IMPACT OF MACROECONOMIC INDICATORS ON STOCK MARKET PERFORMANCE: THE CASE OF THE ISTANBUL STOCK EXCHANGE

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Abstract

The purpose of this study is to investigate whether it is possible to predict stock market returns on the Istanbul Stock Exchangewith the use of macroeconomic variables. Turkey’s economy has gone through rounds of high inflation and negative real interest rates in the 1980s and 1990s, but in the last decade has been relatively stable. As a result of this stability and the growth that has followed, Turkey is today a G20 economy. Turkey’s growing economic power and the active foreign policy of the Justice and Development Party in the region has led Turkey and the Istanbul Stock Exchange to now work towards positioning itself to become the nexus of Islamic finance. In light of this, it is useful to investigate any possible relationships among national macroeconomic factors and the stock market in Turkey. Looking at the period from 1994 to 2013, we use stock indices as proxies of stock prices. We focus at a macro level on the XU100 National index, and at a micro level on various sector indices to tease out any industry specific differences. The sectors investigated include the financial, services, industrials, and technology indices. In the international literature there is a wide variety of methods used for modeling the relationship between financial variables. We use the Engle and Granger (1987) multivariate cointegration approach to test for a long-run relationship between these indices and various macroeconomic factors, before turning to estimate our factor models. Due to the data driven and historically grounded nature of the paper, our results are important for policy makers, financial managers, financial analysts and investors dealing with the Turkish market.

Key words: Turkey; Istanbul Stock Exchange; Macroeconomic factors; Portfolio theory; Engle Granger cointegration; Factor models

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1 Introduction

1.1 Background of the Study

There is a magnificent, four-meter high marble statue of the "Bull and Bear", in front of the Istanbul Stock Exchange (ISE) building entrance. Symbolizing the behavior of the world's stock markets, it depicts an aggressive bull poised to attack the surrendering bear. During the last decade, the ISE main index has seen a price change of more than 300% - a true bull market. In Turkey and elsewhere, considerable popular debate revolves around the link between policy choices and economic outcomes – or in the context of this statue, whether national government decisions can move the odds in favor of the bull rather than the bear (or vice versa). A key cornerstone of a liberal market is its stock exchange. Providing access to capital for businesses, and liquidity for investors, as well as a connection to the world’s capital markets, their development is often cultivated by national ministers and international Bretton Woods institutions alike. Understanding the stock exchange is therefore key to understanding a country’s economy.

Several prominent US economists have written extensively on the Turkish economic experience from a macroeconomic perspective. An early study by Krueger (1974) on trade regimes and economic performance is among the most widely known. Turkey’s trade liberalization in the 1980s also attracted several studies (e.g. Aricanli and Rodrik, 1990a,b or Krueger and Aktan, 1992), while numerous other studies examine Turkey’s economic experience in the context of such issues as debt, exchange rate regimes, and stabilization policies (e.g. Rodrik, 1990, or the studies in Sachs and Collins, 1990) (Altug et al, 2006). However, few studies have focused on the Turkish macroeconomic experience in the context of its stock exchange.

Turkey has had a ‘Bourse’ since the days of the Ottoman Empire, but the current one is more recent. Founded in 1984, the Istanbul Stock Exchange has experienced rapid growth, particularly during the last decade. Prior to this, the return developments have been mixed. During the time since its founding, Turkey has gone through various macroeconomic stages, including periods of hyperinflation. One prominent cause of this has been high instability in politics, which led directly to failures in macroeconomic policy, in turn leading to financial and economical crises (Altunbas et al, 2009). In a study by the International Monetary Fund looking at the period 1971-80, Turkey was classified as a country with severely negative real interest rates (IMF, 1983). To remedy such destructive developments, Turkey initiated several rounds of IMF led economic reforms in the 1980s, although their effectiveness is disputed. Following political unrest in the 1990s, and twin bank crises in 2000 and 2001 where 13 domestic banks failed, the IMF once again issued severe restructuring targets for Turkey. The Justice and Development Party came to power around the same time, with current Prime Minister Recep Tayyip Erdogan serving as its head throughout the last decade. Thanks to the subse-
quent implementation of the new IMF reforms, Turkey came down to single digit inflation in April 2004, having last seen it over 30 years prior in September 1972. In part as a consequence of the reforms and political stability of these years, Turkey’s economy received its first investment grade rating since 1994 in November 2012, when the rating agency Fitch upgraded their foreign currency ranking to BB+ from BBB- (Bloomberg, Nov 2012). It has also rapidly started attracting listings of companies from other countries and is actively cultivating relationships with other bourses stretching from Egypt to central Asia (FT.com, 2011). The success of the Istanbul Bourse over the last few years has led it to touting ambitions of becoming the centre of Islamic finance, hoping soon be the exchange of choice for firms from the Middle East and North Africa (MENA). While it seems clear that the last decade of stability has been favorable for Turkey’s economy, the relationship between the different macroeconomic interventions and the prices on the stock exchange is less certain. For investors and policy makers alike it therefore becomes interesting to understand the extent to which there has been a long-run relationship between the performance of the exchange and various macroeconomic variables. Should there be a clear link, they will be able to use that information to guide future actions.

Inspired by Fama (1991), who conducted similar studies on the US stock market, and who encouraged work that “relates cross section properties of expected returns to the variation of expected returns, through time, and (...) relates the behavior of expected returns to the real economy”, this study thus concerns itself with the extent to which government macroeconomic policies affect the performance of the stock exchange, using Turkey’s Istanbul Stock Exchange (ISE) as a case study. Such analyses are important in general for two main reasons: Firstly, the results can be used to predict the effect of a macroeconomic variable on the equity market and thereby beneficially inform investment decisions. Taking the real exchange rate as an example, information on this specific relation can be used by foreign investors concerned about their currency exposure in Turkish Lira (TRY). Secondly, this type of study can be used by policy makers to guide fiscal and monetary policy. For example, the preferred instrument of the Turkish Central Bank in its inflation targeting policy is the interest rate. Tightening monetary policy in response to inflationary pressure will however only give the desired result if the TRY is currently depreciating and it is known that depreciation stimulates the economy via the share market. If, on the other hand, it is known that the falling TRY dampens the share market, there may be justification not to intervene since inflationary pressures may naturally ease.

Besides these two general motivations for performing this type of study as encouraged by Fama (1991), there are three reasons why such an analysis of Turkey is important. Firstly, Turkey is an interesting case in itself, partly because it is understudied, but also because of its anticipated future as a regional financial powerhouse. Understanding the effect of the local macroeconomy on its equity markets will thus be one of many important steps for all stakeholders as the ex-
change continues to grow. Secondly, given its status as an ‘emerging market’ on various emerging market indices and the higher levels of risk associated with investing on it, it will be interesting to see if the results found in more developed markets hold. And finally, the fact that it has a small capitalization compared to developed countries may indicate that it is more susceptible to speculation and government policy. As many studies have shown that a well functioning stock exchange promotes economic growth (see e.g. Levine 1996, 1998), this makes it all the more important to study the link between macroeconomic movements and the stock market and ensure that e.g. the government does not mistakenly pursue policies that damage it.

1.2 Research Question

There are a number of angles one could take when looking at the ISE. To ensure proper focus in the study, we want to concentrate on national macroeconomic variables as they relate to the stock exchange. Other possible angles, such as the effect of macroeconomic policy decisions in other countries, therefore fall outside the scope of this paper. The research question formulated becomes:

What is the relationship between Turkish macroeconomic variables and stock returns on the Istanbul Stock Exchange?

More specifically, to investigate the overall effect and also allow for differing effects on the various sectors that make up the exchange, we aim to answer the following sub questions:

1. How can we use modern economic and financial theory to predict the relationship between stock returns and macroeconomic variables?

2. To what extent does the relationship between macroeconomic variables and stock returns change over time?

3. What is the relationship between macroeconomic variables and stock returns in different sectors represented on the Istanbul Stock Exchange?

These sub questions together we believe will serve to create a meaningful discussion around our area of interest. By covering both the time varying aspect and the industry specific aspect, we will also be going beyond the scope of the studies that have been conducted on Turkey previously – thereby contributing to bridging a knowledge gap.

1.3 Structure of the Study

To answer our three sub research questions, the paper has been split into a number of chapters. Chapter 2 provides relevant background information through a
brief introduction to Turkey’s economic history and the Istanbul Stock Exchange. Chapter 3 discusses the rationale for the study and the sources for our time series data, and outlines the econometric Engle Granger testing method employed, along with an explanation of macroeconomic variables investigated in the study.

Chapter 4 then seeks to answer the first of our three research questions, by providing a thorough introduction to the relevant theoretical literature and detailing predictions made by these on the relationship between the different macroeconomic variables and prices on the stock exchange. As will be seen, our study employs both macroeconomic theory and elements of portfolio theory to inform our analysis. This is inspired by the fact that there are two approaches most often used when understanding stock price changes: The standard approach used by investors is typically portfolio theory driven, where one looks at firm specific factors such as earnings figures, the discount rate, and expected growth rate (i.e. bottom up). However investors also look at macroeconomic variables to understand the context which the firm is working within (i.e. top down). By using both theoretical approaches throughout our study, we will aim to employ both a ‘top-down’, and a more ‘bottom up’ lens to understand the trends observed.

Chapter 5 builds on the proceeding theoretical literature review by providing an empirical literature review of the results from previous studies conducted on developed countries, developing countries, and Turkey.

Chapter 6 conveys the results from our own tests on the time series data from the Istanbul Stock Exchange, both on the overall XU 100 index and the sector indices, and in doing so begins to answer the last two sub questions posited above. Chapter 7 goes further in detail about what our results tell us in relation to our questions, and seeks to go beyond simply stating our findings by discussing the possible reasons for why we observe the patterns found.

Finally, Chapters 8 and 9 conclude the study and discuss its implications, and provide some thoughts on topics for future analysis.

2 Overview of Turkey and the Istanbul Stock Exchange

2.1 An Outline of Turkish Economic History

Turkey has undergone various spouts of economic progress and setbacks since its establishment as a Republic in 1920. While it is impossible to describe each of these in sufficient detail to understand all the complexities behind them, we will for the purpose of this paper suffice to provide a broad outline of the main economic periods in order to understand the large role both government policies and external events have played in the health of the Turkish economy.

Starting with immediately after its founding, it may be argued that the major impact of the collapse of the Ottoman Empire on the young Turkish Republic
was a huge debt burden. Nearly all of the 50 final years of the Empire were lost through wars that ended with border losses and devastating destruction of already scarce infrastructure. The extremely costly defence of Dardanelles in Çanakkale and the First World War destroyed the human capital and an additional burden of domestic conflicts increased the human toll in the years that followed. Compared to neighboring countries, Turkey’s infrastructure was insufficient and underdeveloped. It lacked the basic infrastructure for railways, roads, schools, while basic health services were adequate (Gormez et al, 2008). Industry and manufacturing were nearly non existent, with agriculture holding the dominant share in the national economy.

Until 1936, the economic growth rate fluctuated widely, falling by more than 10 percent in some years and growing by more than 15 percent in others. Although Turkey did not enter the Second World War, the state defense costs increased dramatically and these expenses negatively affected economic development efforts and lowered the average growth rate. During the war years between 1940 and 1945, GNP growth was negative except in 1942. On the other hand, inflation was under control and the value of TRY against the U.S. dollar followed a steady course especially after the year 1934 (Gormez et al, 2008).

Following WWII, the country suffered economic disruptions about once a decade. In each case, an industry-led period of rapid expansion, marked by a sharp increase in imports, resulted in a balance of payments crisis. To cope, the International Monetary Fund issued guidelines to devalue the Turkish lira and implement austerity programs to dampen domestic demand for foreign goods. These measures usually led to sufficient improvement in the country’s external accounts to make possible the resumption of loans to Turkey by foreign creditors. The Turkish military, who had held the position of safeguarder of political secularism since Turkey’s founding, staged coups in both 1960 and 1971 partially in response to these economic difficulties and the socially oppressive policies that followed. Still, after each military intervention Turkish politicians failed to implement serious structural reforms, and instead continued to boost government spending.

This caused the economy to overheat - by 1979 inflation was in the triple digits and unemployment had risen to about 15 percent, while industry was using only half its capacity. Financed by external borrowing, this spending furthermore led to chronic current account deficits that made Turkey’s external debt rise from decade to decade - reaching US$16.2 billion by 1980, or more than one-quarter of annual gross domestic product. Turkey could not even pay the interest on these loans, with debt-servicing costs in 1980 equaling 33% of exports of goods and services.

By the late 1970s, Turkey’s economy had thus perhaps reached its worst state since the fall of the Ottoman Empire, with the interventionist and protectionist policies that had been followed since the early 1930s clearly not leading to a healthy economy (Altunbas et al, 2009). To deal with these economic difficulties, Deputy Prime Minister Turgut Özal undertook a program of economic liberalization at
the beginning of 1980 with the aim of integrating the Turkish economy into the world and promoting export-led growth. Özal’s program consisted of several parts (adapted from Watkins, 2000):

- Abandonment of the import-substitution strategy of economic development, in which protectionist measures had fostered uncompetitive local firms
- Devaluation of the Turkish lira and the pursuit of exchange rates which more closely approximate those that would be determined by supply and demand in the market
- Tighter control of the money supply and credit
- Maintainance of positive real interest rates
- Decontrol of prices
- Elimination of subsidies
- Reform of the tax system
- Encouragement of foreign direct investment in Turkey

This liberalization of the Turkish economy brought a substantial increase in export earnings, alleviating Turkey’s balance of payments problems. Turkey was once more able to meet the required payments on its foreign-owned national debt. Still, inflation remained a chronic problem - while it was no longer in the triple digits, it was still high at 25 percent. The effects of the liberalization policy of Özal’s program were obscured by another military takeover of the government in 1980 which ended in 1982 with a new constitution (Watkins, 2000).

Still, during the first half of the 1980’s Turkey’s export performance outperformed other emerging economies (Altunbas et al, 2009). Amendments were made in 1984 to enforce the liberal economic system, reducing state intervention in the economy and abolishing quantitative restrictions (Demir, 2002). It was also here that the Istanbul Stock Exchange was decreed, and the abolishment of all restrictions on foreign investment in securities listed on it. In 1986, the Central Bank then took important steps towards greater autonomy by going away from its prior reliance on public sector credits and interest rates as monetary policy instruments and instead switching to contemporary practices of monetary reserve targeting and open-market operations.

Despite this progress in the 1980s, the 1990s became what has been described as the “lost decade” in terms of banking and financial stability. Failure to control fiscal deficits led to a volatile economic environment with very high inflation rates. In 1994 Turkey experienced a significant economic crisis. Alper and Onis (2003) have stated that this crisis was triggered by two interrelated causes; first, the government’s attempt to control interest rates and level of the exchange rate in a high inflation environment; second, the lowering of Turkey’s credit rating. Consequently, Turkey signed a stand-by agreement with the IMF that helped bring
down inflation to 87% in 1995. However, macroeconomic instability continued until the late 1990s, mainly due to government reluctance in implementing the necessary painful measures (Altunbas et al, 2009).

In 2000-01, Turkey then suffered twin economic crises in the form of a liquidity crisis and banking crisis. Overnight, the number of commercial banks in Turkey dropped from 61 to 46, and the Istanbul Stock Exchange main index fell by 63% in two days (Marois, 2012). To push forward the necessary measures to save the Turkish banking sector from complete disintegration, the Democratic Left Party coalition elected a long time World Bank executive and neoliberal technocrat, Kemal Dervis, as the new Minister for the Economy in March 2001. His background was key in that Dervis’s most pressing task was to get international lenders to offer more debt to Turkey. He also embarked on a program to “separate the economic from the political” (quoted in Banks Association of Turkey, 2001). For example, the Central Bank Law now granted the institution formal independence from the government, and gave it sole responsibility for maintaining price stability. With the Central Bank no longer able to grant loans or extend credit to other state institutions, Turkey was now more than ever shielded against government initiatives financed by inflationary money printing. In retrospect, this crisis thus offered Turkey a chance to restructure and curb the fiscal irresponsibility of the preceding decades (Marois, 2012).

The AKP, or Justice and Development Party, came to power in the aftermath of the 2001 banking crisis. They have continued the post-Washington Consensus policies initiated by Dervis, and in the decade that has followed, Turkey has become a G20 economy. It has had an average growth rate of 6%, and managed to bring inflation under control. Erdogan’s more active foreign policy has ensured that Turkey has also become a more important regional player, and today Turkey is one of the main trading partners of both Gulf states and Balkan countries.

