural break point of each variables. The finding reveals for the tested variables that reject the null hypothesis there is unit root with structural break in both intercept and trend, according to the t-statistics and the critical values at significant level at 1%, 5% and 10%. So the results shown that the time series are stationary with structural break. Hence, could be adding the dummy variables for each factor into the VAR model according to the structure break point. According to the results shown in the table 6.3 both of LIIP and EXC are stationary with structural break. Which mean they may have been affected within the world crises that happened in 2008. On the other

hand, both of the LSINT and LM2 are stationary with structural break due to in the changes in the monetary policy for the time period spans are selected in our study. At the beginning of 2002, it used two nominal anchors which they are inflation target and monetary target, that announced by CBRT, this mechanism in effect of full-fledged inflation target framework for monetary policy implementation until 2006. The Short-term interest rate has been become the major policy tools of the monetary policy to avoid the inflation, (Civcir, 2009).

### 6.2.2 Optimal Lag Length Selections

To determine the optimal lag length for the VAR model that the existence of a long-run relationship between the variables, which is determine the optimal lag length that the variables does not have serial autocorrelation which is "white noise" residuals. There is five criteria are widely used as shown in the table 6.4, such as modified likehood ratio (LR) test statistic, the final prediction error criteria (FPE), the Akaike information criterion (AIC), the Schwarz information criterion (SIC) and the Hannan-Quinn information criterion (HQ) have been used to determine the optimal lag length into the VAR system.

Table 6.4: Optimal Lag length of the VAR Model

| Lag | Log-Likelihood | LR | FPE | AIC | SIC | HQ |
|---|---|---|---|---|---|---|
| 0 | 981.8974 | NA | 4.26e-09 | -5.08441 | -4.538421 | -4.862542 |
| 1 | 1037.97 | 103.5847 | 1.79e-13 | -15.16452 | -14.07255* | -14.72079 |
| 2 | 1057.755 | 35.03968 | 1.32e-13* | -15.47529 | -13.83733 | -14.80970* |
| 3 | 1076.654 | 32.02676 | 1.39e-13 | -15.4292 | -13.24526 | -14.54174 |
| 4 | 1090.782 | 22.86293 | 1.44e-13 | -15.40386 | -12.67393 | -14.29454 |
| 5 | 1118.779 | 43.17206* | 1.73e-13 | -15.23702 | -11.96111 | -13.90584 |
| 6 | 1139.062 | 29.72771 | 1.37e-13 | -15.49768* | -11.67579 | -13.94464 |
| 7 | 1161.263 | 30.84313 | 1.76e-13 | -15.27865 | -10.91077 | -13.50374 |
| 8 | 1180.89 | 25.77008 | 1.84e-13 | -15.27506 | -10.3612 | -13.27829 |
| 9 | 1194.82 | 17.22686 | 2.06e-13 | -15.21855 | -9.758696 | -12.99991 |
| 10 | 1208.633 | 16.02678 | 2.56e-13 | -15.07449 | -9.068653 | -12.63399 |
| 11 | 1237.604 | 31.40346 | 2.75e-13 | -15.09276 | -8.540942 | -12.4304 |
| 12 | 1255.533 | 18.06641 | 2.15e-13 | -15.44865 | -8.350838 | -12.56442 |

*Indicates optimal lag order selection by the criterion

Table 6.4 reports the results with a maximum of 12 lags. We determined in our analysis using five lags that are proposed by the (LR) test that will be applied into VAR system. After determine the maximum lag depend on (AIC) criteria is six lags $AIC_{max}= 2K - 2\ln(L)$ where (K) is the number of parameter and (L) is the maximized value of the likelihood function and the minimum lag by (SIC) criteria is two lags $SIC_{min}= Tln|\sum.| + n\ln(T)$ where T represented the number of observations, $(\sum.)$ is sum of squared residual and (n) is the number of parameters. Therefore, at the lag five according with (LR) criteria that indicates the absence of the serial autocorrelation. That implies "white noise" residuals are estimated from the VAR system up to lag = 12.

### 6.2.3 Johansen Cointegration Results

A principal feature of cointegrated variable is that their paths are influenced by the extent of any deviation from long-run equilibrium. Therefore, if the system is to return to long-run equilibrium; hence there is at least some of the variables must respond to the magnitude of the disequilibrium from their movements, (Enders, 2004). Thus, by conducting the VAR model after determined the optimal lag length that implies "white noise" residuals at five lags as verified before, and include the dummy variables for each variable according to their structural break point, that has been determined by Zivot-Anderws unit root test as exogenous variables into VAR model to adjust the structural breaks through the period are tested. After that, conduct the Johansen cointegration test that is to determine the number of the cointegration vector and examine the long-run relationship between Turkish stock price index LTSPI and the rest of macroeconomic variables into the model.

Table 6.5 repots the results of cointegtation tests for the system comprehensive the trace test and the max-eigenvalus tests at 5% significance level. The finding reveals from table 6.5 that there are two cointegration vectors at 5% significance level according to the trace test, while there is one cointegration vector at 5% significance level related to max-eigenvalue test. The main importance of conduct these two tests are: there is long-run relationship that has been shared by the macroeconomic variables. Thus, remove the short-run deviation of long-run equilibrium, which means each macroeconomic variable are tend to adjust their proportionally in the model.

Table 6.5: Johansen Cointegration Test.

| Hypothesis | R=0 | R=1 | R=2 | R=3 | R=4 |
|---|---|---|---|---|---|
| Trace | 135.5492* | 50.99112* | 25.22057 | 7.192125 | 0.058573 |
| Critical Value | 69.81889 | 47.85613 | 29.79707 | 15.49471 | 3.841466 |
| Max, Eigen | 84.55807* | 25.77055 | 18.02844 | 7.133552 | 0.058573 |
| Critical Value | 33.87687 | 27.58434 | 21.13162 | 14.26460 | 3.841466 |

*, rejecting the null hypothesis of no cointegration at 5% level.

The findings reveal that there is long-run relationship among the (LTSPI) and the macroeconomic variables which are selected of the Turkish economy is identical with the empirical studies are: Rjoub (2012), Ahmad and Abdioglu (2010), Kaplan (2008) and Kasman (2003), had been conducted in Turkish stock markets. From the cointegration equation that indicates the long-run relations between the (LTSPI) and the set of macroeconomic variables selected, and how might affect on Turkish stock prices through the tested period; which are estimated as follow:

LTSPI = 3.961262 LIIP – 1.415689 LINT – 1.170528 LM2 – 0.559380 EXC

From the cointegration equation the findings reveal that there is positive long-run relationship between Turkish stock prices and the industrial production, the result which has been obtained are consistent with the empirical studies are: Ahmad and Abdioglu (2010), Cagli and Halas (2010), Erbaykal el al (2008) and Kaplan (2008), which has been conducted in Turkish stock market. Also, Humpe and Macmillan (2009) for US and Japan stock market and Rahman et al (2009) for Malaysian stock market. Therefore, the industrial production represents the real economic activity in Turkish economy, which indicates it has direct influences in the firm's for the expectation about future cash flow.

