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A SECTOR LEVEL ANALYSIS FOR MACROVARIABLES AND STOCK INDICES IN TURKEY

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A SECTOR LEVEL ANALYSIS OF MACROVARIBLES AND STOCK RETURNS IN TURKEY

MAKROGÖSTERGELER VE STOK GETİRİLERİ İLİŞKİSİNİN SEKTÖR BAZINDA ANALİZİ

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ABBREVIATIONS

ADF: Augmented Dickey Fuller

AIC: Akaike's Information Criteria

SIC : Schwarz Information Criteria

GDP: Gross Domestic Product

VAR: Vector Autoregressive

VECM: Vector Error Correction Model

GARCH: Generalized Autoregressive Conditional Heteroskedasticity

NARDL: Non-linear Autoregressive Distributed Lag

APT: Asset Pricing Theory

CBRT: Central Bank of the Republic of Turkey

FED: Federal Reserve Bank

PPI: Producer Price Index

CPI: Consumer Price Index

ISE: Istanbul Stock Exchange

XUHIZ: Services Index

XUMAL: Financial Index

XUSIN: Industrial Index

XUTEK: Technology Index

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ABSTRACT

The way of macroeconomical factors affect stock returns has been discussed for long time by investors. The paper aims to examine stock returns and macroeconomic variables relationship on sector level for Turkey by covering period of 2006:1 and 2018:12. The choosen domestic economical factors are exchange rate USD/TRY, consumer price index, industrial production and 1-year deposit rates ; international factors are US M2 money supply and 10-year treasury constant maturity rate. BIST00, service, industry, technology and financial sector indices are selected as endogenous variables in VAR model. The main findings are while exchange rate USD/TRY, 1-year deposit rate and US M2 money supply have negative effects on stock indexes; industrial production influence positively compatibly previous researhes. In addition, global factors found to be significant on returns like local factors. The test results also show that Turkish consumer price index and US long term treasury yield do not have any effect on chosen sector indices. Moreover, there is no bilateral correlation among BIST100 index and other sector indices between 2006-2018.

KEYWORDS: Stock Return, Exchange Rate, Interest Rate, Money Supply, BIST

ÖZET

Makroekonomik göstergelerin stok getirilerini nasıl etkilediği uzun zamandır tartışılmaktadır. Bu çalışmanın amacı 2006-2018 yılları arasında BIST endeks getirileri ve makroekonomik değişkenler arasındaki ilişikiyi sektör bazında incelemektir. Tüketici fiyat endeksi, sanayi üretim endeksi, 1 yıllık mevduat faizi ve dolar kuru lokal faktörler olarak seçilirken, ABD M2 para arzı ve 10 yıllık hazine getiri oranları global faktörler olarak seçilmiştir. Vektör otoregresyon modelinde endojen değişkenler olarak BIST100 endeksi, servis, sanayi, finans ve teknoloji sektör endeksleri kullanılmıştır. Sonuçlarda, önceki araştırmalara uyumlu şekilde, dolar kuru, faiz oranları ve para arzı stok getirilerini negatif olarak etkilerken, sanayi üretim endeksi pozitif olarak etkilemektedir. Bunun yanında, global faktörlerinde getiri üzerinde lokal faktörler gibi etkili olduğu görülmüştür. Tüketici fiyat endeksi ve ABD hazine getiri oranlarının stok getirileri üzerinde etkisi olmadığı gözlemlenmiştir. Ayrıca 2006 ve 2018 yılları arasında BIST100 ve diğer sektör endeksleri arasında ikili bir ilişkiye rastlanmamıştır.

ANAHTAR KELİMELER: Stok getirisi, Döviz kuru, Faiz oranı, Para Arzı, BIST

INTRODUCTION

The relationship between macroeconomic factors and share prices has been deliberated both in economics and finance literature since the beginning of 1970. The anomalous findings and ever-growing ideas modernized this issue. Unanticipated share price volatility in world markets during 1980's and 1990's increased interest on this relationship. Some researchers stated that this volality was resulted by speculative movements, some others focused on causality among share returns and macrovariables.