Still, Turkey also faces some clear structural problems. It has a chronic current account deficit financed by international fund managers. It also is nearly completely energy dependent, meaning that if oil and gas prices rise both external financing needs and inflation are likely outcomes (Wall Street Journal, May 2013). The Gezi protests in May 2013 in which thousands of people clashed with police while demonstrating against the demolition of a historical park in Istanbul have furthermore made it clear to the international community that while Erdogan’s economic policies have been largely successful, his social policies are less popular with many in his constituency. Until this uncertainty regarding the political situation in Turkey is resolved, one will most likely observe foreigners being hesitant with making longer term investments in the country. Still, as our investigation includes data only up until May 2013, we do not expect this most recent political turbulence to have an impact on our macroeconomic variables and thereby our results.
2.2 Overview of the Istanbul Stock Exchange

While predecessors existed during the Ottoman Empire, today’s version of the Istanbul Stock Exchange (ISE) was formally inaugurated at the end of 1985. It was part of the larger liberalization effort in Turkey, and so as mentioned earlier the decree which launched the ISE also removed all restrictions on overseas individual and institutional investments in securities listed on the ISE (Tasan-Kok, 2004). We therefore do not have to worry about restrictions on foreign investment in the context of this study. Since then and until 2013, the ISE has been run under a *sui generis* ownership structure: as a semi-governmental organization with a general assembly of the exchange’s members, banks and brokerages that trade on the ISE. The decisions of the assembly were subject to approval by Turkey’s Capital Markets Board in Ankara. In a further sign of the government’s role, the chairman and chief executive were appointed with the approval of the president, prime minister and economy minister (FT.com, 2008).

In 2013 however, the ISE converted to Borsa Istanbul, and in doing so brought together all the exchanges operating in the Turkish capital markets under a single roof. This also converted the ownership structure of Borsa İstanbul into an internal entity under private law, as well as a self-regulatory entity. As described under the ‘Legal Ground’ section of their website:

“In an effort to harmonize the Turkish capital markets regulation with the EU acquis and improve the integration of the Turkish capital markets with the global markets and enhance competitiveness thereof, Turkish law maker has enacted the Capital Markets Law No. 6362 as a reform making law, bringing about not only liberalization of the activity of running organized markets, but also re-structuring and re-branding of İMKB as Borsa İstanbul, which is devised by the said law as a joint-stock company subject to private law, having market stakeholders as shareholders alongside the shares of Treasury, and thus allowing the realization of good governance principles as well. The process of re-branding of İMKB as Borsa İstanbul under the provisions of CML has been completed by the registration of articles of incorporation of Borsa İstanbul on April 3, 2013” (Borsa Istanbul, 2013).

To avoid confusion, we will keep calling the Borsa the Istanbul Stock Exchange (ISE) throughout the study despite this recent name change. Shareholders of the ISE are: 49% Government of Turkey, 41% Borsa Istanbul, 5% VOB, 4% Borsa Istanbul members, 1% Borsa Istanbul brokers and 0.3% IAB members. It is planned that all the Government-owned shares will be offered for sale. The liberalization of the Istanbul Stock Exchange has thus been an important development for both foreign and domestic investors. For foreign investors, the Istanbul Stock Exchange has gradually emerged as a new investment alternative that allows them to benefit from diversification and valuation gaps.
Market capitalization and total traded value on the ISE reached an all time high in 2010, where the market capitalization was at $307,551m and traded value was $425,747mn. After the market capitalization fell dramatically in 2011 to $201,982mn, it is now back at $304,458mn (Borsa Istanbul, 2013). It is the 13th largest stock exchange by market capitalization in Europe, the Middle East, and Africa, ahead of exchanges in Abu Dhabi, Ireland, and Egypt. Out of emerging markets, its total value of shares traded is 7th out of 20 countries (Borsa Istanbul, 2013). This is quite remarkable, considering it is 15th in the same list when it comes to stock market capitalization. This suggests a fairly liquid market.

2.3 Index Profiles

2.3.1 XU100 index profile

The Borsa Istanbul Stock Exchange National 100 Index is a capitalization-weighted index composed of National Market companies except investment trusts. The constituents of the BIST National 100 Index are selected on the basis of predetermined criteria directed for the companies to be included in the indices. The base date is January 1986 and base value is 1 for the TL based price.

Its value reached a historical high in 86’046 million lira in April 2013. After large fluctuations during the financial crisis and during the Gezi Park protests its value is at the time of writing 79’275TRY (Borsa Istanbul, 2014).

The index is today heavily weighted in commercial banks which constitute 36% of the index, as seen in Figure 2.1. Other industries that figure prominently in the index are industrial conglomerates (6%), food retailers (6%), diversified financial services (6%), and beverages (5%). One thing which becomes apparent is that often there are only a few companies representing each of the industries in the GICS classification. This may indicate that firm specific information will be an important contributing factor in addition to the macroeconomic variables in our study. However, we expect that overall this will be largely diversified away through the many industries represented.

The overall Price/Earnings ratio on the Index is 9.60. Investing in the index in 1994 would have resulted in a total return of 41’502%, or 37% annual return, based on the price change only (excluding dividends). Had one invested in 2002, this would have resulted in a total return of 524%, or an annual return of 18%. These are of course nominal returns, so to get real returns one has to adjust for inflation in the TRY in the same period. This compares to a total nominal return on the S&P500 since 1994 of 41’970% (37% annual), and of 72% since 2002 (5% annual).
2.3.2 XUSIN industrials index profile

The Borsa Istanbul National Industrials Index is a capitalization-weighted free float adjusted index composed of listed companies in the industrial sector. Its peak market capitalization took place on May 22nd 2013 at 66’879 mLira. Its average value since 2002 has been 34’073 mLira, with an all time low on June 6th 2002 of 8’234 mLira.

If one began investing in January 2002, reinvesting dividends into the index, one would today have earned a total return of 729%, giving an annual return of 21%. If one excludes dividends, the return becomes 522% or an annual return of 17% just based on the price change (Bloomberg terminal, Dec 2013). Its Price/Earnings ratio is currently 11.66.

The Industrials index is composed largely of firms in the Beverages, Metals & Mining, and Oil & Gas industries. Together, these make up over 50% of the value of the index. Here, the three largest firms are Tupras Turkiye Petrol Rafinerileri AS (Tickr: TUPRS), a gas refinery firm, Anadolu Efes Biracilik Ve Malt Sanayi AS (Tickr: AEFES), the Efes brewery group, and Coca Cola Icecek AS (Tickr: CCOLA), an anchor bottler and a part of the Coca-Cola System. An interesting note about Coca Cola Icecek is that while 25.6% is traded on the public exchange, it is also 50.3% owned by Anadolu Efes.
Figure 2.2: XUSIN Index industry weighting

Source: Bloomberg terminal. Notes: Weightings are from December 2013, and based on the GICS classification of industries

2.3.3 XUHIZ services index profile

The Borsa Istanbul National Services Index is also a capitalization-weighted free float adjusted index, but composed of listed companies in the service sector. It reached its all time high on May 28th 2013 at 57’395 mLira. It’s average over our time period has been 26’082 mLira (Bloomberg, 2013), with a lowest point of 5’355 mLira on June 6th 2002. If one invested at the beginning of 2002 one would today have earned a total returns of 429% or an annual return of 16%, just based on the price change (excluding dividends) (Bloomberg terminal, 2013). Its Price/Earnings ratio is currently 17.07.

There are a number of industries that make up the main part of the services index. Telecommunications, Food & Staples Retailing, and Transportation make up 31%, 30% and 21% of the index respectively.

There are only two firms in the Telecom Services industry, but 9 and 5 members in the two others. This indicates that firm specific information from the Telecom Services Industry may have a large effect on the overall performance of the Services index. The two companies are Turkcell Iletisim Hizmetleri AS (Tickr: TCELL) and Turk Telekomunikasyon AS (Tickr: TTKOM). Turkcell is the leading mobile phone operator of Turkey, based in Istanbul. The company has 34.4 million subscribers as of September 30, 2011 (Turkcell.com). Turkcell is the first Turkish company to be listed on the New York Stock Exchange, where its shares have been traded since July 11, 2000 along with trading on the Istanbul Stock Exchange. Turk Telekom is the former state owned telecommunications company,
which still retains 30% ownership. They provide integrated telecommunication services from PSTN, GSM to wide-band Internet.

Other very large firms that make up the services index is BIM Birlesik Magazalar (Tickr: BIMAS), a food and basic consumer goods retailer, and Turkish Airlines (Tickr: THYAO), the national flag carrier airline of Turkey. Individually, they make up 26% and 16% of the total services index.

2.3.4 XUTEK technology index profile

The Borsa Istanbul National Technology Index is a capitalization-weighted free float adjusted index composed of listed companies in the technology sector. The index’s highest value was on May 22, 2013 at 34’777mLira. It’s lowest was actually during the financial crisis, where it hit a bottom of 4’046 mLira on January 23rd 2009. The average since the start of 2002 has been 13’308mLira. If one invested at the beginning of 2002 one would today have earned a total returns of 254% or an annual return of 12%, just based on the price change (excluding dividends) (Bloomberg terminal, 2013). This is lower than the other indexes, and indicates that the Technology industry in Turkey has not developed as much as other industries. It’s Price/Earnings ratio is currently 27.54.

Looking at its industry weightings, one finds that it is 55% composed of the Aerospace & Defence industry, and further that there is only one firm in this category. The name of the company that has this large representation on the index is Aselsan Elektronik, and it is a company that provides military communication
systems – mainly to the Turkish government. As Turkish government spending can be argued to depend on the state of the economy, one can already sense that the general macroeconomy may have a large effect on the Technology index.

2.3.5 XUFIN financials index profile

The Borsa Istanbul National Financials Index is a capitalization-weighted free float adjusted index composed of listed companies in the financial sector. The index’s highest value was 98’218 on May 22nd 2013, and its lowest value since 2002 was 10’452 mLira (24 March 2003). The average value since 2002 has been 60’453 mLira. If one invested at the beginning of 2002 one would today have earned a total returns of 460% or an annual return of 16%, just based on the price change (excluding dividends). It’s Price/Earnings ratio is currently at 8.16.

The financial index is heavily weighted in commercial banks, which make around 62% of the index value. In contrast to some of the other indices however, we see here that there are a larger number of companies in the primary industry: there are 16 commercial banks. Likewise, in the second largest industry group of Industrial Conglomerates, we find that there are 10 members. This should reduce the appearance of very firm specific effects on the index.
2.4 Chapter Conclusion

This chapter reviewed Turkish economic history since WWII, gave some background to the Istanbul Stock Exchange, and outlined some of the main characteristics of the indices we will be performing our tests on.

Specifically, the history section described the move from the import-substitution approach to development towards a more export oriented economy. It also outlined the large role the Dervis/IMF restructuring plan which was enacted after the 2000-1 banking crisis played in curbing government spending, and how it lead to a more stable economy. Section 2.2 on the ISE then connected the liberalization of the 1980s with the creation of an exchange without foreign restrictions on investment, which today is the 7th largest in a ranking of 20 emerging markets. Finally, our section on the various indices outlined some key statistics and their sector weightings, and commented on the fact that quite a few seemed to have 1-2 companies make up a large percentage of the index. Having given some background to our study, we will now proceed to outlining the method we will employ when performing our research.

3 Method

This section of the paper outlines what methods will be employed in data collection and analysis in order to produce reliable and valid findings.
3.1 Research Philosophy

Research philosophy relates to the development of knowledge and the nature of that knowledge (Saunders, Lewis, Thornhill, 2009). As the research philosophy we adopt contains some important assumptions about how we view the world, we find it important to outline these. Our ontology can be seen to be objectivism, in that we hold the position that “social entities exist in reality external to social actors concerned with their existence” (Saunders et al, 2009). In other words - the world exists independently of our observation of it. Epistemology outlines what constitutes acceptable knowledge in a field of study. Here, our study is done in the positivist tradition as we use a highly structured methodology and work with observable data to in the end derive certain generalizations. While we acknowledge the likely influence that past perceptions and experiences will have even in a study such as this, we aim to undertake our research in a value free way.

3.2 Research Approach

Business research approaches are commonly distinguished between quantitative research and qualitative research. The quantitative research strategy is characterized by emphasizing the use of numbers in a data analysis whereas the qualitative strategy usually emphasizes the use of non-numerical approaches (Bryman & Bell, 2003). As will be explained in the research strategy, this thesis relies heavily on the use of quantitative data while building on a qualitative review of literature which guides our selection of data and informs the interpretation of our results. In terms of the nature of the relationship between theory and research in our study, our approach can largely be said to be deductive. We concern ourselves with quantitative testing and methods based on existing knowledge within a particular field, from which hypotheses are deducted, tested, rejected or confirmed, rather than theory building as under an inductive research approach (Bryman & Bell, 2003).

3.3 Research Strategy

The figure below presents our research strategy.

Figure 3.1: Research strategy for this paper

Here one can see that we start with the development of the research question and move through to the literature review, data collection, econometric analysis,
and interpretation, before concluding on the overall implications. To get a better understanding of the method employed in this study, we will now detail each of the steps of our research strategy.

3.3.1 Development of research question

The analysis of determinants of stock market returns is a classic area of study within finance. Our initial interest for writing about Turkey was sparked by the press coverage of the Gezi park protests there in May 2013, and subsequent articles on the state of the Turkish economy. One factor which quickly became evident from the massive drop in the stock exchange is how vulnerable Turkey is to political disruption. In this light we set out to investigate the link between the public sector and the Istanbul Stock Exchange. To get an idea of knowledge gaps that we might fill, we started by investigating previous studies written on the Istanbul Stock Exchange. Given our existing knowledge regarding Turkey’s fluctuating macroeconomic variables as well as lack of recent studies on this topic, we were compelled to look further into how this has had an effect on the returns on the stock exchange over time.

3.3.2 Literature review

The literature on the long-run influence of macroeconomic factors on the stock market was found in a variety of books and databases. The theoretical literature review was put together after an extensive review of macroeconomic as well as financial models. In each case we tried to determine what predictions these models could make. The empirical literature was collected from primarily financial and economic journals. The Journal of Financial Economics provided us with several articles that informed our methodological approach, particularly in relation to our choice of tests. Please refer to the References section at the end of this paper for a complete list of the sources used.

3.3.3 Data collection and choice of variables

We chose to analyze the Istanbul Stock Exchange for a number of reasons. First and foremost, we believed it would make an interesting case study due to the fluctuating nature of Turkish macroeconomic factors over time. Secondly, we chose it due to the availability of data on sector indices, allowing for the testing of more fine tuned nature where we can observe the effects hidden in the whole. This is especially important in the case of the Istanbul Stock Exchange because it is very financial sector heavy – 36% of the national index is banks alone (Figure 2.1). The study focuses on one aggregate stock index, namely the Istanbul Stock Exchange XU100 National 100 Index, and four sector indices. A stock market index is a
listing of stocks and a statistic reflecting the composite value of its components. It is used as a tool to represent the characteristics of its component stocks, all of which bear some commonality such as trading on the same stock market exchange, belonging to the same industry or having similar market capitalization.

We picked the Borsa Istanbul Stock Exchange XU100 National Index as the dependent variable in our overall regression analysis, as this variable captures the overall performance of the market as well as other performance measures such as market capitalization, liquidity, and turnover ratio. The sector indices were chosen not only according to their relative size and importance to the Turkish economy, but also according to the availability of data. We found monthly data on the Industrials index (XUSIN), Services index (XUHIZ), Technology index (XUTEK), and Financial index (HUMAL) on a Bloomberg terminal available at Copenhagen Business School. While such time series are by default price indices, we have seen relatively stable dividends (particularly since 2002) and therefore do not see any significant issues with using this data.

Following the review of literature as well as expert interviews with specific knowledge about Turkey (see Appendix 1), five macroeconomic variables were chosen, namely:

1. Turkish Real Effective Exchange Rate (LEX)
2. USD to Turkish Lira Nominal Exchange Rate (LUSD)
3. Turkish Industrial Production (LIND)
4. Inflation (LCPI)
5. Turkish Interbank Lending Rate (LINT)

These variables have been viewed as important determinants of stock market behavior, since each features prominently in the Turkish economy. Moreover, these variables have featured in numerous past studies (Jefferis and Okeahalam, 2000; Moolman and du Toit, 2005; Pyman and Ahmad, 2009; Hussainey and Ngoc, 2009) that are of a similar nature. Data availability was of course also a determinant for which measure we chose – having figures that go back to two decades was a criteria. Most of the data was sources from Bloomberg, as well as the Turkish Central Bank and the OECD’s statistical websites. All data points were found in monthly frequency. Except for the interbank lending rate which is quoted as a percentage change, all the variables are transformed into natural logs to reduce multicollinearity and assume linearity. Table 1 summarizes the variables and their measurement.

The longer time period for our XU100 data allows for a time series analysis split up into various economic histories. We choose to look at relationship both for the overall time period, but also separately for the two decades featured in our data,
from 1994-2001, and 2002-2013. This is especially useful when looking at the effect of the banking crisis and financial reform period in 2001. All sector indices have data starting in 2002 and ending in 2013. This will thus allow us to look at the effect of macroeconomic variables following the 2001-2002 banking crisis, where many institutions were strengthened. We will also be able to compare our sector results to the insights found on the general market index, the XU100. Summary information about the stock market indicators are presented in Table 2.

### 3.3.4 Econometric testing of historical data

The first part of this study centers on the effects predicted by theory. However, looking at only economic theory would not tell us the process by which variables are linked, or the factor model that can give a pointer as to the effect of each on the various indices going forward. It is therefore important to turn to statistical methods to help us determine such relations. The proper application of these methods are dependent on a number of assumptions. We will now explain the importance of these assumptions and how we test for them.