Also, the results that indicate there is negative long-run relationship between Turkish stock prices and the short-run interest rate, which implies when the interest rate is high, the investors would not consider the Turkish stock market; thus the capital market and the money in the Turkish economy which indicates they are substitutes in the long-run. On the other hand, after 2002 as a result of use the Short-term interest rate in the Turkish economy tools of monetary policy to fight the inflation, which might explain the

negative interest rate in our result, would increase the real interest rate; which is increase risk and required of return of the investment. Therefore, increase the cost of capital that indicates the profits of a firm's tend to decrease. The result consistent with Buyuksalvoci (2010), Zugul and Sahin (2009) and Ozbay (2009) these studies are evidence from Turkish stock market. Also, Paul and Mallik (2003) for the Australia stock market, Trivedi and Behera (2012) for India stock market and Coleman and Teety (2008) for the Ghana stock market.

From the cointegration equation indicates that there is negative long-run relationship between TSPI and money supply (M2). Economists and policymakers in Turkey started to pay attention to control the economy performance right after 2001 crises (restructuring period 2002-2007), through the changes in the monetary policy mechanism in that period to fight the inflation "inflation target" where the inflation rate was reached 35% for 2002 approximately; that implies an increase in the money supply might would increase and generate inflation and participate to inflation uncertainty. Hence, it might any increase in money supply generate risk premium, led up to equity prices to fall thereby exert a negative influence on Turkish stock prices. The findings reveal consistent with Zugul and Sahin (2009), and Ozbay (2009) has been conducted in Turkish stock market; also, Raymond (2009) for Jamaican stock market, and Ibrahim el al (2003) for Malaysian stock market.

As well as, the results has been indicated there is negative long-run relationship between TSPI and EXC through the tested period. The finding reveals are consistent with traditional approach was proposed by classical economic theory that examines the dynamic relation between stock prices and exchange rate, through verifying the effect of the current account movement on the trade balance position and international competitiveness. Therefore, that might effect on real output and income of the country; which is implies affect on the current and future cash flow of firms and stock price, (Dornbusch and Fisher, 1980). The negative long-run relation is consistent with empirical literatures are: Kasman (2003), Rjoub (2012) and Zugul and Sahin (2009) which these studies has been conducted in Turkish stock market; further, Raymond (2009) for Jamaican stock market and Menke (2006) for Sir Lanka stock market.

### 6.3 Short-Run Analysis

Through using the short-run analysis to investigate the nature of the dynamic relationship among the variables in the short-run, the most commonly methods are used to examine the short-run direction between the variables are causality test, impulse response function and the variance decomposition.

#### 6.3.1 Causality Test of VECM

Vector error correction model VECM (Granger, 1988) is estimated to examine the causation between LTSPI and set of macroeconomic variables, and investigate the short-run casual interaction dynamic of cointegrated variables. According to the formula of short-run VECM causality test as previously had explained, short-run VECM was determined with five lag "white noise" residuals which is implies that does not have serial autocorrelation.

Table 6.6: VECM Causality Test Block Exogeneity Wald Test.

| Dependent Variable | Independent Variables | | | | |
|---|---|---|---|---|---|
| | D(TSPI) | D(LIIP) | D(LSINT) | D(LM2) | D(EXC) |
| D(TSPI) | - | (8.5281) | (5.7541) | (6.8794) | (15.5899) |
| | | 0.1294 | 0.3309 | 0.2298 | 0.0081* |
| D(LIIP) | (18.2907) | - | (2.5863) | (9.9357) | (13.9167) |
| | 0.0026* | | 0.7634 | 0.0771 | 0.0161** |
| D(LSINT) | (0.6109) | (12.1029) | - | (2.3044) | (4.6091) |
| | 0.9875 | 0.0334** | | 0.8056 | 0.4654 |
| D(LM2) | (24.2023) | (23.9295) | (3.6282) | - | (7.9975) |
| | 0.0002* | 0.0002* | 0.6041 | | 0.1564 |
| D(EXC) | (4.1637) | (1.4633) | (7.2991) | (25.4879) | - |
| | 0.5261 | 0.9173 | 0.1993 | 0.0001* | |

*, and ** significance level at 1%, and 5% respectively. The P-value that associated with the $x^2$-statistic between parenthesis; which represents the joint significance of the independent variable.

The findings reveal as shown in table 6.6 the EXC has unidirectional short-run granger cause on the LTSPI at 5% level of significance, that implies exchange rate (EXC) predict Turkish stock prices in the short-run, but not vice versa; that is consistent with

traditional approach which is examine the relations between exchange rates and stock price suggested by Dornbusch and Fisher, (1980) advocate that the depreciation of the domestic currency lead up to increase the export for the local firms and become more competitive which is causing to higher stock prices. Thereby, this approach has been proposed that exchange rates lead to stock price. Also, our results are consistent with Erdem et al (2005) and Kasman (2003) for Turkish stock market, Issahaku and Ustarz (2013) for Ghana stock market. On the other hand, the LTSPI has unidirectional granger cause on both of industrial production (LIIP) and LM2 as shown in table 6.6 that indicates the Turkish stock market is consider as leading indicator for two macroeconomic variables are: LIIP and LM2. The findings reveal is consistent with Ozbay (2009) and Ahmad and Abdioglu (2010) for Turkish stock market; also, Rymond (2009) for Jamaican stock market and Pilinkus (2009) for Lithuanian stock market.

## 6.4 Dynamic Analysis

In spite the importance of conducting causality test between the variables. However, does not it characterize the relationship among these variable over time. Thus, the response of Turkish stock prices are checked to shocks to the some macroeconomic shocks are represented by industrial production index (IIP), the Short-term interest rate (SINT), money supply (M2) and the exchange rate (EXC). The methods most commonly are used to estimate the response between the variables are impulse response function and variance decomposition.

### 6.4.1 Impulse Response Functions

The Impulse response functions IRF to trace out the time path of the effect of structural shocks on the dependent variables of the model. It allows examining the behavior of current and future variables, as follows: the impact on the other variables in the system. IRF is a useful tool for determining the magnitude of time that has been affected by the impact of the variables on another variable and whether the shocks are permanent or temporal in the system. Thus, it allows track the impact of the various shocks on the variables contained in the VAR system (as shown in the figure 6.1).