#### The problem with stationarity and choice of method

In time-series regressions the data need to be stationary in order for the usual econometric procedures to have the proper statistical properties. Basically this requires that the means, variances and covariances of the time-series data cannot depend on the time period in which they are observed (Adkins, 2013). The most important property of a stationary process is that the auto-correlation function (acf) depends on lag alone and does not change with the time at which the function was calculated. The property of stationarity is important because it allows one to avoid the problem of spurious regressions. Spurious regressions occur when one finds statistically significant relationships between the variables in the regression model when in

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#### Table 1: Variable and model description summary

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Unit</th>
<th>Time Period</th>
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<tbody>
<tr>
<td>LXU100</td>
<td>LOG of XU100/NATIONAL 100 INDEX</td>
<td>PRICE INDEX</td>
<td>1/1994 - 3/2013</td>
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<tr>
<td>LXUSIN</td>
<td>LOG of XUSIN/INDUSTRIALS INDEX</td>
<td>PRICE INDEX</td>
<td>1/2002 - 3/2013</td>
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<td>LXUHZ</td>
<td>LOG of XUHZ/SERVICES INDEX</td>
<td>PRICE INDEX</td>
<td>1/2002 - 3/2013</td>
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<tr>
<td>LXUTEK</td>
<td>LOG of XUTEK/TECHNOLOGY INDEX</td>
<td>PRICE INDEX</td>
<td>1/2002 - 3/2013</td>
</tr>
<tr>
<td>LXUMAL</td>
<td>LOG of XUMAL/FINANCIALS INDEX</td>
<td>PRICE INDEX</td>
<td>1/2002 - 3/2013</td>
</tr>
<tr>
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<td>LOG of REAL EFFECTIVE EXCHANGE RATE</td>
<td>PRICE INDEX</td>
<td>1/1994 - 3/2013</td>
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<td>LUSD</td>
<td>LOG of NOMINAL EXCHANGE RATE</td>
<td>USD/TRY</td>
<td>1/1994 - 3/2013</td>
</tr>
<tr>
<td>LIND</td>
<td>LOG of INDUSTRIAL PRODUCTION</td>
<td>PRICE INDEX</td>
<td>1/1994 - 3/2013</td>
</tr>
<tr>
<td>LCPI</td>
<td>LOG of CPI LEVEL</td>
<td>PRICE INDEX</td>
<td>1/1994 - 3/2013</td>
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<td>INT</td>
<td>INTERBANK LENDING RATE</td>
<td>PERCENTAGE</td>
<td>1/1994 - 5/2013</td>
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Table 2: Main indicators of the ISE indices and macroeconomic variables, YOY
% Change

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<tr>
<th>Year</th>
<th>XU100</th>
<th>Industrials</th>
<th>Services</th>
<th>Technology</th>
<th>Financials</th>
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<th>TRYUSD</th>
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<td>55%</td>
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<td>26%</td>
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<td>32%</td>
<td>43%</td>
<td>0%</td>
<td>3%</td>
<td>9%</td>
<td>1%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: Bloomberg, Istanbul Stock Exchange database
fact all that is obtained is evidence of contemporaneous correlations rather than meaningful causal relations (Harris, 2003). As we are looking to test for relationships between macroeconomic data and returns on the stock exchange, it is thus essential that we avoid drawing the wrong conclusions due to a spurious regression. Such issues are more pronounced with non-stationary data, as a common time-dependent underlying factor could be driving the seeming causality.

The simplest way to explain the issue of spurious regressions is by providing a graphical example:

Figure 3.2: Example of data that may lead to spurious regressions

Take the two time series plotted in figure 3.1. If one ran a direct regression on R20 and R30, one would most likely get statistical output that said that one was causing the other with a very high statistical significance, close to 0.99 $R^2$ value (suggesting very high explanatory power), and an extremely small standard error. This does of course not have to be the case, as there could be a common underlying reason or completely random reasons as to why these variables move together - such as the weather if R20 was apple stocks and R30 was orange stocks. This is the problem of spurious regression in econometrics which one often finds in non-stationary variables such as financial time series.

It is however generally accepted that very few financial variables exhibit stationarity over time. Instead they tend to have differing means at different points in time, and a variance which increases with sample size. It thus becomes important with a method that can allow for testing of long-run relations despite of this. The cointegration method is the only method that allows one to infer causal relationship(s) between non-stationary time series (Harris, 2003). There are two traditional methods for testing long-run relationships – The Engle-Granger Test (Engle and Granger, 1987) and the Johansen Cointegration Test (Johansen and Jesulius, 1990). Both approaches have benefits and complications. Whereas the
Engle-Granger approach has the setback of not being able to identify multiple cointegrating vectors and suffers from an inability to accommodate the possibility of simultaneity in the causal relationship among variables, the Johansen approach is less understood and leaves the problem of testing for significance of each of our parameters harder.

Given its popularity in previous studies and the recommendation of Econometrics Professor Lisbeth La Cour at Copenhagen Business School, we will employ the Engle-Granger test. The Engle-Granger model (EGM) uses a vector error correction model (VECM) to test for the long-run relationship between the variables. For the VECM we first determine the order of integration of the variables, making use of Augmented Dickey-Fuller test to test for unit roots, and then apply the Granger procedure. We will now outline each step of the cointegration method employed in this study.

Testing for stationarity While financial data may be nonstationary, it is important that they have a unit root. In practice this means that a nonstationary variable becomes stationary after it is differenced (although not necessarily just first-differencing – the number of times it needs to be differences in order to induce stationarity depends on the number of unit roots it contains). To understand this concept of unit roots better, let us look at a simple equation (Adapted from Harris, 2003):

\[ y_t = \rho y_{t-1} + u_t \]

Here, current values of the variable \( y_t \) depend on last period’s value \( y_{t-1} \) plus a disturbance term \( u_t \), the latter encapsulating all other random (i.e. stochastic) influences. It is assumed that this disturbance term comprises \( T \) random numbers drawn from a normal distribution with mean equal to 0 and variance \( \sigma^2 \). The variable \( y_t \) will be stationary if \( |\rho| < 1 \). If \( |\rho| = 1 \), then \( y_t \) will be non-stationary. If \( |\rho| > 1 \), then \( y_t \) will be non-stationary and explosive, meaning it will tend to either \( \pm \infty \) (rare case). A stationary series will thus tend to return to its mean value, and have a more or less constant variance. Unit roots help us determine if a variable is stationary. To see this, we rewrite the above equation as:

\[ (1 - \rho L) y_t = u_t \]

where \( L \) is the lag operator (i.e. \( L y_t = y_{t-1}, L^2 y_t = y_{t-2}, \text{etc} \)). By forming a characteristic equation (i.e. \( 1 - \rho L = 0 \)), we see that if the roots of this equation are all greater than unity in absolute value then \( y_t \) is stationary. In this example, there is only one root \( (L = 1/\rho) \), thus stationarity requires that \( |\rho| < 1 \) (Harris, 2003).

If a series must be differenced \( d \) times before it becomes stationary, then it contains \( d \) unit roots and is said to be integrated of order \( I(d) \). If a linear combination of any two time series \( y_t \) and \( x_t \) is formed and each is integrated of a different order, then the resulting series will be integrated at the highest of the two orders.
of integration. Thus if $y_t \sim I(1)$ and $x_t \sim I(0)$, then these two series cannot possibly be cointegrated as the $I(0)$ series has a constant mean while the $I(1)$ series tends to drift over time, and consequently the error between them would not be a constant over time. Cointegration requires that if $y_t$ and $x_t$ are both $I(d)$, and if there exists a vector $\beta$ such that the disturbance term from regression $(u_t = y_t - \beta x_t)$ is of a lower order of integration $I(d - b)$, where $b > 0$, then $y_t$ and $x_t$ are cointegrated of order $(d, b)$. Before beginning to perform cointegration tests, we thus have to confirm that the variables are difference stationary, rather than deterministic. This is done through the unit root test.

In this paper, we employ the Augmented Dickey-Fuller (ADF) approach (1979) to this end. It tests the null hypothesis of there being a unit root in the series (i.e. the series is not stationary), with the alternative of there being no unit root. We test for the unit roots in the level of the data first. If we are not able to reject the null hypothesis about the unit root we run the ADF on the first differences of the original time series. In this step, we should be already able to reject the null hypothesis about the unit root in order to be able to conclude that the original time series are $I(1)$ or have one unit root.

ADF tests require one to define the number of lagged values of the variable to include. There is however no universal rule for how to determine the number of lags to be used in the ADF regressions. Said and Dickey (1984) found that the order of $T^{(1/3)}$ was sufficient (where $t= \text{number of time periods} + 1$). Schwert (1989) on the other hand, suggested that one set the number of lags equal to:

$$p_{\text{max}} = \left[12\left(\frac{n}{100}\right)^{0.25}\right], \text{ where } n = \text{sample size}$$

Selection based on Schwert’s formula results in a relatively large lag length in small samples ($\sim 100$) and a modest one when the sample size is large ($\sim 10,000$), which is reasonable, because one would want to include as large number of a lag terms as feasible in finite samples and not too large when $T \to \infty$. In practice, the principle to follow is to include just enough so that the residuals of the ADF regression are not autocorrelated. The recommendation we have followed in this study is to start with a relatively large lag number (based on Schwert’s formula), and to then test down using the option in the statistical software (Adkins, 2013).

**Testing for cointegration** Following our unit root test, we then estimate the long-run relationships by running a regression on the equations and the first differences of the equation. We save regression residuals, and test whether the residuals are stationary again using the standard ADFt. The procedure is the same as before. If we are able to reject the null hypothesis about the unit root, we can conclude that the variables are cointegrated of the orders $CI(X,Y)$. Determining whether or not there is a long-run cointegrating relationship is important as it will allow us to modify our tests for the effect of the variables on the Istanbul Stock Exchange accordingly.
Creating a factor model  If there is a long-run cointegrating relationship be-
tween the variables, this needs to be accounted for in our tests. The way this is
done in practice is by saving the residuals from the initial OLS regression con-
ducted when testing for cointegration, and then adding these (lagged once) to
our regression equation, giving us the vector error correction model (VECM).
The VECM thus has co-integration relations built into the specification so that
it restricts long-run behavior of the variables to converge to their co-integrating
relationships while allowing for short-run adjustment dynamics. This lagged term
is called the Error Correction Term since the deviation from long-run equilibrium
is corrected gradually through a series of partial short-run adjustments, and ex-
plains why the overall model is called a VEC model. Note that our regression
requires all variables to be I(0) to avoid the problem of spurious regressions, and
so we take the difference of those variables that were determined to be I(1) or I(2)
in our ADF tests (Harris, 1995).

If there is no cointegration between our variables, we can conclude that there is
no long-run relation at least among this combination of variables. In this case
we simply run a regular regression on the differences of our variables, giving us a
factor model. As there is no long-run trend to take into consideration, we again
just difference the time series so they become stationary. In other words, the only
change is that there is no long-run error correction term.

3.3.5 Analysis

Following our deductive reasoning approach, our interpretation chapter (Chapter
7) uses the values found in the above analysis to inform a discussion on what
these results might tell us. We approach our analysis from the three main angles
covered in our literature review: portfolio theory, macroeconomic theory, and real
world evidence. Using insights from these we then try to explain our results and
answer our research questions, particularly in relation to how effects change over
time and across sectors. Together we hope that this will allow us to draw some
valuable insights for policy makers and investors alike.

Our conclusion chapter then delivers a summary of our main discoveries and use
the insights gained from the analysis to provide some advice for investors and
legislators.

3.4 Generalizations

As our method is largely a case study approach, the ability to generalize from our
findings is in essence limited. Still, case studies provide a forum for highlighting
perhaps more detailed insights and areas for further research. Furthermore, our
method can be used in general to evaluate other stock markets at a later date. Per-
haps most importantly, as this study evolved out of Fama’s (1991) encouragement
of work “that relates cross section properties of expected returns to the variation of expected returns, through time, and ( . . . ) relates the behaviour of expected returns to the real economy. . .” (Fama, 1991, p. 1610), this study can be seen as a small part of that effort - to be combined with all the others that have been done during the last two decades. Together, these lead to valuable insights about the financial markets-government nexus.

3.5 Demarcations

This paper does not seek to cover all macroeconomic variables, nor does it look at the entire price history of the Istanbul Stock Exchange. Rather, by using a select number of variables identified through theoretical and empirical literature, we hope to create a more robust model.

We also recognize the presence of non-macroeconomic influences on the Istanbul Stock Exchange. For example, most stock markets in the world are correlated with the US stock exchanges and this could potentially have a great effect. Furthermore, the Istanbul Stock Exchange may be impacted by the fact that it is included under general emerging markets indices. Thus when investors reduce their exposure to emerging markets, even if it is because they do not like South East Asian or Latin American stocks, they also sell their exposure in Turkey – which again may effect the price levels on the exchange. While we recognize these potential effects, we choose here to focus on the effect of national macroeconomic variables and will therefore not be including other exchanges in our model.

A practical demarcation of our study is that due to ongoing events in the markets and in Turkey, we have had to select a cut off point for the data included. As the time series we drew from Bloomberg ends in May 2013, we therefore choose to only include data, news, and considerations published before the end of this year.

3.6 Limitations

As in most studies in econometrics, there are limitations to the approaches used. One limitation of our study is the fact that due to data availability constrictions, we are using price indices. As these do not include dividend payments, we can risk not modeling returns correctly. This is especially the case if dividends tend to fluctuate a lot. However, as price indices are most commonly used in other studies we hope that this will still yield meaningful results.

3.7 Chapter Conclusion

In the above chapter we have outlined the method we will be employing to answer our research questions. Taking our basis in the positivist tradition, our study
will be informed by a mixture of theory and empirical data testing. Within our empirical tests, we will be using Engle-Granger cointegration analysis combined with other regression analyses to draw out meaningful results. Before performing our tests however, we will now turn to our literature review to understand what theory predicts the effect of macroeconomic variables on the ISE will be.

4 Literature Review

In this section we will be providing a literature review and in the process aim to answer our first sub research question: How can we use modern economic and financial theory to predict the relationship between stock returns and macroeconomic variables? In this, it quickly becomes apparent that there is no single theoretical framework that can inform our predictions. As such, we have found it necessary to immerse ourselves in different branches of financial and macroeconomic literature. This section details the key insights from each of these areas, and concludes with a summary of the resulting theoretical predictions. The setup of the chapter can thus be seen in Figure 4.1:

Figure 4.1: Chapter overview

4.1 Review of Financial Theoretical Literature

Financial theoretical literature spans a wide range of models used to understand stock prices and returns. We will here outline the five main models: The efficient market hypothesis, the capital asset pricing model, arbitrage pricing theory, the present value model, and the Gordon growth models. As will be seen, the second and third model are more 'top down' than the final two. This is because the present value model and Gordon growth models employ firm specific information, such as dividends and the firm discount rate, to a much greater extent when valuing securities.
4.1.1 Efficient market hypothesis

An efficient capital market is one where stock prices adjust rapidly to the arrival of new information, ensuring that current prices reflect all available information about the security. What this means is that no investor should be able to employ readily available information in order to predict stock price movements quickly enough so as to make a profit through trading shares.

Championed by Fama (1970), the efficient market hypothesis (EMH) usually defines markets as exhibiting strong, semi-strong, and weak-form efficiency. Strong efficiency indicates that stock prices contain all available information, including private and publicly available information. Semi-strong form efficiency removes the requirement of reflecting private information, and states that stock prices must contain all relevant information including publicly available information. Finally, weak form efficiency still asserts that future prices are random and cannot be predicted, but allows for investors to be able to earn excess returns in the short run. Still, all three forms conclude that investors cannot earn excess returns by using technical analysis and the like in the long run.

The EMH has important implications for both policy-makers and the stock-broking industry. If it holds true, policy makers may feel free to conduct national macroeconomic policies without the fear of influencing capital formation and the stock trade process. As for the effect of macroeconomic variables such as interest rates on stock prices, the efficient market hypothesis suggests that competition among the profit-maximizing investors in an efficient market will ensure that all the relevant information currently known about changes in macroeconomic variables are fully reflected in current stock prices, so that investors will not be able to earn abnormal profit through prediction of the future stock market movements (Chong and Koh, 2003).

The claim that only 'new' news affects asset values has been much more difficult to substantiate, however. Several studies of security pricing have challenged the view that stock price movements are completely attributable to the arrival of new information. Roll’s (1985) analysis of price fluctuations in the market for orange juice suggests that news about weather conditions, the primary determinant of the price of the underlying commodity, can explain only a small share of the variation in returns. Shiller’s (1981) claim that stock returns are too variable to be explained by shocks to future cash flows, or even by plausible variation in future discount rates, is also an argument for other sources of movement in asset prices. Frankel and Meese (1987) report similar difficulties in explaining exchange rate movements. French and Roll (1986) demonstrate that the variation in stock prices is larger when the stock market is open than when it is closed, even during periods of similar information release about market fundamentals. All of these studies therefore bring into question the absoluteness of the EMH, and highlight the importance of the human element in financial markets. As a testament to the
importance of these human heuristics, behavioral finance is an entire field of study
that has emerged to explain such anomalies.