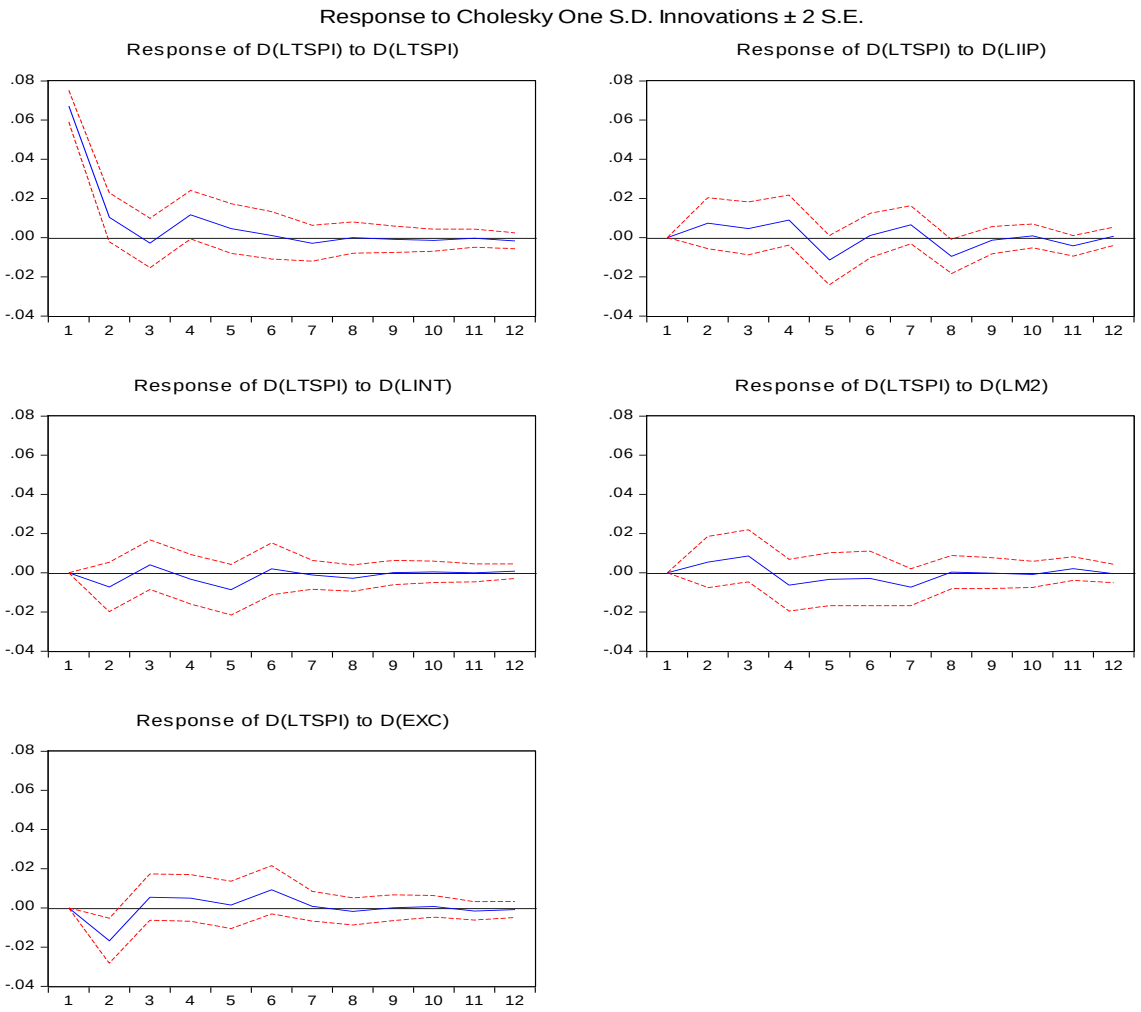


Figure6.1. Impulse response to non-factorized one S.D. innovation ∓ 2 S.E; 1) response of D(LTSPI) to D(LTSPI); 2) response of D(LTSPI) to D(LIIP); 3) response of D(LTSPI) to (LINT); 4) response of D(LTSPI) to D(M2); 5) response of D(LTSPI) to D(EXC).

Figure 6.1 is reported the results of impulse responses of LTSPI of a set of macroeconomic variables. That indicates LTSPI response to its own shock is significant and negative in the 2th period. But, the response of LTSPI to shock from LIIP is significant and positive in the 8th period. While, there is no response of LTSPI over the periods to chock LM2 and LSINT. Where, the response of LTSPI to a shock from EXC it has a significant and negative effect in the 2th period then will dies out maximum within the 2th period. The response of LIIP and LM2 to shock from LTSPI is significant and negative in the 3th period and 4th respectively[8].

[8] Appendix 6: Impulse response.

### 6.4.2 Variance Decompositions Test Results

The Variance decomposition is estimated to examine the change in a variable is due to its own shock and the shocks effect to other variables. And provide while much of the variation in LTSPI can be attributed of macroeconomic variables in forecasting the variance of stock price over the time period.

Table 6.7: Variance Decomposition

| Period | D(TSPI) | D(LIIP) | D(LSINT) | D(LM2) | D(EXC) |
|---|---|---|---|---|---|
| 1 | 100 | 0.00000 | 0.00000 | 0.00000 | 0.00000 |
| 6 | 82.18258 | 4.969409 | 2.736855 | 2.813475 | 7.29768 |
| 12 | 79.07028 | 7.334171 | 2.785685 | 3.684183 | 7.125682 |
| 18 | 78.87664 | 7.350812 | 2.837515 | 3.716498 | 7.21854 |
| 24 | 78.85428 | 7.351162 | 2.841814 | 3.724124 | 7.228615 |
| 30 | 78.85283 | 7.351417 | 2.84233 | 3.724741 | 7.228686 |
| 36 | 78.85274 | 7.351491 | 2.842342 | 3.72474 | 7.228688 |
| 42 | 78.85273 | 7.351496 | 2.842342 | 3.724741 | 7.228692 |
| 48 | 78.85273 | 7.351496 | 2.842343 | 3.724742 | 7.228693 |

Cholesky Ordering: D (LTSPI), D (LIIP) D (LSINT) D (LM2) D (EXC).

The findings reveal as shown in table 6.7 the results reveal that variance decomposition, this is deliver evidence about the relative importance of each random innovation in affecting the variables in the VAR system. Hence, the results indicate that LTSPI response to own innovation effect goes down over time period. And the LTSPI response to of both LSINT and LM2 are and increasing over time period. While, the LTSPI has more response to both of LIIP and EXC increase over time, that implies in our results there is dominant role of monetary variables in explaining the variation in Turkish stock prices such as exchange rates and industrial production index.

## 6.5 Conclusion

In this chapter the long-run and short-run linkage between stock price index LTSPI has been investigated. As it was shown a set of macroeconomic variables are: index of industrial production (LIIP), Short-term interest rate (LSINT), money supply (LM2) and exchange rate (EXC). The analysis has been verified on standard and techniques that commonly used of cointegration and VAR system, to reveal the long-run relationship and the interaction into short-run between the variables for the period span from January 2002 to December 2013. By including the dummy variables into VAR model for a set of macroeconomic variables to examine the structural break points that determined by Zivot-Andrews unit root test with structural break over time period, that regarding to the changes in the monetary transmission mechanism after 2001 crisis up to 2007 "restructuring period" and the world crisis that happened into 2008. Moreover, compute the impulse response function and variance decomposition to examine the robust of the Granger causal linkage between the variables, and interpret the innovations responses between each other within the Turkish economy.

Empirical findings reveal that there are several implications on the stock market of monetary transmission mechanism. Johansen cointegration test indicates that, there is presence long-run cointegration between Turkish stock prices and a set of macroeconomic variables over time period. In our result by conducting the impulse response and variance decomposition, it was concluded that there are dominant roles of macroeconomic variables that have crucial explanation of the variation into Turkish stock prices; such as, exchange rate (EXC) and index of industrial production (LIIP) as proxy of economic activity.

## CHAPTER SEVEN

### 7. Conclusion and Policy Implications

The aim of this research is to provide an empirical analysis and elucidate the relationship between the whole Turkish stock price index and macroeconomic variables, for a wiser time span from Jan 2002 to Dec 2013; it's witnessed a new monetary policy during the restructuring period (2002-2007) and world crisis.

The findings from the Johansen cointegration indicates that there is long-run relationship between the whole Turkish stock price index and macroeconomic variables where included monetary policy instruments; Short-term interest rate (SINT), money supply (M2) and exchange rate (EXC) and index of industrial production (IIP) as a proxy of economic activity. Where have been added dummy variables to avoid the changes effect of monetary policy and world crisis. The finding related to industrial production indicates that there is a positive impact on prices. During the boom, the demand for the stock may increase in which the prices will increase subsequently.

The finding for Short-term interest rate suggested negative relationship with stock price, indicate an increase in Short-term interest rate would increase real interest rate would increase the required return on stock market and the value of share or stock will be decline, as a result of estimation for the value of future dividends, will be less valuable with higher interest rate due to discount the dividends back to the present value. One more variable found to be negatively related to stock prices, is money supply (M2). However, any fluctuation in money supply would increase the real interest rate, in this case the increase in the discount rates due to of the increase real interest rate which lead to decrease the value of stock. Finally, exchange rate found to be negatively related to stock prices. In other words, increase the current and future cash flows of companies due to a depreciation of the domestic currency would makes local firms more competitive, leading to an increase in their export and consequently higher stock price. Furthermore, there is robust response of Turkish stock price to a shock of exchange rate over time period.

This study has a policy implication to the Policymakers in Turkey. Policymakers should take into account the use of the exchange rate as tool in monetary policy, because of its robust influence on whole Turkish stock market, and Short-term interest rate that was used as instrument to fight the inflation during the restructuring period that has negative long-run effect on stock market.

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**Appendix**

Appendix 1: Macroeconomic Data

| Date | LTSPI | LIIP | LINT | LM2 | EXC |
|---|---|---|---|---|---|
| **2002 Jan** | 3.81755 | 4.34461 | 4.09434 | 24.54659 | 1.30849 |
| **2002 Feb** | 3.68623 | 4.30798 | 4.09434 | 24.60453 | 1.39839 |
| **2002 Mar** | 3.65188 | 4.37508 | 4.09434 | 24.62554 | 1.34102 |
| **2002 Apr** | 3.70169 | 4.40354 | 4.09434 | 24.65073 | 1.33510 |
| **2002 May** | 3.64053 | 4.38901 | 4.00733 | 24.67055 | 1.44148 |
| **2002 Jun** | 3.48692 | 4.35464 | 4.00733 | 24.69568 | 1.57293 |
| **2002 Jul** | 3.49372 | 4.37967 | 4.00733 | 24.71192 | 1.68592 |
| **2002 Aug** | 3.52678 | 4.37646 | 4.00733 | 24.70812 | 1.62526 |
| **2002 Sep** | 3.44716 | 4.39186 | 4.00733 | 24.75184 | 1.65444 |
| **2002 Oct** | 3.48247 | 4.40695 | 4.00733 | 24.78241 | 1.66652 |
| **2002 Nov** | 3.77463 | 4.39548 | 4.00733 | 24.79867 | 1.53904 |
| **2002 Dec** | 3.69348 | 4.36897 | 4.00733 | 24.84846 | 1.64370 |
| **2003 Jan** | 3.57929 | 4.49786 | 4.00733 | 24.83415 | 1.63947 |
| **2003 Feb** | 3.65030 | 4.35603 | 4.00733 | 24.84507 | 1.59241 |
| **2003 Mar** | 3.53769 | 4.43289 | 4.00733 | 24.87864 | 1.70417 |
| **2003 Apr** | 3.61565 | 4.41766 | 4.00733 | 24.86329 | 1.57106 |
| **2003 May** | 3.61177 | 4.41754 | 4.00733 | 24.89248 | 1.43812 |
| **2003 Jun** | 3.61653 | 4.43761 | 3.91202 | 24.94003 | 1.41104 |
| **2003 Jul** | 3.58605 | 4.47623 | 3.91202 | 24.97050 | 1.41522 |
| **2003 Aug** | 3.67768 | 4.47384 | 3.91202 | 24.99123 | 1.39615 |
| **2003 Sep** | 3.77167 | 4.49794 | 3.91202 | 25.04037 | 1.38772 |