4.1.2 The capital asset pricing model

The Capital Asset Pricing Model (CAPM) uses a diversification argument implicit
in capital market theory to explain why only general economic state variables
will influence the pricing of large stock market aggregates (Chen et al, 1984).
Developed by Sharpe (1964), Lintner (1965, 1969) and Mossin (1966), it is used to
investigate the effect of risk on the expected return of an investment relative to the
market portfolio. Macroeconomic factors underpinning the economy represent the
main source of risk, and will therefore be the primary source of returns difference.
The propensity of a stock or a group of stocks to react to the market risk measure
is summarized by the Beta (β) factor in the CAPM model:

\[ E(R) = r_f + \beta (r_m - r_f) \]

From this equation it becomes apparent that there are a number of ways macroeco-
nomic factors can influence returns. Firstly, unanticipated changes in the riskless
interest rate will influence pricing, and through their effect on the time value of
future cash flows, they will influence returns. Secondly, the discount rate also
depends on the risk premium; hence, unanticipated changes in the premium will
influence returns. Thirdly, any macroeconomic factor that affect the market risk
premium will also change expected returns. There are thus three main avenues
through which the macroeconomic factors we will study can translate into stock
price movements on the ISE.

The equity risk premium, or Rm-Rf (+ some adjustments), is furthermore inter-
esting from an investor’s perspective as it is the factor that compensates investors
for taking on the relatively higher risk of the equity market. The premium is the
excess over the risk free rate, often quoted as the rate on (relatively) safe govern-
ment bonds. The size of the premium will vary as the risk in a particular stock, or
in the stock market as a whole, changes; high-risk investments are compensated
with a higher premium. Thus looking at the underlying fundamentals of the Turk-
ish economy and taking the global outlook of today’s investors by comparing the
risk premiums becomes quite relevant.

There are three primary ways of calculating the equity risk premium: 1. Surveys
— The reporting of ERP estimates based on surveys conducted by investors,
adventists and financial professionals. 2. Ex-post method — The derivation of
ERP estimates based on historical returns of equity securities in excess of the risk-
free rate. 3. Ex-ante method — The derivation of the ERP implied by current
market prices and expected future benefits (e.g., dividends, stock appreciation)
(Grant Thornton, 2012). In a survey by Fernandez, Aguirreamalloa, and Corres
of nearly 4000 investment professionals and professors, the equity risk premiums
used in 2013 for 56 countries was mapped out. Out of these 56 countries, Turkey
came out as having the 9th highest equity premium – exhibiting more risk than countries like Brazil and Russia. On the other hand, Argentina and India were deemed to have a higher equity premium than Turkey in this year. While this relationship does not necessarily remain constant each year, comparing the results for one year gives some idea of investor’s perceptions of Turkey’s equity market.

Figure 4.2: Equity risk premium comparison across countries

Source: Fernandez, Aguirreamalloa, and Corres, 2013

The CAPM itself has drawn several criticisms however. Roll (1977) suggests that the market portfolio factor presents a key weakness in the CAPM, since it does not state the assets to be included or excluded in the market portfolio. Furthermore, its underlying assumptions that investors may borrow and lend at the risk-free rate, that there are no taxes and that short selling of securities is unrestricted, and the behavior assumption that investors are risk averse who aim to maximize their wealth have all been questioned.

4.1.3 Arbitrage pricing theory

The Arbitrage Pricing Theory (APT) attempts to deal with these shortcomings and expands the CAPM by allowing for multiple sources of risk to explain asset returns, instead of simply market risk:

\[
E(R) = \alpha + \beta_1 F_1 + \beta_2 F_2 + \ldots + \beta_N F_N
\]

where \( F_1, \ldots, F_n \) are unspecified factors. If the factors are returns on a mean-variance portfolio, the equation holds exactly.

Championed by Ross (1976), this approach is often preferred to CAPM as it corresponds well with empirical studies which show that factors such as whether the
index is weighted toward firms with small capitalization can lead to additional liquidity premiums. In terms of our study, one can see how here a change in a given macroeconomic variable could be seen as reflecting a change in an underlying systematic risk factor influencing future returns (Humpe & Macmillan, 2007). The openness of this approach is however in many ways its downfall, as it does nothing to specify limits as to which factors should be taken into consideration. Furthermore, it is subject to the same underlying assumptions and thereby criticisms as the CAPM.

4.1.4 Present value model

An alternative, but not inconsistent, approach to the aforementioned models is the discounted cash flow or present value model (PVM). Contrary to the previous two models however, this model uses a more bottom up approach in valuing stocks. Specifically, this model relates the stock price to future expected cash flows and the future discount rate of these cash flows:

\[ p = \frac{E(C)}{k}, \]

where \( c \) is the dividend stream and \( k \) is the discount rate. The share price depends upon the expected stream of dividend payments and the market discount rate. Still, as before, all macroeconomic factors that influence future expected cash flows or the discount rate by which these cash flows are discounted should have an influence on the stock price. The relationship predicted by this equation is outlined by Chen (1984):

“The discount rate changes with both the level of rates and the term-structure spreads across different maturities. Unanticipated changes in the riskless interest rate will therefore influence pricing, and, through their influence on the time value of future cash flows, they will influence returns. The discount rate also depends on the risk premium; hence, unanticipated changes in the premium will influence returns. Changes in the expected rate of inflation would influence nominal expected cash flows as well as the nominal rate of interest. To the extent that pricing is done in real terms, unanticipated price-level changes will have a systematic effect, and to the extent that relative prices change along with general inflation, there can also be a change in asset valuation associated with changes in the average inflation rate. Finally, changes in the expected level of real production would affect the current real value of cash flows. Insofar as the risk-premium measure does not capture industrial production uncertainty, innovations in the rate of productive activity should have an influence on stock returns through their impact on cash flows.”

A related tool that comes out of the PVM is that one can find the present value of a firm’s future investments. This is calculated by finding the difference between the price of equity with constant growth and the price of equity with no growth.
PVGO = P(Growth) − P(No growth) = \frac{D_1}{r-g} - \frac{E}{r}, where D_1 = Dividend for next period, r = Cost of Capital or the capitalization rate of the company, E = Earning on equity, and g = The growth rate of the company.

This tool may become important later as we analyze different sectors where the present value of future growth opportunities play a smaller or larger part in the company stock price compared to current cash flows. The advantage of the PVM model is thus that it can be used to focus on the long-run relationship between the stock market and macroeconomic variables. It is however critiqued for being too simplistic and static in its approach.

### 4.1.5 Gordon growth models

The Gordon Growth Model proposed by Gordon (1962) tries to account for the simplicity of the Present Value Model by allowing for both changes in dividends and different discount rates during the lifetime of a stock. The assumption of a fixed dividend was dealt with by the addition of a growth factor for dividends, allowing them to grow at a constant or steady rate into the future. Thus the Gordon growth model formula says that the value of common stock at time 0 ($V_0$) is equal to the dividend next period ($D_1$) divided by the required return on common equity ($r$) minus the constant growth rate for dividends ($g$):

$$V_0 = \frac{D_0(1+g_s)}{r-g} = \frac{D_1}{r-g},$$

where $V_0 =$value of common stock, $D_1 =$dividend next period, $r =$cost of capital, and $g =$growth rate of dividends.

Again, the Gordon growth models can be seen to be more 'bottom up' in its approach to valuing securities.

However in the long run a firm is unlikely to experience constant dividend growth due to the cyclicity of expected profits. As a result, the GGM has been further modified to a Two-Stage Gordon Growth Model (Damodoran, 2011):

$$V_0 = \sum_{t=1}^{n} \frac{D_0(1+g_s)^t}{(1+r)^t} + \frac{D_0(1+g_s)^n x (1+g_l)}{(1+r)^n x (r-g_l)} ,$$

where $V_0 =$value of common stock, $D_0 =$dividend this period, $r =$cost of capital, and $g_s =$growth rate of dividends in the short run, $g_l =$growth rate of dividends in the long run.

In this model, the first stage of rapid growth abruptly transitions to a second stage of constant growth. The formula says that the value of common stock at time 0 is equal to two terms: the discounted stream of dividends during the high-growth phase, which grows at $g_s$ (the short-term growth rate); and the present value of the dividend stream growing in perpetuity at $g_l$ (the long-term growth rate). A firm that is expected to have a high rate of growth until patents expire, for example, could usefully be modeled by this two-stage model, with one rate of growth before the patent expires and another rate thereafter. The model assumes that earnings eventually decline to a long-term rate equal to that of the economy. There are however two main limitations associated with this model. The first is that it is difficult to determine the length of time for which there is high growth. Second,
the model assumes that the stable growth period follows instantaneously after the initial period of high growth. Realistically, these changes are likely to occur over a period of time (Damodaran, 2011).

As a result of these critiques of the two-stage Gordon Growth Model, we have today seen the development of the three-stage Gordon Growth Model. This allows for three periods of growth: a stable high growth period, a declining growth period and a lower stable period. Through this, the three-stage GGM provides increased flexibility in accommodating periods of inconsistent growth. However, the three-stage GGM is empirically more advanced than previous versions since a larger number of variables are required.

Importantly in terms of our study and research question, all of these dividend discount models elucidate on the various factors that may influence a stock’s price, but also the channels in which macroeconomic forces may influence stock prices.

4.1.6 Summary: The financial relationship between macroeconomic variables and the equity market

In summary, we can see that the five models that form a large part of portfolio theory use slightly differing methods to understand stock price developments, with some focusing on risk while others discount firm specific cash flows. While portfolio theory is silent on the effect of a number of macroeconomic factors on stock prices, we can nonetheless use the above frameworks to develop three main conclusions about what they would predict the various relationships between our variables and stock exchange performance would be.

Firstly, inflation can be seen to impact stock prices through the impact on future earnings and the manner that investors discount these future earnings. Participants in the stock market anticipate the changes in real activity, so that stock prices appear to move inversely with inflation. This is supported by studies by Fama (1981), Chen et al (1986), and Wongbangpo and Sharma (2002).

Secondly, the models predict that an increase in interest rates would increase the discount rate and thus negatively affect the value of stocks. As nominal interest rates increase, it also encourages the investor to change the structure of his portfolio in favor of bonds and vice versa. As a result of the drop in demand, stock prices are expected to decrease. Modigliani and Cohn (1979) state that interest rate is one of the most important determinants of stock prices.

Thirdly, exchange rates can be seen in the light of particularly the APT model, where exchange rate risk could figure as a separate risk factor. Here, the final effect on a stock price would be a function of how susceptible the firm is to exchange rate fluctuations through for example foreign operations. One can also look at the effect of currency appreciation on the stock market as a whole, by seeing how investor behavior changes. According to Tian (2009): “One could argue that
changes in stock prices may influence movements in exchange rates via portfolio adjustments (inflows/outflows of foreign capital). If there were a persistent upward trend in stock prices, inflow of foreign capital would rise. However, a decrease in stock prices would induce a reduction in domestic investor wealth, leading to a fall in demand for money and lower interest rates, causing capital outflows that would result in currency depreciation. Therefore, according to this portfolio balance approach, changes in stock prices would influence exchange rates in the same direction. Overall, there is however no theoretical consensus on either the existence of a relationship between stock price and exchange rate or its direction.

Finally, the predictions of the efficient market hypothesis deserves to be mentioned separately. In its most extreme form (strong efficiency), the EMH suggests an insignificant relationship between all macroeconomic indicators and the stock exchange, as any released information should already be priced in to securities. Based on the results of previous studies which have shown that this high degree of efficiency is very rare however, we might instead limit this insignificance to the industrial production factor investigated, since the information on the level of production is very much already present in the market (this figure is collected ex-post), while our monetary policy factors can be seen to be determined at the discretion of the government.

4.2 Review of Macroeconomic Theoretical Literature

The macroeconomic literature relevant to our study is split between the Keynesian line of thought and the monetarist. We will outline the main arguments of each, and try to conclude with what each predicts for the results of our study.

4.2.1 Keynesian predictions of monetary policy effects

Keynesian monetary policy is built up around the key argument that money supply influences interest rates, which in turn influences the level of investment in the economy, which in turn leads to a change in national GDP. The direction of influence as well as the rationale behind this can be explained more clearly through three diagrams (below).

The first panel outlines the predicted inverse relationship between interest rates and money supply in the economy. The relationship is negative because interest rates can in many ways be seen as the opportunity cost of holding cash. As a result, the higher the interest rate the less money people want to hold. Since the supply of money is fixed by the central bank, it is shown as an inelastic supply curve. The intersection of these curves give us the interest rate in the economy, thus showing how the central bank (by changing money supply) can influence interest rates. In practice, the central bank increases and decreases money supply by buying or selling government bonds. Thus, a country issuing government bonds is decreasing
the amount of money circulating in the economy. In addition to this, a central bank can also alter the money supply by changing short-term interest rates or by changing the reserve requirements for banks. By lowering the discount rate that banks pay on short-term loans or by lowering the reserve requirements, the Central Bank is able to effectively increase the liquidity of money in the economy. However, decreases in interest rates fuel inflation, so Central Banks are usually careful not to lower interest rates too much for too long.

The second panel shows the predicted relationship between the interest rate offered by banks and the amount of investment in the economy. Again, the relationship is negative for many of the same reasons described above. In addition, the lower the interest rate in the economy, the easier it is for businesses to borrow money (and the less they can earn by keeping their money in the bank). This is why Keynesian’s believe that a lower interest rate will lead to increased investment in the economy. They also believe that wages are sticky in the short run, meaning that employers can pay less (for a while) for the same amount and quality of labor – thus increasing incentives for investments.

The reason why this increased investment is important, is shown in the third panel. The Aggregate Demand curve is made up of Consumption, Investment, Government Spending, and Net Exports. Thus, if Investment goes up, the whole curve shifts upwards leading to a higher point of intersection with the Aggregate Supply curve. This in turn translates into a higher level of National Income. While all Keynesians believe this relationship hold in the short run, they disagree even amongst themselves the extent to which this effect persists in the long run. Looking at Panel 1 again, one can see that if National Income increases, the Money Demand curve will shift upwards in response to people buying more stuff. This would then lead to an increase in interest rates at the current level of money supply. Increased interest rates will in turn lead to a reversing of the process described above.

Figure 4.3: The Keynesian relationship between money supply, interest rates, investments, and national income
4.2.2 Monetarist predictions of macroeconomic policy effects

In contrast with Keynesians, Monetarists believe in an efficient version of the economy, in which wages are not sticky and adjust quickly to changes in money supply. While some monetarists may concede that some short run changes in output will take place as a result of changes in money supply, all agree that in the long run increasing money supply will only lead to inflation and increased prices in the economy – thus offsetting this effect. In some sense, this means that monetarists believe that an economy under given conditions can only run at a specific pace and that government attempts at intervention will at best have no effect, and at worst be harmful. Given these differences in opinion between Keynesians and Monetarists, it becomes even more interesting to test if there is a long-run relationship between the monetary policy pursued by government and the value of the stock market.

4.2.3 The quantity theory of money

In many ways, the differences in opinion about monetary policy between Keynesians and Monetarists can be summarized using the Quantity Theory of Money (QTM). The QTM is based on the key insight that all the consumption in an economy has to be paid for somehow. The theory takes this insight and has traditionally been used to summarize the Keynesian viewpoint in a single equation, called the Quantity Equation:

\[ M^* V = P^* Y \]

where \( M = \) money supply, \( V = \) velocity, or the rate at which money changes hands, \( P = \) prices of goods and services in the economy, and \( Y = \) quantity of goods and services in the economy.

The right hand side of the equation is the equivalent of the national GDP. Holding velocity constant, Keynesians believe that increasing the money supply can increase GDP by increasing the amount of goods produced \( Y \) (and for some, also by increasing prices). This leads to the following predicted relationship:

\[ M \uparrow \ast \bar{V} = \bar{P} \ast Y \uparrow \]

For monetarists, this equation looks very different. As they believe that the goods and services produced are to a large extent fixed, increasing money supply will only have the effect of increasing the prices – aka inflation:

\[ M \uparrow \ast \bar{V} = P \uparrow \ast \bar{Y} \]

The two theories thus predict very different outcomes. We can relate these insights back to our key research question most readily by assuming that there is a correlation between GDP and the stock exchange performance as proven by the studies by Levine (1996, 1998), and Beck & Levine (2002).
Here one can see that Keynesian economists will argue that inflation will have a positive relationship on the stock exchange through the increase in investments and national income, while Monetarists will argue it has either no or a negative effect on the stock exchange. The prediction is however unclear for both. In many ways it depends on how fast you assume that prices adjust. DeFina (1991) has argued that rising inflation initially has a negative effect on corporate income due to immediate rising costs and slowly adjusting output prices, reducing profits and therefore the share price.

Interest rates have a similar pattern, with Keynesian’s arguing that lower interest rates will lead to higher stock prices through rising investment, GDP, and better performing stocks, while Monetarists expecting less of an effect.