| | | | | | |
|---|---|---|---|---|---|
| **2003 Oct** | 3.93650 | 4.51206 | 3.76120 | 25.06852 | 1.48248 |
| **2003 Nov** | 3.98353 | 4.42751 | 3.76120 | 25.09013 | 1.45879 |
| **2003 Dec** | 4.07772 | 4.53904 | 3.76120 | 25.13864 | 1.39664 |
| **2004 Jan** | 4.15507 | 4.55198 | 3.76120 | 25.22791 | 1.34023 |
| **2004 Feb** | 4.13884 | 4.49316 | 3.76120 | 25.21762 | 1.32449 |
| **2004 Mar** | 4.20790 | 4.54356 | 3.76120 | 25.25104 | 1.31338 |
| **2004 Apr** | 4.18319 | 4.56187 | 3.76120 | 25.27928 | 1.42072 |
| **2004 May** | 4.05915 | 4.57212 | 3.76120 | 25.28379 | 1.49562 |
| **2004 Jun** | 4.07673 | 4.57929 | 3.63759 | 25.30219 | 1.48950 |
| **2004 Jul** | 4.15276 | 4.59296 | 3.63759 | 25.31204 | 1.46618 |
| **2004 Aug** | 4.18760 | 4.55867 | 3.63759 | 25.33649 | 1.50574 |
| **2004 Sep** | 4.28880 | 4.55241 | 3.63759 | 25.35716 | 1.50096 |
| **2004 Oct** | 4.33130 | 4.52673 | 3.63759 | 25.37256 | 1.47370 |
| **2004 Nov** | 4.35797 | 4.52125 | 3.63759 | 25.38151 | 1.42945 |
| **2004 Dec** | 4.39177 | 4.56430 | 3.63759 | 25.41038 | 1.33950 |
| **2005 Jan** | 4.49226 | 4.52559 | 3.46574 | 25.38761 | 1.33270 |
| **2005 Feb** | 4.54428 | 4.57789 | 3.46574 | 25.40974 | 1.28160 |
| **2005 Mar** | 4.48946 | 4.56205 | 3.46574 | 25.45700 | 1.34945 |
| **2005 Apr** | 4.43459 | 4.57044 | 3.46574 | 25.49171 | 1.38775 |
| **2005 May** | 4.43333 | 4.56278 | 3.33220 | 25.51526 | 1.35825 |
| **2005 Jun** | 4.49357 | 4.58958 | 3.33220 | 25.56404 | 1.33690 |
| **2005 Jul** | 4.57219 | 4.57563 | 3.33220 | 25.59576 | 1.32440 |
| **2005 Aug** | 4.60319 | 4.61047 | 3.33220 | 25.62177 | 1.35055 |

| | | | | | |
|---|---|---|---|---|---|
| **2005 Sep** | 4.71468 | 4.63887 | 3.33220 | 25.65428 | 1.34545 |
| **2005 Oct** | 4.70611 | 4.69222 | 3.33220 | 25.69590 | 1.34495 |
| **2005 Nov** | 4.78502 | 4.64146 | 3.33220 | 25.71066 | 1.35325 |
| **2005 Dec** | 4.87586 | 4.68652 | 3.13549 | 26.19890 | 1.34505 |
| **2006 Jan** | 4.99688 | 4.54057 | 3.13549 | 26.18192 | 1.32310 |
| **2006 Feb** | 5.04024 | 4.65591 | 3.13549 | 26.20115 | 1.30915 |
| **2006 Mar** | 5.00904 | 4.68172 | 3.13549 | 26.23632 | 1.34495 |
| **2006 Apr** | 5.00194 | 4.66893 | 3.13549 | 26.25490 | 1.31865 |
| **2006 May** | 4.93841 | 4.67904 | 3.13549 | 26.33873 | 1.56375 |
| **2006 Jun** | 4.77417 | 4.68537 | 3.13549 | 26.35275 | 1.57350 |
| **2006 Jul** | 4.78930 | 4.66539 | 3.13549 | 26.32634 | 1.48465 |
| **2006 Aug** | 4.83480 | 4.67576 | 3.13549 | 26.34024 | 1.45130 |
| **2006 Sep** | 4.84921 | 4.69370 | 3.13549 | 26.36468 | 1.50070 |
| **2006 Oct** | 4.87581 | 4.65394 | 3.13549 | 26.37189 | 1.45750 |
| **2006 Nov** | 4.88723 | 4.77587 | 3.13549 | 26.39280 | 1.44930 |
| **2006 Dec** | 4.88932 | 4.70374 | 3.29584 | 26.41947 | 1.40900 |
| **2007 Jan** | 4.90785 | 4.71670 | 3.29584 | 26.42457 | 1.41690 |
| **2007 Feb** | 4.98364 | 4.73890 | 3.29584 | 26.43144 | 1.41640 |
| **2007 Mar** | 4.95957 | 4.74610 | 3.29584 | 26.44526 | 1.38345 |
| **2007 Apr** | 5.05450 | 4.72464 | 3.29584 | 26.46034 | 1.36400 |
| **2007 May** | 5.04489 | 4.74934 | 3.29584 | 26.47362 | 1.31980 |
| **2007 Jun** | 5.04685 | 4.72890 | 3.29584 | 26.49161 | 1.30775 |
| **2007 Jul** | 5.16984 | 4.72124 | 3.29584 | 26.50487 | 1.27765 |

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|---|---|---|---|---|---|
| **2007 Aug** | 5.11092 | 4.75408 | 3.29584 | 26.52048 | 1.29450 |
| **2007 Sep** | 5.16493 | 4.74834 | 3.29584 | 26.51465 | 1.20770 |
| **2007 Oct** | 5.25549 | 4.74915 | 3.29584 | 26.51765 | 1.17445 |
| **2007 Nov** | 5.22075 | 4.85464 | 3.29584 | 26.52991 | 1.17435 |
| **2007 Dec** | 5.23820 | 4.68407 | 3.21888 | 26.56500 | 1.17080 |
| **2008 Jan** | 5.11038 | 4.82069 | 3.21888 | 26.56693 | 1.17080 |
| **2008 Feb** | 5.02501 | 4.82497 | 3.21888 | 26.58559 | 1.19345 |
| **2008 Mar** | 4.94997 | 4.78344 | 3.21888 | 26.64333 | 1.30955 |
| **2008 Apr** | 4.96829 | 4.79559 | 3.21888 | 26.64942 | 1.28800 |
| **2008 May** | 4.95205 | 4.77993 | 3.21888 | 26.63714 | 1.20960 |
| **2008 Jun** | 4.87122 | 4.75026 | 3.21888 | 26.66106 | 1.22155 |
| **2008 Jul** | 4.83094 | 4.76007 | 3.21888 | 26.66512 | 1.15920 |
| **2008 Aug** | 4.94316 | 4.72144 | 3.21888 | 26.66621 | 1.17745 |
| **2008 Sep** | 4.83918 | 4.72180 | 3.21888 | 26.71302 | 1.23455 |
| **2008 Oct** | 4.56191 | 4.67786 | 3.21888 | 26.74941 | 1.56405 |
| **2008 Nov** | 4.45228 | 4.71829 | 3.21888 | 26.76941 | 1.56615 |
| **2008 Dec** | 4.47238 | 4.48941 | 3.21888 | 26.80178 | 1.52545 |
| **2009 Jan** | 4.48422 | 4.57211 | 3.21888 | 26.79978 | 1.63845 |
| **2009 Feb** | 4.44287 | 4.55012 | 3.21888 | 26.81971 | 1.69145 |
| **2009 Mar** | 4.40826 | 4.54325 | 3.21888 | 26.82596 | 1.67220 |
| **2009 Apr** | 4.57507 | 4.58615 | 2.94444 | 26.80841 | 1.58240 |
| **2009 May** | 4.74750 | 4.59327 | 2.94444 | 26.81873 | 1.53820 |
| **2009 Jun** | 4.78778 | 4.64660 | 2.89037 | 26.83300 | 1.52840 |

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|---|---|---|---|---|---|
| **2009 Jul** | 4.87134 | 4.66260 | 2.89037 | 26.83729 | 1.47265 |
| **2009 Aug** | 5.04272 | 4.66058 | 2.89037 | 26.84847 | 1.49900 |
| **2009 Sep** | 5.06565 | 4.62816 | 2.89037 | 26.87196 | 1.48055 |
| **2009 Oct** | 5.13451 | 4.73428 | 2.89037 | 26.88003 | 1.48620 |
| **2009 Nov** | 5.07595 | 4.69077 | 2.89037 | 26.90639 | 1.48610 |
| **2009 Dec** | 5.14443 | 4.70185 | 2.70805 | 26.92390 | 1.49090 |
| **2010 Jan** | 5.22307 | 4.68528 | 2.70805 | 26.92159 | 1.48670 |
| **2010 Feb** | 5.17544 | 4.70628 | 2.70805 | 26.93841 | 1.53980 |
| **2010 Mar** | 5.20923 | 4.73941 | 2.70805 | 26.95380 | 1.51935 |
| **2010 Apr** | 5.29511 | 4.74283 | 2.70805 | 26.95126 | 1.47745 |
| **2010 May** | 5.24466 | 4.73778 | 2.70805 | 26.96751 | 1.57030 |
| **2010 Jun** | 5.24338 | 4.74549 | 2.70805 | 27.00013 | 1.57750 |
| **2010 Jul** | 5.28861 | 4.76079 | 2.70805 | 27.00233 | 1.50815 |
| **2010 Aug** | 5.30671 | 4.78688 | 2.70805 | 27.01009 | 1.52455 |
| **2010 Sep** | 5.37147 | 4.72095 | 2.70805 | 27.02603 | 1.44690 |
| **2010 Oct** | 5.45040 | 4.80305 | 2.70805 | 27.03558 | 1.43355 |
| **2010 Nov** | 5.45375 | 4.76293 | 2.70805 | 27.05227 | 1.50270 |
| **2010 Dec** | 5.41569 | 4.84362 | 2.63906 | 27.09874 | 1.54130 |
| **2011 Jan** | 5.42621 | 4.85231 | 2.63906 | 27.09574 | 1.60300 |
| **2011 Feb** | 5.38987 | 4.83667 | 2.63906 | 27.12118 | 1.59670 |
| **2011 Mar** | 5.36765 | 4.84700 | 2.63906 | 27.14149 | 1.54000 |
| **2011 Apr** | 5.44595 | 4.83427 | 2.63906 | 27.14646 | 1.51780 |
| **2011 May** | 5.40974 | 4.82955 | 2.63906 | 27.17011 | 1.58970 |

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|---|---|---|---|---|---|
| **2011 Jun** | 5.36210 | 4.84308 | 2.63906 | 27.18505 | 1.61960 |
| **2011 Jul** | 5.35959 | 4.82961 | 2.63906 | 27.19872 | 1.67740 |
| **2011 Aug** | 5.22545 | 4.85239 | 2.63906 | 27.21835 | 1.74960 |
| **2011 Sep** | 5.27363 | 4.85132 | 2.63906 | 27.22144 | 1.85570 |
| **2011 Oct** | 5.27786 | 4.90273 | 2.63906 | 27.21363 | 1.75000 |
| **2011 Nov** | 5.21236 | 4.84743 | 2.63906 | 27.21716 | 1.84535 |
| **2011 Dec** | 5.18968 | 4.88153 | 2.83321 | 27.23710 | 1.89345 |
| **2012 Jan** | 5.20538 | 4.86916 | 2.83321 | 27.21540 | 1.76825 |
| **2012 Feb** | 5.32372 | 4.88495 | 2.83321 | 27.22111 | 1.74170 |
| **2012 Mar** | 5.33676 | 4.88024 | 2.83321 | 27.23328 | 1.77720 |
| **2012 Apr** | 5.33378 | 4.86130 | 2.83321 | 27.23725 | 1.75310 |
| **2012 May** | 5.27160 | 4.88673 | 2.83321 | 27.25124 | 1.84485 |
| **2012 Jun** | 5.29590 | 4.86729 | 2.77259 | 27.26683 | 1.81085 |
| **2012 Jul** | 5.36366 | 4.86469 | 2.77259 | 27.27250 | 1.79070 |
| **2012 Aug** | 5.40450 | 4.83311 | 2.77259 | 27.28263 | 1.81545 |
| **2012 Sep** | 5.43743 | 4.89528 | 2.77259 | 27.29923 | 1.78900 |
| **2012 Oct** | 5.46486 | 4.83890 | 2.77259 | 27.31113 | 1.78960 |
| **2012 Nov** | 5.49701 | 4.97235 | 2.77259 | 27.30957 | 1.78170 |
| **2012 Dec** | 5.56824 | 4.85521 | 2.60269 | 27.33402 | 1.78190 |
| **2013 Jan** | 5.63583 | 4.88389 | 2.60269 | 27.33699 | 1.75905 |
| **2013 Feb** | 5.58667 | 4.89594 | 2.60269 | 27.34684 | 1.80660 |
| **2013 Mar** | 5.64144 | 4.88073 | 2.60269 | 27.36095 | 1.81535 |
| **2013 Apr** | 5.68036 | 4.90831 | 2.60269 | 27.37281 | 1.79690 |