One non-monetary variable we have included is the Industrial Production index. This is used as a proxy to measure the amount of production in the industrial sector, to see how this impacts our indices. Keynesian theory might link this variable to interest rates and their effect on consumer spending. A high interest rate reduces spending, and this leads to a lower demand situation. Producers respond by cutting down on the production, which in turn results in lower corporate sales and profits – leading to lower stock prices. Thus, weak Industrial Production data is expected to have a negative effect on stock prices (International Monetary Fund, 1998).

The effect of a change in a country’s real exchange rate can be seen in its effect on the Aggregate Demand and Supply Equations in Panel 3 of Figure 4.3. Monetarists will most likely agree with International Economics insights that currency depreciation in a country leads to a relative decrease in the price of that country’s products in international markets, an increase in demand for its export goods, and increased cash flows into the country. At the same time, weak currency increases the cost of imported goods. Thus the net effect depends on if the country is a net importer or a net exporter of goods and services. Turkey is a net importer, and so increase in the real exchange rate is expected to have a positive relationship with the stock exchange value. To understand this relationship better in the context of a country’s trade balance, we now turn to outlining the Marshall-Lerner condition.

4.2.4 The Marshall-Lerner condition

The Marshall-Lerner condition, named after English economist Alfred Marshall and Romanian economist Abba Lerner, aims to explain the relationship between exchange rate shifts and changes in the current account balance, although it is today also used to explain a similar relationship with the balance of payments. We will here focus on the latter.

The logic of the Condition is this: In order to gain currency one must sell goods abroad. This is the demand for the national currency. On the other hand, when one imports goods one uses foreign currency – this is the supply. If one assumes no
remittance or other money transfers such as foreign aid, the demand for currency = export, while the supply for currency = import. If the purchase value of exports and imports do not balance, there will be a deficit or a surplus on the balance of payments.

The amount that a country’s balance of payments changes with its exchange rate, depends on the elasticity of the demand and supply curves. To understand this condition better, let us look graphically at how it plays out.

Figure 4.4: Role of demand and supply curve elasticity in the change in balance of payments following an exchange rate shift

In the above graph, the purple lines represent a quite elastic demand and supply curve, while the blue show relatively inelastic curves. The level of elasticity is impacted by among other things the goods produced by a nation – if the goods produced are not supplied by other countries, the demand from abroad will be quite inelastic. On the other hand, if the goods are commoditized, then the price elasticity of demand will be high, and demand will shift quickly with the foreign exchange rate.

Assuming an exogenous exchange rate of S0 (marked by an orange dotted line in the graph), foreign actors will see a nation’s goods as too expensive while national actors will be attracted to the relatively cheaper prices of foreign goods. In other words, there will be too high a supply of currency and too low demand from abroad. This leads to a balance of payments deficit.

Countries can change the exchange rate by reducing the supply of the currency. However as shown by the green S1 line, such a shift will not necessarily solve the issue. The shape of the supply and demand curves matter - meaning that if for example Turkey chooses to depreciate its currency it can only correct the balance of payments in the case of elastic curves, while it will only decrease the deficit if the curve is inelastic. If the curves are inelastic and the government wants to correct the current account deficit, a greater exchange rate change is needed.

In addition, the relative elasticity of demand for exports and imports matters.
What matters is not only whether Turkey is importing less and exporting more, but rather (in the case of a currency depreciation), whether the increase in currency demand from exports exceeds the decrease in supply from imports. If foreign demand for Turkish exports is relatively elastic, a weaker Turkish lira should cause the demand for Turkish goods and currency to go increase significantly. If at the same time Turkish national demand for foreign imports is highly price elastic, the same currency depreciation will also lead to a sharp decrease in imports. The Marshall-Lerner condition thus states that if the combined elasticities of demand for imports and exports is elastic with a coefficient greater than 1, then a currency depreciation will lead to a move towards a balance of payments (or current account) surplus.

In practice, one tends to observe a J curve effect when a country’s currency is depreciated, with the balance of payments initially worsening. This effect is seen because often the Marshall-Lerner Condition does not hold in the short run. Reasons for this include:

1. Imperfect markets: Markets are not perfectly transparent and actors do not have all relevant information. Thus, foreign consumers will not immediately realize that for example Turkey’s exports are cheaper and change their spending habits. Similarly, Turkish consumers’ limitations in registering the increased import prices leads to a time lag before import expenditure falls.

2. The nature of contracts: Both importing and exporting firms often have fixed contracts in the short term, limiting their ability to reflect changes in the exchange rate in their purchasing decisions.

Figure 4.5: The J Curve effect: Change in balance of payments following a currency depreciation

Figure 4.5 illustrates the J curve effect as a function of time. Initially, quantities purchased stay the same and a country’s balance of payments worsens. The higher
exchange rate first corresponds to more costly imports and less valuable exports, leading to a bigger initial deficit or a smaller surplus. As foreign consumers begin to realize that the nation’s goods are relatively low-priced and firms can change their contracts accordingly however, a country’s exports will start to increase. Local consumers will also purchase less of the more expensive imports and focus on local goods. The balance of payments in this way improves. The J curve effect is often supported by proponents of Keynesian theory, and its insights will therefore be included as part of this grouping in our final overview of theory based predictions.

4.3 Chapter Conclusion: Creation of Theory Base Predictions

The following table summarizes the key predictions given by portfolio theory as well as Keynesian and Monetarist macroeconomic theory for each of the variables.

We find that the Marshall-Lerner prediction is generally accepted by Monetarists, while Keynesians are more likely to expect the J curve effect in the short run. This explains the differing predictions on exchange rates.

For Industrial Production, portfolio theory through the EMH expects no significance on stock prices as this is an ex-post figure, released after the production has taken place. Keynesians and Monetarists on the other hand are more likely to assume that positive Industrial Production index results will transfer into positive development on the stock exchange.

Inflation is expected by Keynesians to have a positive effect on firm performance through sticky wages in the short run, while portfolio theory and Monetarists both will tend to assume a negative effect.

Finally, an increase in the interbank lending rate is expected by both Portfolio theory and Keynesians to have a negative relationship to prices on the stock exchange, by making investors more likely to switch to bonds and increasing a firm’s discount rate (portfolio) or making consumers less likely to spend money (Keynesian). Monetarists expect zero effect.

Table 3: Predicted effect on stock prices of increase in variables

<table>
<thead>
<tr>
<th></th>
<th>Real Exchange Rate</th>
<th>USD/TRY</th>
<th>Industrial Production</th>
<th>Inflation</th>
<th>Interbank Lending Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portfolio</td>
<td>+</td>
<td>+</td>
<td>0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Keynesian</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Monetarist</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-/0</td>
<td>0</td>
</tr>
</tbody>
</table>

Notes: *Increase in USD/TRY is the same as appreciation of the TRY

Table 3 thus summarizes our answer for sub research question 1, and shows what theory postulates the relationship between our variables will be. To understand
better how these relationships hold in practice, we will now continue with a review of existing empirical studies.

5 Review of Empirical Studies

The theories we have outlined above can only take us so far in predicting the direction of effects of macroeconomic variables on stock prices. As economic theory is not an exact science and humans are social beings who may not always act as expected by these ideal world models, it is important that we look at existing empirical studies on the topic to gain further insight.

In the literature, there are a limited number of studies explaining stock market behavior by using macroeconomic variables. The more recent use of cointegration methodology has however enabled the dispersion of more long-run steady state property analysis on this topic. In order to get a proper overview, we have here grouped the studies according to their geographical focus: developed markets, emerging markets, and Turkey.

5.1 Global and Developed Markets

Evidence that key macroeconomic variables help predict the changes in stock prices has accumulated for nearly 30 years, and helps support our decision to test this relationship on Turkey. Early studies by Fama and Schwert (1977), Nelson (1977), and Jaffe and Mandelker (1976), all affirm that macroeconomic variables influence stock returns, thereby providing an assault on the conclusions drawn from the EMH, which expects stock prices to already include this information and therefore not change. Concentrating primarily on the US stock exchanges, such early studies attempted to capture the effects of economic forces in a theoretical framework.

For the US market, Fama (1981) investigated the relationships between stock prices and real activity, inflation, and money. He found a strong positive correlation between common stock returns and real variables, such as production, GNP, the money supply, lagged inflation and the interest rate. Bulmash and Trivoli (1991) developed a model to describe the relation between stock price and economic variables. They found that stock prices are predicted by various lagged economic variables such as money supply and interest rate. Dhakal et al (1993) analyzed the relationship between the money supply and share prices for the United States and found a direct causal impact of changes in the money supply on share prices. Cheng (1995) examined the relationships between security returns and economic indicators and finds a positive relationship between stock price and money supply, government securities price index and unemployment. Chopin and Zhong (2001) examined the relationship between stock returns and inflation and found that a negative correlation between stock returns and inflation.
For the UK, Morelli (2002) examined the relationships between conditional stock market volatility and conditional macroeconomic volatility based upon monthly data for industrial production, real retail sales, money supply, inflation and exchange rate and found that the volatility in the macroeconomic variables did not explain the volatility in the stock market (Erdem et al, 2005).

Studies have also been conducted on groups of nations. Rapach (2001) examined the long-run relationship between inflation and real stock prices for 16 industrialized countries and found that an increase in inflation does not cause a sustained real depreciation of share values. Nasseh and Strauss (2000), identified a significant long-run relationship between stock prices and domestic and international economic activity in France, Germany, Italy, Netherlands, Switzerland and the U.K. In particular, they found large positive coefficients for industrial production and the consumer price index, and smaller but nevertheless positive coefficients on short term interest rates and business surveys of manufacturing. The only negative coefficients were found on long term interest rates. Additionally, they found that European stock markets were highly integrated with that of Germany and that industrial production, stock prices and short term rates in Germany positively influenced returns on other European stock markets (namely France, Italy, Netherlands, Switzerland and the UK).

5.2 Emerging Markets

As stock exchanges were set up in newly liberalizing countries and data began to become available, more recent studies have expanded the scope of focus from the developed world to the emerging markets.

Maysami and Sims (2002, 2001a, 2001b) employed the Error-Correction Modeling technique to examine the relationship between macroeconomic variables and stock returns in Hong Kong and Singapore (Maysami and Sim, 2002b), Malaysia and Thailand (Maysami and Sim 2001a), and Japan and Korea (Maysami and Sim 2001b). Their analyses focused on the influence of interest rate, inflation, money supply, exchange rate and real activity, along with a dummy variable to capture the impact of the 1997 Asian financial crisis. The results confirmed the influence of macroeconomic variables on the stock market indices in each of the six countries under study, though the type and magnitude of the associations differed depending on the country’s financial structure.

Wongbangpo and Sharma (2002) looked at similar macroeconomic variables as Maysami and Sims and examined the role of inflation, the money supply, the interest rate, GNP, and the exchange rate on the stock prices in Indonesia, Malaysia, the Philippines, Singapore and Thailand and find causal relationships from the macroeconomic variables to stock prices. They observed that stock prices were negatively related to inflation. Interest rate was found to be negatively related
with stock prices in the Philippines, Singapore and Thailand, but positively related with stock prices in Indonesia and Malaysia. The exchange rate variable was positively related to stock prices in Indonesia, Malaysia and the Philippines, but negatively in Singapore and Thailand (Erdem et al, 2005). Their study thus provides a clear indication that the relationships can change significantly from country to country, even among emerging markets.

Moving geographically closer to Turkey, Apergis and Eleftheriou (2002) investigated the relationship between stock prices, inflation and interest rates in Greece and found that the stock prices in Athens Stock Exchange follow inflation but do not follow interest rate movements, despite the close relationship between the two. Similarly, Dritsaki and Dritsaki (2004) examined the long-run relationship between the Greek Stock Market Index and its fundamentals, namely industrial production, inflation and interest rates and found a significant causal relationship between stock prices and macroeconomic variables.

On a more aggregate level, Al-Khazali (2003) investigated short- and long term relationship between stock prices, inflation and output for 21 emerging markets. His study details a negative relationship between real stock return and inflation in the short term for all countries except Malaysia. In the long run, he found a positive relationship between stock returns and both expected inflation and change in the expected inflation.

A study by Naik and Padhi (2012) on the effect of macroeconomic variables on the Indian stock market index (Sensex) found that the macroeconomic variables and the stock market index are co-integrated. It was observed that the stock prices positively relate to the money supply and industrial production but relate negatively to inflation. The exchange rate and the short-term interest rate were found to be insignificant in determining stock prices. In the Granger causality sense, macroeconomic variables caused stock price movements in the long-run but not in the short-run. Furthermore, bidirectional causality was proven between industrial production and stock prices, whereas unidirectional causality was found from money supply to stock price, stock price to inflation and interest rates to stock prices.

5.3 Turkey

The Istanbul Securities Exchange (ISE) became operational in 1986 with 42 listed companies. Owing to this relatively short history of the emerging Turkish stock market there are therefore a limited number of studies explaining stock returns using macro-economic variables. We will detail the main findings of the ones conducted below.

Erol and Aydogan (1991) tested an arbitrage pricing model and found the ISE price movements to be sensitive to unexpected inflation and the real rate of return.
Muradoglu and Onkal (1992, 1996) estimated separate equations to distinguish between expected and unexpected components of monetary and fiscal policy and reported a significant lagged relationship between these policy instruments and stock returns.

Muradoglu et al also completed a study in 2001 where they used daily data and Engle and Granger’s cointegration analysis to test for the effect of macroeconomic variables on stock prices over ‘shorter’ time horizons such as one year to allow for the shorter holding periods for stock investments at the time. They found that the cointegrating relationship changed over time, and therefore advised investors not to base their investment strategies on the assumption of a static equilibria.

Erdem, Arslan and Erdem (2005) have conducted one of the only studies on the effects of macroeconomic variables to the different Istanbul stock exchange indexes. Price volatility spillovers in ISE indexes were analysed based on monthly data from January 1991 to January 2004 for exchange rate, interest rate, inflation, industrial production and M1 money supply. Here they used an Exponential Generalized Autoregressive Conditional Heteroscedasticity model to test univariate volatility spillovers for macroeconomic variables. It was found that there exists unidirectional strong volatility spillover from inflation and interest rate to all stock price indexes. They furthermore found spillovers from M1 money supply to financial index, and from exchange rate to both XU 100 and industrial indexes.

As these studies are not very recent, they can be seen as being conducted on a different regime, both politically and economically. Still, the last two papers provided some key input as to what kind of analyses we found to be prudent to perform on the Istanbul Stock Exchange. We decided to include both the time varying aspect of Muradoglu et al (2001) and the sector index angle of Erdem et al (2005), and expanded on their approaches by including a much longer time period of monthly data, and by seeking to compare the relationships before and after the 2001 banking crisis.

5.4 Chapter Conclusion

This chapter reviewed a small proportion of the empirical literature pertaining to the empirical link between the macroeconomy and stock prices. Overall, a read through of this body of literature makes it quite clear that the predictions of the EMH, at least as it relates to strong efficiency, do not seem to hold in the real world. The fact that the relationships found differ strongly from country to country furthermore make it particularly interesting to understand the Turkish situation.

We further find that while there have been a few studies conducted on Turkey that try to link the effect of government policy on the stock market, there has not been a recent study to observe the long-run relationship, especially on a sector level. We could also not identify any studies that looked at the relationship both
before and after the banking crisis of the early 2000s. We will therefore now try to fill this knowledge gap by performing our own study of these relationships.

6 Data and Testing

6.1 Data Description

Our data consists of a number of level time series downloaded from Bloomberg, the Turkish statistical bank, and the OECD’s statistical website. The initial tests on the XU100 index are conducted on monthly data beginning in January 1994 and ending in March 2013. We have split up our tests in three time periods to look at differences resulting from before and after the banking crisis and following financial sector reforms the early 2000s. Thus, we will be running all tests on the whole time period, the period 1994-2001, and finally the period 2002-2013. Due to data constrictions, the tests on the sector indices will only be run on the last period from 2002-2013. We hope that this will give us some insight into the nature of the relationship between the macroeconomic variables and the Istanbul Stock Exchange, and also how these vary over time.

6.2 Tests on the XU100

To determine the long-run relationship between the macroeconomic variables and the ISE index, we employ the Engle Granger procedure. As outlined in our method section, this approach to analyzing financial time series involves a number of steps: First, one determines the order of integration of the time series by running unit root tests. Second, one conducts cointegration tests on the residual of the overall OLS regression to find evidence of whether the series move together in the long run. Third, to find the predictive model one either estimates a VECM (if there is a cointegrating relationship) or a regular factor model. Finally, we supplement these tests by looking at the covariance matrix for our factors. We will now turn to performing each of these tests in turn.

6.2.1 Unit root tests

There are a number of tests for unit roots employed in the literature. One method championed by practitioners (Harris, 1995) and Copenhagen Business School’s econometrics expert Professor Lisbeth La Cour is the visual method, as there is still quite a bit of error (Type 1 and Type 2) in many of the mathematical tests used. We thus begin with an informal test of stationarity by graphing how our variables develop over time.