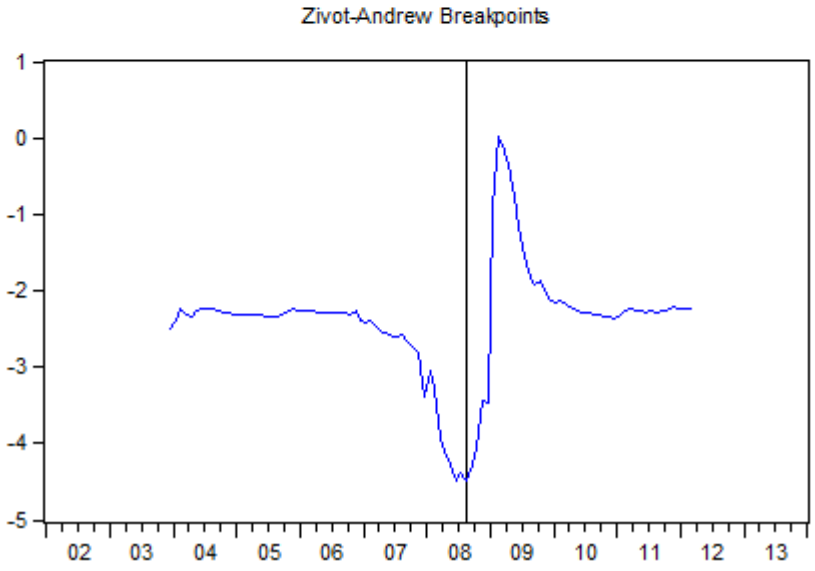
| | | | | | |
|---|---|---|---|---|---|
| **2013 May** | 5.72634 | 4.90501 | 2.60269 | 27.39787 | 1.86780 |
| **2013 Jun** | 5.56008 | 4.89946 | 2.25129 | 27.41665 | 1.92890 |
| **2013 Jul** | 5.53428 | 4.92434 | 2.25129 | 27.44438 | 1.92585 |
| **2013 Aug** | 5.50083 | 4.82470 | 2.25129 | 27.46647 | 2.05755 |
| **2013 Sep** | 5.51366 | 4.95312 | 2.25129 | 27.48428 | 2.03600 |
| **2013 Oct** | 5.57108 | 4.83481 | 2.25129 | 27.49043 | 1.99055 |
| **2013 Nov** | 5.54031 | 5.01770 | 2.25129 | 27.50244 | 2.01925 |
| **2013 Dec** | 5.49596 | 4.92368 | 2.32728 | 27.53452 | 2.13620 |

Appendix 2: Zivot-Andrews unit root test for index of industrial production

Zivot-Andrews Unit Root Test
Date: 04/14/14 Time: 11:04
Sample: 2002M01 2013M12
Included observations: 144
Null Hypothesis: LIIP has a unit root with a structural break in both the intercept and trend
Chosen lag length: 2 (maximum lags: 3)
Chosen break point: 2008M08

| | t-Statistic | Prob. * |
|---|---|---|
| Zivot-Andrews test statistic | -4.490491 | 0.000531 |
| 1% critical value: | -5.57 | |
| 5% critical value: | -5.08 | |
| 10% critical value: | -4.82 | |

* Probability values are calculated from a standard t-distribution and do not take into account the breakpoint selection process

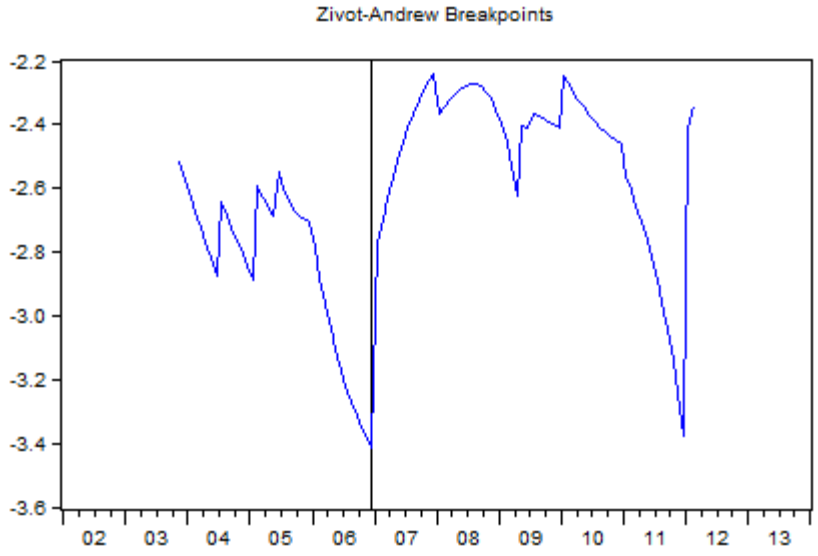


Appendix 3: Zivot-Andrews unit root test for Short-term interest rate

Zivot-Andrews Unit Root Test
Date: 04/18/14 Time: 21:04
Sample: 2002M01 2013M12
Included observations: 144
Null Hypothesis: LINT has a unit root with a structural break in both the intercept and trend
Chosen lag length: 0 (maximum lags: 1)
Chosen break point: 2006M12

| | t-Statistic | Prob. * |
|---|---|---|
| Zivot-Andrews test statistic | -3.411936 | 0.031625 |
| 1% critical value: | -5.57 | |
| 5% critical value: | -5.08 | |
| 10% critical value: | -4.82 | |

* Probability values are calculated from a standard t-distribution and do not take into account the breakpoint selection process

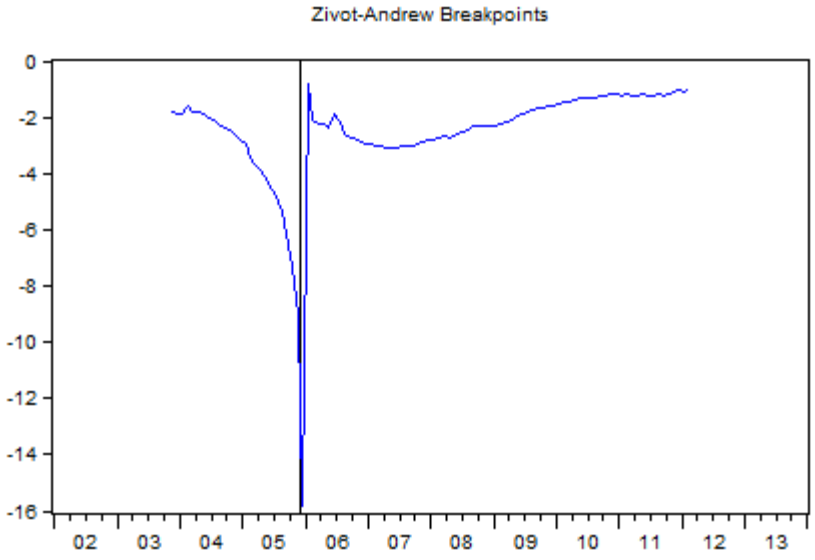


Appendix 4: Zivot-Andrews unit root test for money supply (M2)

Zivot-Andrews Unit Root Test
Date: 04/14/14 Time: 11:04
Sample: 2002M01 2013M12
Included observations: 144
Null Hypothesis: LM2 has a unit root with a structural break in both the intercept and trend
Chosen lag length: 0 (maximum lags: 1)
Chosen break point: 2005M12

| | t-Statistic | Prob. * |
|---|---|---|
| Zivot-Andrews test statistic | -15.79965 | 5.91E-28 |
| 1% critical value: | -5.57 | |
| 5% critical value: | -5.08 | |
| 10% critical value: | -4.82 | |