From Figure 6.1 one can see that most of our time series appear to be trending upward or downward over time and are not stationary in their log or level values.
Figure 6.1: Time series graphs of variables

(a) For whole period, 1994-2013

(b) For period 1994 – 2001

(c) For period 2002-2013
This is especially true for the whole period from 1994-2013, and the time period 1994-2001 where we know there was more volatility in the Turkish economy. Also interesting to note in this regard is the downward trend in the log of the interbank lending rate following 2002, providing support to claims of improved stability in the Turkish financial system.

To confirm our hypothesis regarding stationarity, we run the Augmented Dickey Fuller tests on our variables and their first differences. In order to calculate the optimal number of lags to include to minimize autocorrelation, we use Schwert’s (1989) method (see equation in Section 3.3). This turns out to be 15 lags for the whole period, 12 lags for the period 1994-2000, and 13 lags for the period 2002-2013. These become our upper bounds for each test, and we allow our statistical program to test down from here. Our results are presented in Table 4.

Table 4: ADF unit root tests on level and difference of XU100 time series

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF test</th>
<th>p value</th>
<th>Comments</th>
<th>ADF test (-1)</th>
<th>p value</th>
<th>Order of integr.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1994-2013 (max lag 14)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LUX100</td>
<td>-2.005</td>
<td>0.285</td>
<td>Failed to reject h0</td>
<td>-6.766</td>
<td>0.000</td>
<td>I(1)</td>
</tr>
<tr>
<td>LEX</td>
<td>-1.943</td>
<td>0.312</td>
<td>Failed to reject h0</td>
<td>-10.231</td>
<td>0.000</td>
<td>I(1)</td>
</tr>
<tr>
<td>LUSD</td>
<td>-3.726</td>
<td>0.004</td>
<td>Reject h0</td>
<td>n.a.</td>
<td>n.a.</td>
<td>I(0)</td>
</tr>
<tr>
<td>LIND</td>
<td>-0.816</td>
<td>0.814</td>
<td>Failed to reject h0</td>
<td>-13.853</td>
<td>0.000</td>
<td>I(1)</td>
</tr>
<tr>
<td>LCPI</td>
<td>-2.750</td>
<td>0.056</td>
<td>Failed to reject h0</td>
<td>-1.076</td>
<td>0.000</td>
<td>I(2)</td>
</tr>
<tr>
<td>INT</td>
<td>-1.059</td>
<td>0.734</td>
<td>Failed to reject h0</td>
<td>-19.580</td>
<td>0.000</td>
<td>I(1)</td>
</tr>
</tbody>
</table>

| **1994-2001 (max lag 12)** |
| LUX100   | -0.929   | 0.780   | Failed to reject h0 | -4.251  | 0.000   | I(1)            |
| LEX      | 0.259    | 0.976   | Failed to reject h0 | -5.892  | 0.000   | I(1)            |
| LUSD     | -1.489   | 0.540   | Failed to reject h0 | -0.515  | 0.886   | I(2)            |
| LIND     | -1.924   | 0.321   | Failed to reject h0 | -6.914  | 0.000   | I(1)            |
| LCPI     | -1.417   | 0.578   | Failed to reject h0 | -0.902  | 0.788   | I(2)            |
| INT      | -3.964   | 0.002   | Reject h0           | n.a.   | n.a.    | I(0)            |

| **2002-2013 (max lag 13)** |
| LUX100   | -1.656   | 0.454   | Failed to reject h0 | -4.177  | 0.000   | I(1)            |
| LEX      | -2.264   | 0.184   | Failed to reject h0 | -6.194  | 0.000   | I(1)            |
| LUSD     | -1.303   | 0.631   | Failed to reject h0 | -6.311  | 0.000   | I(1)            |
| LIND     | -1.723   | 0.420   | Failed to reject h0 | -7.599  | 0.000   | I(1)            |
| LCPI     | -0.512   | 0.887   | Failed to reject h0 | -8.273  | 0.000   | I(1)            |
| INT      | -4.150   | 0.001   | Reject h0           | n.a.   | n.a.    | I(0)            |

As Table 4 shows, our variables are integrated of different orders. Still in general, the null hypothesis of no unit root is rejected in almost all level tests, since the p-value is above 0.05. For the opposite reason, the null hypothesis is in general
confirmed for all difference tests. This is very much in line with what we expected going into the tests, as financial data has previously been found to be nonstationary in nature.

Looking closer at each time period, only the TRY/USD spot exchange rate (LUSD) was found to be stationary for the whole period, while the interbank lending rate was found to be stationary in both sub periods. One interesting observation we found is that the CPI level was found to be integrated of the order two in the whole period and the years 1994-2002, but not in the last sub decade. This may be an indication of the very fluctuating nature of the inflation rate in the 1990’s, which was subsequently stabilized a bit in the 2000’s.

Importantly, the presence of unit roots in some of the data series is an indication of the existence of a possible long-run relationship among the variables. To ascertain the presence of the long-run relationship the next stage of the estimation is a test for cointegration.

6.2.2 Cointegration tests

Engle and Granger (1987) introduced the concept of cointegration with regard to non-stationary variables. It tests for stationarity in the residuals of an equation. Where non stationarity is found, it is seen as evidence that there is a tendency for the variables to drift together over time (i.e. have a long-run relationship). In practice, one tests for stationarity of the residuals by conducting an ADF test, but this time on the residuals generated from an Ordinary Least Squares (OLS) regression of the variables in levels. We start with a visual test, by graphing the residuals generated from our OLS (Figure 6.2).

From the residual graphs one can see that there is some indication of non stationarity in the residuals, as the values do not move equally around 0. To be certain, we now test formally whether the XU100 index is cointegrated with the macroeconomic variables. We do this by performing ADF tests on the residuals of our regressions with these variables, to see if they are stationary. This gives us the $t$ statistic and the level of significance of our tests, which are conducted with the $h_0$ that the residuals are not stationary.

We perform both bivariate tests with each of the macroeconomic variables alone, as well as a test for cointegration with the variables as a block. This is to ensure that we are not overlooking any individual cointegrating relations with the index. Our results for all three periods are presented in Table 5.

From Table 5 we find that the $p$ values are larger than 0.05, and thus the no cointegration hypothesis is accepted for all time periods both for our bivariate tests and our block test. This means that our macroeconomic variables and the XU100 Index do not have a significant long term cointegrating relation, and we do not need to include an adjustment vector in our final model. Earlier studies
Figure 6.2: Residuals of OLS regressions

(a) Residuals for whole period, 1994-2013

(b) Residuals for time period 1993-2013

(c) Residuals for period 2002-2013
Table 5: Cointegration for entire model, with constant

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LEX</td>
<td>$T$</td>
<td>-2.286</td>
<td>-2.332</td>
</tr>
<tr>
<td></td>
<td>$p$</td>
<td>0.380</td>
<td>0.357</td>
</tr>
<tr>
<td>LUSD</td>
<td>$T$</td>
<td>-2.608</td>
<td>-2.848</td>
</tr>
<tr>
<td></td>
<td>$p$</td>
<td>0.496</td>
<td>0.151</td>
</tr>
<tr>
<td>LIND</td>
<td>$T$</td>
<td>-1.757</td>
<td>-0.604</td>
</tr>
<tr>
<td></td>
<td>$p$</td>
<td>0.651</td>
<td>0.934</td>
</tr>
<tr>
<td>LCPI</td>
<td>$T$</td>
<td>-2.526</td>
<td>-2.813</td>
</tr>
<tr>
<td></td>
<td>$p$</td>
<td>0.264</td>
<td>0.161</td>
</tr>
<tr>
<td>INT</td>
<td>$T$</td>
<td>-2.319</td>
<td>-0.432</td>
</tr>
<tr>
<td></td>
<td>$p$</td>
<td>0.363</td>
<td>0.967</td>
</tr>
<tr>
<td>LEX + LUSD + LIND + LCPI + INT</td>
<td>$T$</td>
<td>-4.057</td>
<td>-2.809</td>
</tr>
<tr>
<td></td>
<td>$p$</td>
<td>0.212</td>
<td>0.815</td>
</tr>
</tbody>
</table>

Notes: (1) The values reported here are the ADF test t-statistics based on regressions with a constant. (2) The critical values for the ADF test statistics are obtained from Engle and Granger (1987, Table 2); (3) * denotes test statistics significant at 5%.
on the Istanbul Stock Exchange have also concluded similarly (e.g. Muradoglu et al, 2001; Berument et al, 2005). The result is thus not necessarily surprising, particularly given Turkey’s status as an emerging market where such relations may not have been semented yet. Knowing this, we can now turn to estimating the factor model in order to determine the short run effect of the variables on the overall stock exchange.

6.2.3 Estimating a factor model

As we have rejected the presence of a long-run cointegrating vector for all three time periods, we go on to estimate the respective factor models. Here we take the difference of all our variables, except those that were shown to be stationary in their levels in our ADF tests. In other words, they are already I(0) and so do not have to be differenced. For the variables shown to be I(2), we difference them twice to get them to their stationary values - as indicated by the ’d2’ preceding them. Our factor equations thus become:

1994-2013 \( \Delta LXU100 = \text{constant} + \alpha \Delta LEX + \alpha \Delta LUSD + \alpha \Delta LIND + \alpha \Delta LCPI + \alpha \Delta \text{INT} + \epsilon_t \)

1994-2001 \( \Delta LXU100 = \text{constant} + \alpha \Delta LEX + \alpha \Delta 2LUSD + \alpha \Delta LIND + \alpha \Delta 2LCPI + \alpha \Delta \text{INT} + \epsilon_t \)

2002-2013 \( \Delta LXU100 = \text{constant} + \alpha \Delta LEX + \alpha \Delta LUSD + \alpha \Delta LIND + \alpha \Delta LCPI + \alpha \Delta \text{INT} + \epsilon_t \)

The equations differ quite a bit. Specifically, note how in the 1994-2013 equation we have not differenced the LUSD as it was found to be stationary, while in the 1994-2013 period we had to difference this variable twice as it had two unit roots. Running a regression on the factor model for each of the time periods gives us the results found in Table 6.

Turning to our results, we can see that the coefficients of our variables change signs depending on the time period. Furthermore, the significance of these coefficients change as well. This is inconsistent with economic theory which tends to predict a static relationship, and we will get back to this in our analysis section. Looking more in detail, there are a number of our explanatory variables that significantly explain the returns on the XU100.

In the time overall period 1994-2013, we find:

- A significant relationship between the returns on the XU100 and the real exchange rate which has a positive coefficient
- A negatively significant relationship with the interbank lending rate
**Table 6: XU100 OLS model regression results**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t value</th>
<th>p value</th>
<th>Coefficient</th>
<th>t value</th>
<th>p value</th>
<th>Coefficient</th>
<th>t value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.0224</td>
<td>1.964</td>
<td>0.0508*</td>
<td>0.0521</td>
<td>2.843</td>
<td>0.0057**</td>
<td>0.0207</td>
<td>2.259</td>
<td>0.0256*</td>
</tr>
<tr>
<td>LEX</td>
<td>0.386</td>
<td>1.694</td>
<td>0.0916*</td>
<td>-0.1896</td>
<td>-0.3349</td>
<td>0.7386</td>
<td>-0.4024</td>
<td>-1.555</td>
<td>0.1224</td>
</tr>
<tr>
<td>LUSD</td>
<td>-0.0132</td>
<td>-1.512</td>
<td>0.1319</td>
<td>0.7697</td>
<td>1.286</td>
<td>0.2023</td>
<td>-1.4551</td>
<td>-7.591</td>
<td>0.0000***</td>
</tr>
<tr>
<td>LIND</td>
<td>-0.0957</td>
<td>-0.4653</td>
<td>0.6422</td>
<td>-0.1129</td>
<td>-0.457</td>
<td>0.6489</td>
<td>-0.0338</td>
<td>-0.423</td>
<td>0.673</td>
</tr>
<tr>
<td>LCPI</td>
<td>-0.0957</td>
<td>-0.2614</td>
<td>0.794</td>
<td>0.1554</td>
<td>0.4208</td>
<td>0.6751</td>
<td>-0.9689</td>
<td>-1.267</td>
<td>0.2075</td>
</tr>
<tr>
<td>INT</td>
<td>-0.0001</td>
<td>-1.782</td>
<td>0.0761*</td>
<td>-0.001</td>
<td>-1.866</td>
<td>0.0659*</td>
<td>-0.0123</td>
<td>-1.918</td>
<td>0.0574*</td>
</tr>
</tbody>
</table>

* Durbin Watson:
  - 1994-2013: 2.0735
  - 1994-2001: 1.847
  - 2002-2013: 2.339

* LM Test:
  - 1994-2013: Test statistic 0.8800, p value 0.5681
  - 1994-2001: Test statistic 1.1812, p value 0.3152
  - 2002-2013: Test statistic 1.1994, p value 0.2885

* R²:
  - 1994-2013: 0.0454
  - 1994-2001: 0.0822
  - 2002-2013: 0.3907
In the sub period 1994-2001, we find:

- A negatively significant relationship between the returns on the XU100 and the interbank lending rate, just as in the overall time period

In the sub period 2002-2013, following the banking crisis, we find:

- While the real exchange rate is not significant like it was in the overall period, the spot exchange rate between the Turkish lira and the US dollar is very significant at the 1% level

- The interbank lending rate is negative and significant

Overall, these findings suggest that the relationships found in tests of this nature cannot be assumed to be static, and furthermore that different macroeconomic variables are more influential at determining price changes on the ISE than others, depending on the time period.

**Testing for autocorrelation**  
Before taking our results at face value, it is important to ensure that there is no autocorrelation in the residuals from our OLS regressions. Autocorrelation can be a significant problem in analyzing historical pricing as some variables tend not to change too radically from one month to another and thus the values from one month to the next could potentially be highly correlated, even though there is little useful information in this observation. In order to test for autocorrelation, we perform the Durbin Watson and LM tests. The Durbin-Watson statistic is always between 0 and 4, with a value of 2 meaning that there is no autocorrelation in the sample. As our test statistics are close to 2, we can conclude that these are good factor models. Similarly the LM tests the null hypothesis of no autocorrelation. As none of our models reject the null hypothesis we can again assume that there is no autocorrelation in our residuals, which means that the results from our model are true.

**Explanatory power**  
What becomes clear by looking at the $R^2$ value of our models is that during the first sub-period, most of the information that explains stock prices is left out from the specification. In a 2001 study with some overlapping data, Muradoglu et al argues that this may be a consequence of the large increase in the number of firms on the market, and subsequent flow of reported information about these firms. Investors may thus be more concerned with the sudden and large amounts of firm specific information instead of macroeconomic fundamentals. We find the $R^2$ of our model increases dramatically in the last sub period from 2002-2013. While discovering the exact reason for this change is outside our scope of study in this paper, this may be an indication of the fact that the markets became more predictable and established following the intervention of the IMF and the stabilization of the economy.
6.3 Tests on the Sector Indices

Tests on a national index level carry the risk of reflecting the trends of the largest firms in the economy as these are weighted highest, at the expense of smaller firms and sectors. In order to mitigate this risk and answer our final sub research question regarding whether the effects seen on the overall stock exchange are reflected differently in various sectors, we will now perform similar tests on each of the stock indices.

6.3.1 Testing for stationarity

To get a sense of whether the indexes exhibit stationary or not, we graph their log values over time. As seen in Figure 6.3, all of the sector indices appear to have a constant and an upward trend. This indicates nonstationarity.

Figure 6.3: Time series of sector indices, 2002-2013

To test for stationarity, we perform the ADF tests on the level and first differences of our indices. Our results are reported in Table 7. As expected, we find that all the indices are integrated of order I(1). We do not perform the ADF tests for the macroeconomic variables as we have already done them previously in the XU100 section.
### 6.3.2 Cointegration tests

Since our variables are not stationary, there is the potential for a long-run cointegrating relation between them and our independent macroeconomic variables. To determine if this is the case we will now perform the Engle Granger cointegration test on the residual of our level regression. We perform both the bivariate test between each macroeconomic variable and each index, as well as a block Engle Granger test on all our variables combined.

Table 8 shows that none of our sector indices appear to have a cointegrating relation with the macroeconomic variables. There is thus no long-run cointegrating vector we need to take into account, and no loss of information when differencing our variables. Knowing this, we can now estimate the factor model for each index.

### 6.3.3 Estimating a factor model

Following our earlier method, we again difference our variables until they are stationary. This results in the following factor equations for each sector index:

**LXUSIN**
\[
\Delta \text{LXUSIN} = \text{constant} + \alpha \Delta \text{LEX} + \alpha \Delta \text{LUSD} + \alpha \Delta \text{LIND} + \alpha \Delta \text{LCPI} + \alpha \text{INT} + \epsilon_t
\]

**LXUHIZ**
\[
\Delta \text{LXUHIZ} = \text{constant} + \alpha \Delta \text{LEX} + \alpha \Delta \text{LUSD} + \alpha \Delta \text{LIND} + \alpha \Delta \text{LCPI} + \alpha \text{INT} + \epsilon_t
\]

**LXUTEK**
\[
\Delta \text{LXUTEK} = \text{constant} + \alpha \Delta \text{LEX} + \alpha \Delta \text{LUSD} + \alpha \Delta \text{LIND} + \alpha \Delta \text{LCPI} + \alpha \text{INT} + \epsilon_t
\]

**LXUFIN**
\[
\Delta \text{LXUFIN} = \text{constant} + \alpha \Delta \text{LEX} + \alpha \Delta \text{LUSD} + \alpha \Delta \text{LIND} + \alpha \Delta \text{LCPI} + \alpha \text{INT} + \epsilon_t
\]

Here the equations look identical due to the fact that the macroeconomic variables we regress against are from the same time period. Running an OLS regression on each of these equations, we get the results detailed in Table 8.
Table 8: Cointegration tests for the sector indices

<table>
<thead>
<tr>
<th>Variables</th>
<th>LXUSIN</th>
<th>LXUHIZ</th>
<th>LXUTEK</th>
<th>LXUFIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEX</td>
<td>T</td>
<td>-1.750</td>
<td>-1.723</td>
<td>-0.771</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>0.655</td>
<td>0.668</td>
<td>0.936</td>
</tr>
<tr>
<td>LUSD</td>
<td>T</td>
<td>-1.747</td>
<td>-1.703</td>
<td>-2.076</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>0.656</td>
<td>0.677</td>
<td>0.488</td>
</tr>
<tr>
<td>LIND</td>
<td>T</td>
<td>-1.608</td>
<td>-1.707</td>
<td>-1.498</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>0.719</td>
<td>0.675</td>
<td>0.764</td>
</tr>
<tr>
<td>LCPI</td>
<td>T</td>
<td>-2.142</td>
<td>-2.145</td>
<td>-1.420</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>0.454</td>
<td>0.452</td>
<td>0.793</td>
</tr>
<tr>
<td>INT</td>
<td>T</td>
<td>-1.434</td>
<td>-0.885</td>
<td>-0.989</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>0.787</td>
<td>0.920</td>
<td>0.904</td>
</tr>
<tr>
<td>LEX + LUSD +LIND</td>
<td>T</td>
<td>-2.1113</td>
<td>-2.5845</td>
<td>-2.693</td>
</tr>
<tr>
<td>LCPI + INT</td>
<td>p</td>
<td>0.8349</td>
<td>0.8856</td>
<td>0.5758</td>
</tr>
</tbody>
</table>

Notes: (1) The values reported here are the ADF test t-statistics based on regressions with a constant. (2) The critical values for the ADF test statistics are obtained from Engle and Granger (1987, Table 2); (3) * denotes test statistics significant at 5%.
Table 9: Sector indices OLS regression, 2002-2013

<table>
<thead>
<tr>
<th>Index</th>
<th>XUSIN</th>
<th>XUFIN</th>
<th>XUTEK</th>
<th>XUMIZ</th>
<th>Coeff.</th>
<th>t value</th>
<th>p value</th>
<th>Coeff.</th>
<th>t value</th>
<th>p value</th>
<th>Coeff.</th>
<th>t value</th>
<th>p value</th>
<th>Coeff.</th>
<th>t value</th>
<th>p value</th>
<th>Coeff.</th>
<th>t value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0425</td>
<td>1.7600</td>
<td>0.0873</td>
<td>0.0181</td>
<td>1.6700</td>
<td>0.1067</td>
<td>0.0873</td>
<td>1.6700</td>
<td>0.1067</td>
<td>0.0873</td>
<td>1.6700</td>
<td>0.1067</td>
<td>0.0873</td>
<td>1.6700</td>
<td>0.1067</td>
</tr>
<tr>
<td>Variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.3758</td>
<td>-1.5900</td>
<td>-1.1444</td>
<td>-0.0535</td>
<td>-2.4000</td>
<td>-0.7375</td>
<td>-1.3212</td>
<td>-6.8710</td>
<td>-0.0000</td>
<td>-1.7546</td>
<td>-4.2250</td>
<td>-0.0000</td>
<td>-1.7546</td>
<td>-4.2250</td>
<td>-0.0000</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0056</td>
<td>0.0765</td>
<td>0.0657</td>
<td>0.0358</td>
<td>0.0857</td>
<td>0.0318</td>
<td>0.0056</td>
<td>0.0765</td>
<td>0.0657</td>
<td>0.0358</td>
<td>0.0857</td>
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<td>0.0056</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.2617</td>
<td>-0.3570</td>
<td>-0.1952</td>
<td>-0.2858</td>
<td>-0.1952</td>
<td>-0.2858</td>
<td>-0.2617</td>
<td>-0.3570</td>
<td>-0.1952</td>
<td>-0.2858</td>
<td>-0.1952</td>
<td>-0.2858</td>
<td>-0.2617</td>
<td>-0.3570</td>
<td>-0.1952</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.0808</td>
<td>-0.9459</td>
<td>0.3460</td>
<td>-0.0067</td>
<td>0.7739</td>
<td>0.4404</td>
<td>-0.0808</td>
<td>-0.9459</td>
<td>0.3460</td>
<td>-0.0067</td>
<td>0.7739</td>
<td>0.4404</td>
<td>-0.0808</td>
<td>-0.9459</td>
<td>0.3460</td>
</tr>
<tr>
<td>LM Test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.2397</td>
<td>2.4831</td>
<td>0.349</td>
<td>0.0768</td>
<td>0.0002</td>
<td>0.1024</td>
<td>2.6939</td>
<td>0.0000</td>
<td>0.1012</td>
<td>2.6939</td>
<td>0.0000</td>
<td>0.1012</td>
<td>2.6939</td>
<td>0.0000</td>
<td>0.1012</td>
</tr>
<tr>
<td>R²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.036</td>
<td>0.177</td>
<td>0.191</td>
<td>0.177</td>
<td>0.191</td>
<td>0.177</td>
<td>0.036</td>
<td>0.177</td>
<td>0.191</td>
<td>0.177</td>
<td>0.191</td>
<td>0.177</td>
<td>0.036</td>
<td>0.177</td>
<td>0.191</td>
</tr>
</tbody>
</table>
Our regression provides evidence of somewhat differing effects of macroeconomic variables between sector indices: For all the sectors indices, changes in the TRYUSD spot rate has a negative and highly significant effect. This is however where the similarities stop. Changes in the real exchange rate only significantly predict price changes on the Services index. The Technology sector on the other hand, is the only index favorably explained by the interbank lending rate. In the next chapter, we attempt to develop some hypotheses as to why these differences arise.

**Testing for autocorrelation** We ensure that our models do not have autocorrelation by performing the Durbin Watson and LM Tests. Both results (in the last two rows of Table 9) indicate that our models our robust.

**Explanatory power** The $R^2$ of our models is 33% for the Industrials index, 29% for the Services index, 25% for the Technology index, and 37% for the Financial index. The explanatory power of our models is therefore quite high. This is evidence of our earlier hypothesis from our tests on the XU100 regarding how the development of the financial market leads to more semented relationships between macroeconomic fundamentals and stock prices.

6.3.4 Index correlations

For an investor, it becomes interesting to understand the extent to which the differences in effects amongst these variables can allow for portfolio diversification. One way to test the short-run relationship among those indexes is by calculating the correlation coefficients among the growth rates of each index. Table 3 suggests the presence of positive strong correlations among our sector indexes, with the lowest correlation being between the Technology sector and the Services sector at 0.6953. The highest correlation is found between our Financial Index and the Industrial Index. Since there is no benefit of diversification under a correlation coefficient of 1, we need to test if there is any chance that the correlation coefficient is one. If one approximates the standard errors of the correlation coefficient with 1/ T, we can reject these coefficients differ from 1 for any bivariate relationship. Therefore, we conclude that there are benefits of portfolio diversification between our indexes.

6.4 Chapter Conclusion

In this chapter we have performed tests for unit roots and cointegration, and estimated the factor models for each of our indices. We find differing sensitivity and significance of our macroeconomic variables both over time and across sectors. To gain insight into why we observe these differing patterns and to understand
7 Analysis of Results

The above section outlined our empirical tests and results, finding some significant as well as insignificant effects of various macroeconomic variables on the returns on the XU100 and sector indices. Our paper now turns to possible explanations for why we observe these patterns. In doing so, we hope to complete the answers to our final sub research questions:

2. To what extent does the relationship between macroeconomic variables and stock returns change over time?

3. What is the relationship between macroeconomic variables and stock returns in different sectors represented on the Istanbul Stock Exchange?

7.1 XU100 Index Results – An Analysis of How Macroeconomic Effects Change Over Time

We begin by aiming to answer research question number 2 regarding the time varying effect of macroeconomic variables on the stock exchange.

Looking at our overall figures from the XU100 test, we observe that our results indicate that the relationships are not static. We conclude this due to the fact that both the coefficients and the significance of the variables change in each of the three periods. This is in line with the results found by Muradoglu et al (2001) in an earlier study on the Turkish stock exchange. In order to develop some hypotheses for why we observe these differences, we will be employing the insights gained from our literature review of the economic and financial theory (Section 4 & 5) as well as empirical insights from Turkish events and other studies.

As the number of studies on Turkey specifically are limited, we will also compare our results to those found in other countries. Here, we will draw relevant comparisons with particularly Jamin & Ulla’s study of the Pakistani Stock Exchange.
(2013) and Filis’ study on the Greek stock exchange (2009) as these are close in both method and time period. Most previous studies we have reviewed largely makes use of such cross-country comparisons to inform discussions, understand causality and highlight geographical differences. Thus, while we accept that one may not be able to draw a perfect parallel on an international level, we still believe it is still useful to perform such comparisons.

7.1.1 Real exchange rate

Beginning with the real exchange rate variable, we see that it had a positive and significant coefficient for the whole period, but negative and insignificant in the two sub periods. Looking back at Table 3, the positive significance found in the overall time period is most in line with portfolio and Keynesian theory predictions. These expected currency appreciation to have a positive effect on Turkish firms particularly through the channel described by the Marshall-Lerner condition.

The lack of significance in our two shorter time periods goes against the findings of Jamin & Ulla (2013) on the Pakistani stock exchange, who found a significant short run relationship between changes in exchange rate and returns. On the other hand, our findings match other studies, such as Chow et al (1997) on the United States. These differences may indicate that the effect of national macroeconomic variables not only changes over time but also from country to country. This makes sense, as Pakistan and the USA presumably have different business structures and demand elasticities than Turkey.

How can we explain this lack of significance in our two shorter time periods? The real exchange rate of a country is calculated through the nominal exchange rate and a weighted average of various countries’ inflation rates. A paper by Phylaktis (2000) on the Pacific Basin countries showed that the lack of causal relationship between the stock and foreign exchange markets in a country might be due to the omission of an important variable from the system, which acts as a conduit through which the real exchange rate affects the stock market. Referring to Caporale and Pittis (1997), who have shown that inferences about the long-run relationship of variables and the causality structure are invalid in an incomplete system, they argue that the important variable omitted from the system is the US stock market. In line with the ISE becoming more mature, the investor base has also changed, with an increasing amount of foreign investors - they made up 66.2% of the total in 2010. This may result in a greater dependency on alternative investment opportunities such as other stock exchanges or indices. As explained in our delimitations however, we have chosen to focus on national macroeconomic factors and have therefore not included other foreign indexes. This may explain why we do not find a significant effect of the real exchange rate, and may be something to consider when considering future studies on the topic.
7.1.2 USDTRY spot rate

The spot exchange rate coefficient was insignificant in the overall time period and the 1990s, but negative and significant following the banking crisis in 2001. Thus in the last decade, one has seen the appreciation of the Turkish lira have a negative effect on the returns on the Turkish stock exchange.

This is most in line with the Keynesian expectations from Chapter 4, as both portfolio and Monetarist theory predicted a positive effect of a Turkish spot rate appreciation. The relationship found thus indicates that during the last 10 years, publically listed firms in Turkey have been more inclined to be international and thus currency appreciation made them less competitive in their primary markets - causing their stock prices to fall. Perhaps equally importantly, a currency appreciation also makes it more expensive for foreign investors to purchase Turkish stocks on the Istanbul Stock Exchange. Given the high percentage of foreign investors on the ISE, a currency appreciation could through this channel lead to reduced demand and the observed fall in stock prices.

7.1.3 Industrial production

Industrial production has a negative and insignificant coefficient in all three periods. Turning again to Table 3, this is in line with the Efficient Market Hypothesis, which expects the information released on industrial production to already be known by investors.

On the other hand, our findings go very much against both the Keynesian and Monetarist predictions from Chapter 4, which suggest that increased industrial production should be a positive indicator for an economy and thereby lead to improved stock prices. It is also contrary to the results of other studies, for example the analysis done on the Greek stock exchange by Filis (2009).

7.1.4 Interbank lending rate

One commonality over time was found on the interbank lending rate. In all periods, the interbank lending rate has a negative and significant relationship with returns on the XU100. This confirms the theory based prediction we made in Chapter 4, where we outlined the Keynesian view that lower interest rates increase the level of investment in the economy because people are less likely to hold money in the bank. On the other hand, high lending rates increase the cost of operation of firms listed on the exchange and therefore makes the shares of these firms less attractive.

Our findings also match the predictions made by our more 'bottom up' portfolio theory models from Chapter 4. Both the Present Value Model and the Gordon Growth Models expect a fall in interest rates to lower a firm’s discount rate and
thereby increase the price of the security. Furthermore, interest rates are a portfolio alternative in themselves, with investors being able to choose to hold their money in the bank or purchase bonds should interest rates increase. Reduced interest rates thus also means that investors are more likely to switch asset classes to stocks, leading to increased demand and increases in prices on the Istanbul Stock Exchange.

Our findings mirror the results of previous studies on other countries (Pearce and Roley, 1983; Altay, 2003; Omrana, 2003; Filis, 2009). It thus seems that in general, changes in the interbank lending rate is a key predictor of changes in stock prices. This is a useful finding, particularly for politicians aiming to carry out beneficial macroeconomic policies. Keeping interest rates low seems to be a good economic policy, at least in the Turkish context.

Tying our insights back to Turkish history covered in Chapter 2, we can also see that the extremely high lending rates and excessive borrowing of government prior to 2002 had the effect of crowding out the private sector. Decreased lending rates in the last decade has therefore helped the economy and the ISE develop. For a long time, financial press saw rises in interest rates as a bad omen due to the fact that this lead to an increase in Turkish bond yields. This was especially bad for the economy because of the current account deficit and historically high levels of government debt. In 2003 alone, 40% of total government spending went to servicing debt (Financial Times, 2004). Thus a rise in interest rates added pressures to already tight public finances and distressed economy. Investors interpreted this to be bad for the stock markets as well, as we found negative coefficients on interest rates for all sub periods and sectors. In a time where the government has declared successful liberalization, it must therefore still be pointed out that the right policies must be adopted to maintain a reasonable interest rate level. This is especially important given that the Istanbul Stock Exchange is, and has long been, highly weighted in banks and financial players (See section 2.3).

7.1.5 Consumer price index

Interest rates and inflation of course go hand in hand, as explained by theory and our generally negative coefficients for our LCPI variable in the three periods. However none of our inflation factors are significant. This may indicate a higher degree of efficiency in the Istanbul Stock Exchange than we had originally predicted. Furthermore, the lack of significance may be explained by the fact that the Consumer Price Index in many countries usually has some leading indicators released before the actual figures, which tells investors what to expect. Most of this information will thus in this case be priced into the securities before the official figures are published. In the USA for example, research organizations such as Columbia University’s Center for Business Cycle Research (CIBCR) provide leading indicator calculations. While we could not find evidence that Turkey has something
equivalent to this, information from other channels such as commodity price futures in Turkey may be used by investors to get a sense of what the CPI figures will be, reducing the significance of this factor in our tests.

7.1.6 Explanatory power

An observation that was interesting regarding our factor model for the period 1994 to 2000, was how low its explanatory power was. To test whether there was a structural break or other fault in our method, we performed further tests on smaller sub periods. These periods were chosen because they were found to be part of the same macroeconomic and political regime, for example the period of IMF reform from 1995 to 1999, and again from 2001 to 2008. We also performed tests where we tried to exclude outliers we saw in the data. However despite performing numerous tests, no significant differences or more useful explanatory power were discovered. One reason for this may be the fact that OLS models at this level, where one includes differenced variables, have a harder time achieving higher $R^2$. Many authors therefore do not even look at the $R^2$ number following such tests (for example Muradoglu et al, 2001). We have chosen to include them regardless for the sake of transparency, but do not weight them as heavily as we would in a straightforward OLS regression.

The large difference in explanatory power in our two sub periods may be evidence of the fact that in highly uncertain political and economic environments, investors do not act quickly on changes to macroeconomic events, as they expect them to change. We found evidence of this by sorting through Financial Times articles from this tumultuous decade. Titles such as ‘Turkish package fails to put doubts to rest’ (Financial Times, 1994 - copy in Appendix 2), provide some anecdotal evidence of the claim that markets do not regain confidence easily. And while Moody’s has recently upgraded Turkey to investment grade, professor Taner Berksoy, Dean of the Faculty of Economics and Administrative Sciences at Istanbul’s Okan University, says that this may have been a belated decision delayed by lack of investor confidence in the results seen:

“When compared to the situation of other developed countries that suffered seriously from the crisis, Turkey’s rating should have already improved. But we have a bad track record: of the 19 IMF standby agreements, 17 were not completed, we passed through six crises between 1988 and 2001 and four of the six were totally self-made. Because of that record, rating agencies did not believe earlier that Turkey was on the right track. So it is a belated decision.” - Taner Berksoy to Hurriyet Daily News, May 20 2013

There is therefore reason to believe that the difference in explanatory power is due to the lack of investor confidence in Turkish macroeconomic news in the 1990’s
prevented the development of a stable relationship amongst them and the stock market.