* Probability values are calculated from a standard t-distribution and do not take into account the breakpoint selection process

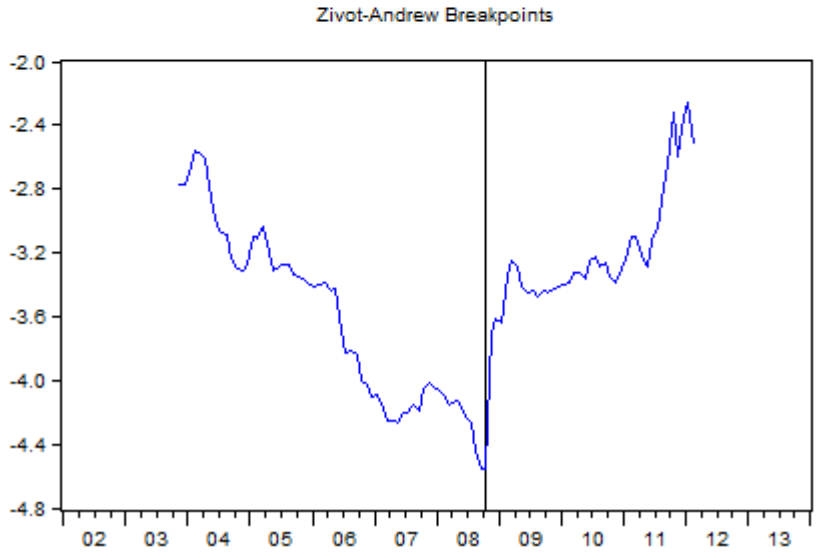


Appendix 5: Zivot-Andrews unit root test for exchange rate

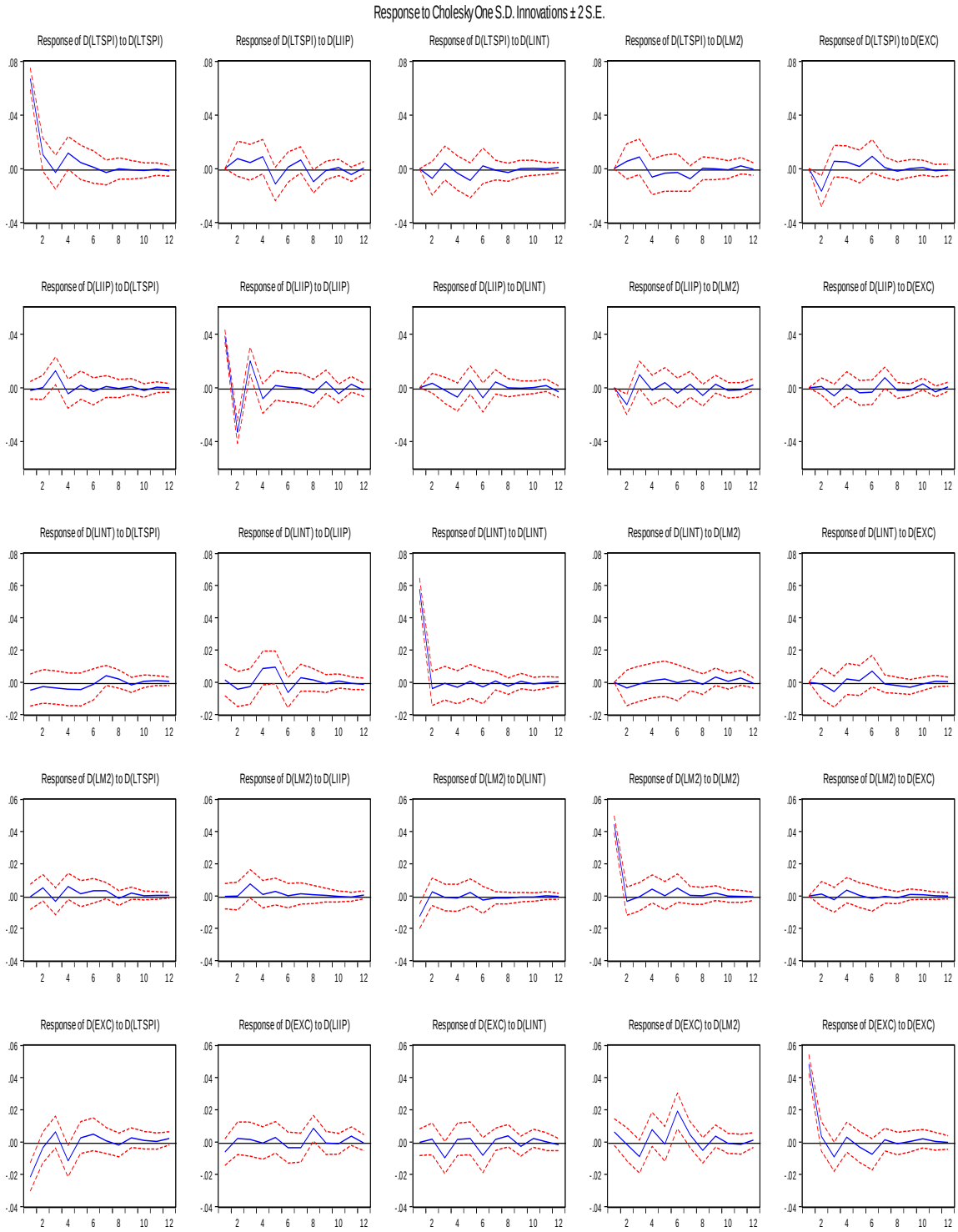
Zivot-Andrews Unit Root Test
Date: 04/14/14 Time: 11:04
Sample: 2002M01 2013M12
Included observations: 144
Null Hypothesis: EXC has a unit root with a structural break in both the intercept and trend
Chosen lag length: 0 (maximum lags: 1)
Chosen break point: 2008M10

| | t-Statistic | Prob. * |
|---|---|---|
| Zivot-Andrews test statistic | -4.561260 | 0.021711 |
| 1% critical value: | -5.57 | |
| 5% critical value: | -5.08 | |
| 10% critical value: | -4.82 | |

* Probability values are calculated from a standard t-distribution and do not take into account the breakpoint selection process



Appendix 6: Impulse Responses.




Impulse response to non-factorized one S.D. innovation ∓ 2 S.E; 1) response of D(LTSPI) to D(LTSPI); 2) response of D(LTSPI) to D(LIIP); 3) response of D(LTSPI) to (LINT); 4) response of D(LTSPI) to D(M2); 5) response of D(LTSPI) to D(EXC).