7.2 Sector Index Results – An Analysis of How Macroeconomic Effects Change Among Industries

We will now turn to answering research question number 3 regarding the effects of macroeconomic variables on different sectors of the Turkish economy. Our results indicate that the effect of macroeconomic variables on stock returns change depending on the industry. In trying to understand the observed patterns, we will now look at the effect of each of the macroeconomic variable in turn, invoking both financial and empirical insights.

7.2.1 Real exchange rate

The real exchange rate is shown to have a negative short term effect on all sector returns. This is in line with both portfolio and Keynesian theory. Turkey is a net importer, and so a change in the real exchange rate is expected to have a negative relationship with the stock exchange value. However only the Services index is significant. To understand why this might be, we need to look at some empirical evidence.

One hypothesis might be that the Services index is composed largely of stocks affected by Tourism, which in turn is negatively affected by an appreciation of the real exchange rate. We check if this is the case by looking at the weightings of the HIZ100 Index (Figure 2.3). Here we find that Transport and Food & Transport firms make up 51% of the index value. Furthermore, we find that 3 stocks make up around 65% of the index: BIM, a food retail chain makes up 26% of the index, while Turkcell the national telecom giant, and Turkish Airlines, make up 21% and 16% respectively. One can see how exchange rate will have a large impact on these firms through its effect on tourism in particular. This provides a tentative explanation of why the effect of the real exchange rate is more pronounced on the Services index than the others.

7.2.2 USDTRY spot rate

Sector indices are all negatively affected by the spot rate of the Turkish lira to the US dollar at 1% significance level. Turning back to our theory, this is most in line with the J curve effect as posited by Keynesian macroeconomic theory, which states that as a currency depreciates a country’s trade balance will initially worsen. Assuming that the effect on stock prices will show a similar pattern as the trade balance, we can see that our short run factor model confirms this.
The effect is particularly high for the Services and Financial indices. To explain the significantly negative relationship to the Services index, one can again see it as a result of the fact that appreciation is deemed unfavorable for the Turkish tourism industry as rates will become relatively more expensive in terms of foreign currencies and hence would decrease demand.

The highly negative effect on the Financial index on the other hand, might be a result of the fact that the Commercial banks which make up the majority of the index face both transaction (short term exposure from differences in exchange rates between the date a transaction is entered and when it is settled) and economic exposure (long term exposure depending on the input/output markets and overall competitiveness of the bank). The transaction exposure, or currency risk, is one of the risks which the Basel Accords stipulate that banks must hedge against. Our results indicate that they are perhaps not good enough at hedging. Even if currency risk is properly hedged, our highly negative sensitivity to exchange rates could be evidence of the fact that they are less competitive than their foreign counterparts. These findings are in line with the study by Caglayan et al (2009) on the effect of exchange rates on financial vs. nonfinancial firms.

7.2.3 Industrial production

Industrial production is not a significant predictor of returns in any index. This is in line with the predictions made by the Efficient Market Hypothesis, in that this figure is expected to be known by the market ahead of its release. The sign on the industrial production coefficient fluctuates as well among the various sectors: There is a positive relationship between industrial production and returns on the Industrials index, while the other indices have a negative coefficient. This makes sense however given the fact that the Industrial Production figure measures production in the Industrial sector only.

7.2.4 Consumer price index

Changes in the consumer price index, or inflation, do not exhibit a significant influence on returns in any index. This is counterintuitive especially for our financial index, as the revenues and costs of banks and financial institutions are directly affected by interest rates. One explanation for why we have found no significance may be that the effect shows up through the interbank lending rate. Another explanation is that again, investors may already have a very good idea of what the CPI figure for the period is going to be, through leading indicators that have been released earlier. The effect of interest rates depends on how well banks balance the maturity mismatch between assets and liabilities, and hedge their risks. A short-funded bank will be negatively affected by an increase in interest rates and vice versa.
7.2.5 Interbank lending rate

Turning to the interbank lending rate, our review of Keynesian and Portfolio theory showed that an increase in interest rates was expected to have a negative effect on stock prices. Portfolio theory expected this to take place through the increase in the discount rate, which decreases the total present value of a firm’s cash flows. Our results confirm this expectation, and all sectors reflect a negative relationship with the interbank lending rate, although only Technology is significant.

For the Technology index we find that on average, a 1% increase in the rate of change of interest rates has decreased the rate of change of the value of technology stocks by 3% in the last decade. To understand why only Technology is significant in the same time period as the other indices are insignificant, it is again important to look at what differentiates technology stocks from other stocks.

In general, sectors marked by high debt will likely underperform when interest rates rise. When debt matures and must be refinanced, the cost to fund new debt rises and weighs on future earnings and dividend growth. However, in the West, most tech companies have low debt and a stable fixed-capital structure, which leads to widening margins when revenue grows. In fact, the Western technology sector has historically been the best performing sector in the six-months after a rise in interest rates, according to data analyzed by JPMorgan and Birinyi Associates (Nasdaq, 2013). If low debt were the case in Turkey, it would therefore not explain why we saw a significantly negative relationship between interest rates and stock performance. As a test, we looked at the financial statements of the largest tech firms – Aselsan Elektronik Sanayi Ve Ticaret AS (ASELS) a defense firm which makes up 55% of the index, and Netas Telekomunikasyon AS (NETAS) a telecommunications firm which makes up 14% of the index (Figure 2.4). Our analysis finds on average a quite low debt/equity ratio, although it seems to have increased in recent years.

Netas went from TRY 5 million in debt to TRY 30 million last year, while Aselsan’s debt levels have fluctuated. The ratios are however very similar to the Western investor favorite Cisco (Figure 7.1). This leads us to conclude that high debt levels are not the reason why we found such a highly significant effect of interest rates on the technology sector.

An alternative explanation for the high significance of the interbank lending rate on the Technology index is one we touched upon earlier in Section 4.1.4. Here we outlined the Present Value Model for pricing stocks, and furthermore the importance of the present value of a firm’s future investments in industries where long term investments are key. Technology stock prices are more often than not driven by the present value of growth opportunities (PVGO) rather than discounted cash flows, as technology firms tend to invest a lot in Research & Development. As the discount rate will be significantly increased by the discount rate, and a higher discount rate leads to a disproportionately lower value for PVGO, this may explain the high significance found for our Technology index.
Figure 7.1: Debt levels and ratios in the Technology industry

(a) Netas debt level over the last 5 years

(b) Aselsan debt level over the last 5 years

(c) Cisco debt level over the last 5 years
7.3 Chapter Conclusion

The analysis of our results suggest both a time and sector varying effect of macroeconomic variables on the ISE. In the two decades studied, we find that the US-DTRY spot exchange rate went from being positive and insignificant in our first period to negative and significant in our second period. On the other hand, we found that the interbank lending rate was negative and significant throughout - suggesting a more stable relationship between this variable and stock returns. This may be of interest to investors who want to create a predictive model, as well as politicians who want to avoid jeopardizing Turkey’s position as a country with a relatively profitable exchange.

In terms of sector differences, we found that often it was only one or two industries that exhibited a significant relationship with a given variable. The real exchange rate was negative and significant only with the Services index, which we hypothesized to be a result of its effect on the Tourism stocks that make up a large part of the index. The interbank lending rate was only negative and significant for the Technology index, which may be a result of investor preferences. Again however, we did find one variable which affected all our sectors in the same way. The spot exchange rate was negative and significant for all. This can be explained by the J curve effect, as well as sector specific effects such as the level of international activity of the firms.

8 Conclusion

This study had as its aim to provide an investigation of the relationship between returns on the Istanbul Stock Exchange and changes in various national macroeconomic variables, in order to help both investors and policy makers in their future decision making. The research question we sought out to answer was first of all: What is the relationship between Turkish macroeconomic variables and stock returns on the Istanbul Stock Exchange? Within this, we developed the following sub questions to guide our research:

1. How can we use modern economic and financial theory to predict the relationship between stock returns and macroeconomic variables?

2. To what extent does the relationship between macroeconomic variables and stock returns change over time?

3. What is the relationship between macroeconomic variables and stock returns in different sectors represented on the Istanbul Stock Exchange?

Through our theoretical literature review in Chapter 4, we were able to outline the predictions made by macroeconomic theory and financial theory, and come up with
a summary table to answer sub question 1. Here we found that the predictions made differed substantially, with Keynesian theory suggesting that for example inflation should have a positive effect on stock returns, while Monetarist theory argued strongly for the exact opposite.

We then looked at previous studies in Chapter 5 as well as their methodologies, to see what other studies had concluded on the topic. These papers helped to develop our own testing method, and also gave us insight into the knowledge gap that existed when it came to studies on the Turkish market.

In Chapter 6 we set up a range of empirical tests to analyze the time series data from the Istanbul Stock Exchange. Here we firstly identified that the relationship between macroeconomic variables and stock prices tend to change over time. This was surprising in light of the theoretical models we had studied, which all seemed to suggest a static relationship. We furthermore found that the relationship differs depending on the sector index analyzed. This was perhaps less surprising, as it is to be expected that variables such as exchange rate changes might affect export-oriented industries more than those who sell to the internal Turkish market. What is interesting to note is that many of the macroeconomic variables did not have a significant effect on any sector. This seems to suggest that both investors and policy makers can conduct their activities without taking them into account.

In Chapter 7, we then commenced a discussion on why we observe the results found in our tests, and aimed to come with some suggested insights based on this. While we recognized that this is largely a hypothesizing activity, we hope that it will provide inspiration for future research. To understand the reason behind the time varying effect of the macroeconomic variables, we employed a mix of the theoretical literature covered in Chapter 4 and a handful of relevant studies to compare results with.

The final results from our factor models on the XU100 for the three time periods are summarized in Figure 8.1. Where a factor was found to be significant, we have included the macroeconomic or financial theory it is most in support of. The strongly significant effect of the USDTRY spot rate (LUSD) in the last decade as well as the Interbank Lending Rate (LIND) in all periods indicates that the ISE is not perfectly efficient. These last two observations are most in line with Keynesian theory predictions, and supports conclusions drawn by previous studies that macroeconomic variables can be used to predict stock price movements. Furthermore, the strong significance of the Interbank Lending Rate with its negative coefficient indicates that this policy makers should aim to avoid increases in this macroeconomic variable as it has historically led to a weaker stock exchange.

For the insignificant variables, our discussion focused on that the insignificance of the Real Exchange Rate (LEX) and the Industrial Production Index (LIND) seems to be most in line with portfolio theory predictions, which depending on whether it is strong, semi-strong, or weak efficiency assumes that all or most information about these is already factored into the stock price.
We then turned to understanding the differing effects on the sector indices. Figure 8.2 outlines the results of our final factor model regression. Again, where a variable was found to be significant we have included the theory from Chapter 4 that predicted this significance and direction. Here one can see that the significance of the Exchange rate variables (both LEX and LUSD) supported the predictions made by the Marshall-Lerner condition and Keynesian theory. The strong significance of these variables furthermore seems to indicate that the ISE is not perfectly efficient when it comes to information about the Turkish macroeconomic situation. Still, the picture is mixed. For proponents of portfolio theory, the insignificance of particularly Inflation (LCPI) and Industrial Production (LIND) could be seen to suggest that market is quite efficient.

In conclusion, our results match many previous studies done on Turkey and developing countries. Not all macroeconomic variables are found to have a significant effect on stock prices, and the direction of those that are significant support opposite schools of thought depending on the variable. For instance, our results on the Exchange Rate Variables LEX and LUSD support Macroeconomic theories such as Marshall-Lerner and Keynesian, while the negative coefficient on the Interbank Lending Rate towards the XU100 supports Portfolio theory models such as Arbitrage Pricing Theory and the Gordon Growth Models. Investors and policy makers should bear this in mind when attempting to use such ‘grand theories’ to inform their decision making. Furthermore, the changing results on our five macroeconomic variables depending on the time period and sector tested suggest that generalizing is difficult, if not impossible. Still, by providing an up to date and

<table>
<thead>
<tr>
<th>Time period</th>
<th>Factor</th>
<th>Significant?</th>
<th>Direction?</th>
<th>Supportive of theory (if significant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994-2013</td>
<td>LEX</td>
<td>✓</td>
<td>+</td>
<td>Marshall Lerner</td>
</tr>
<tr>
<td></td>
<td>LUSD</td>
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<td>-</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>LIND</td>
<td>✓</td>
<td>-</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>LCPI</td>
<td>✓</td>
<td>-</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>INT</td>
<td>✓</td>
<td>-</td>
<td>Portfolio theory &amp; Keynesian</td>
</tr>
<tr>
<td></td>
<td>LUSD</td>
<td>✓</td>
<td>+</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>LIND</td>
<td>✓</td>
<td>-</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>LCPI</td>
<td>✓</td>
<td>+</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>INT</td>
<td>✓</td>
<td>-</td>
<td>Portfolio theory &amp; Keynesian</td>
</tr>
<tr>
<td>2001-2013</td>
<td>LEX</td>
<td>✓</td>
<td>-</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>LUSD</td>
<td>✓</td>
<td>-</td>
<td>Keynesian</td>
</tr>
<tr>
<td></td>
<td>LIND</td>
<td>✓</td>
<td>-</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>LCPI</td>
<td>✓</td>
<td>-</td>
<td>n.a.</td>
</tr>
<tr>
<td></td>
<td>INT</td>
<td>✓</td>
<td>-</td>
<td>Portfolio theory &amp; Keynesian</td>
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</table>
### Figure 8.2: Summary of results from factor models on sector indices, 2001 - 2013

<table>
<thead>
<tr>
<th>Sector</th>
<th>Factor</th>
<th>Significant?</th>
<th>Direction?</th>
<th>Supportive of theory (if significant)</th>
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<tbody>
<tr>
<td>LUSD</td>
<td>✔</td>
<td>–</td>
<td></td>
<td>Keynesian</td>
</tr>
<tr>
<td>LIND</td>
<td>×</td>
<td>+</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>LCPI</td>
<td>×</td>
<td>–</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>INT</td>
<td>×</td>
<td>–</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>LEX</td>
<td>×</td>
<td>–</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>LUSD</td>
<td>✔</td>
<td>–</td>
<td></td>
<td>Marathon-Lerner</td>
</tr>
<tr>
<td>LIND</td>
<td>×</td>
<td>–</td>
<td></td>
<td>Keynesian</td>
</tr>
<tr>
<td>LCPI</td>
<td>×</td>
<td>–</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>INT</td>
<td>×</td>
<td>–</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>LEX</td>
<td>×</td>
<td>–</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>LUSD</td>
<td>✔</td>
<td>–</td>
<td></td>
<td>Keynesian</td>
</tr>
<tr>
<td>LIND</td>
<td>×</td>
<td>–</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>LCPI</td>
<td>×</td>
<td>+</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>INT</td>
<td>✔</td>
<td>–</td>
<td></td>
<td>Portfolio theory</td>
</tr>
<tr>
<td>LEX</td>
<td>×</td>
<td>–</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>LUSD</td>
<td>✔</td>
<td>–</td>
<td></td>
<td>Keynesian</td>
</tr>
<tr>
<td>LIND</td>
<td>×</td>
<td>–</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>LCPI</td>
<td>×</td>
<td>–</td>
<td></td>
<td>n.a.</td>
</tr>
<tr>
<td>INT</td>
<td>×</td>
<td>–</td>
<td></td>
<td>n.a.</td>
</tr>
</tbody>
</table>
comprehensive analysis of the Istanbul Stock Exchange we hope that our paper has served to enlighten the nature of these relationships.

9 Implications & Future Analysis

Investors make their asset and security allocation decisions based on a number of factors, among them being the macroeconomic situation and outlook in a given country. Our analysis has shown that for investors interested in Turkey, they must first of all be careful not to assume that relationships which have held in the past will continue into the future. We also find that depending on the sector, the effect of changes in macroeconomic variable will differ as well. Still, for policy makers and legislators, our findings indicate that especially keeping interest rates low has been a good policy during the last 20 years.

Topics for further study within Turkey identified in our analysis include the influence of non-national macroeconomic variables on the Istanbul Stock Exchange. Herein, the effect of certain US Federal Reserve decisions is expected to be of particular importance, as identified in a by paper by Phylaktis (2000) on the Pacific Basin countries. Furthermore, investigating the effect of non-financial factors such as investor sentiment could help create a more detailed picture of drivers of stock prices on the ISE. Future research could also beneficially be conducted on other emerging markets, to contribute to our understanding of common trends in the long-run relationship between stock returns and macroeconomic variables. Performing country comparisons may help researchers and investors in identifying the market structures that lead to differences in the long- and short-run relationship between macroeconomic variables and stock returns.
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