The present value or discounted cash flow is the most commonly used model for share evaluation. In this model, share price evaluation is directly related with the discount rates and dividends which are affected by real economic activity and government economic decision immediately. Therefore, origin of the debate about the relationship between share prices and macroeconomic indicators stemmed from this vital connection. Flannery and Protopapadakis (2002) claimed that macroeconomic variables affected the discount rate based in discounted cash flow model and so firms' impetus to generate cash flow. By considering macrovariables effects on income and cost structure of the firms, stock returns movements can be foreseen.

This thesis tries to explain the relation between macrovariables and stock returns. Although there are wide range research even for stock returns of emerging markets, due to limited research in sector level analysis on stock returns for Istanbul Stock Exchange, this subject is valuable for Turkey case and will be elaborated in this paper.

This study consists of six parts. Part 3 reviews previous literature associated with the subject. Part 4 describes the data set and examines first set of results, and in section 5 the statistical methodology which is covered in the analysis is illustrated. The empirical findings are detailed in Section 6. Eventually, conclusion section presents the results and evaluations as a whole.

1.MACROVARIABLES AND STOCK RETURNS RELATIONSHIPS

1.1.Money Supply and Stock Returns

The very first study about relationship between money supply and share prices was prepared by Palmer (1970). The research showed that change in money supply influenced the share prices. Many researcher supported this statement; as Ho (1983) found that money supply change caused changes in stock prices unambiguously for Hong Kong and Japan; and then Thornton (1993) concluded that there were feedback effects between money supply and stock prices. The common accepted wisdom tells changes in money supply affect the financial market by impacting on general economy immediately. Loanable funds's amount in the market is directly affected by interest rate through money supply adjustment. When money supply rises, interest rates fall due to increase in the amount of loanable fund. On the contrary, Durham (2003) stated that monetary policy did not demonsrate any relation between easing or tightening money supply cycles and stock prices, in other words the correlation between money supply and stock returns was weak or nonexistent.

1.2.Inflation and Stock Returns

The protection against inflation is very important for investors who have the expectation that revenue genereated from asset acquisition should be a hedge agaist inflation loss in the light of Fisher hypothesis. A reverse relation among stock prices and inflation level was presented by first Fama (1981) and later supported by Lee (1992). In detail, mentioned correlation was not a casual relation but was a proxy for a positive correlation among stock prices and real activity, plus was induced by a negative correlation between real activity and inflation. From a different point of view, the negative correlation results from investors preference changing from stocks to interest bearing assests during high inflation periods. On the contrary to these negative relationship claims, Kessel (1956) stated that if a firm is a net debtor, an increase in unanticipated inflation will rise the firm's value depending on debtorcreditor hypothesis. Kessel was also supported by Abdullah's (1993) Granger causality test which revealed positive relation among price level and stock prices.

1.3.Interest Rates and Stock Returns

Researches so far show that there is a strong relationship between interest rates and share prices. Change in interest rates affects borrowing cost and profitability of a company. In this sense, a decrease in interest rates lowers the cost of borrowing thus incentivize the firm for expansion which may lead an increase future expected value of a firm. Besides a direct effect on share values, interest rate affects returns of alternative investment tool like bonds. Thus it leads change in stock demand in the market. Cook and Hahn (1988) found that when interest rate increased, stock market exhibited a downward trend as a short term reaction (announcement effect), if interest rate increased vice versa. Saunders and Yourougou (1990) examined the side of firm's assets and liabilities and interest sensivity relations and found that industrial firms were less fragile to fluctuations in nominal interest rates than securities claim on monetary assets.

1.4.Exchange Rates and Stock Returns

The currency value fluctuations affects corporate earnings therefore the exchange rate has been scrutinized to explain stock returns for many years. Although there is no satisfactory findings about stock price reaction to exchange rate volatillity in early research because of fix regime of Bretton Wodds, the impressive growths in the world trade and capital movements have done exchange rate as more important topic recently. The possible explanations for stock price and exchange relations: change in exchange rate, first of all, influence value of firm's portfolios. Second, being importer or exporter is matter. If country the country is an exporter one, currency depreciation may increase its competitiveness and positively influences stock price. Third, rather than a casual correlation between stok prices and exchange rates, there may be indirect relation because of the links betweeen exchange rate & economic activity and economic activity & stock price. Solnik (1987) found a positive correlation amoung share returns and foreign exchange rate. Aggarwal

(1981) claimed that this relationship was stronger than in the short term compared to long term. On the contrary, Soenen and Hennigar (1988) concluded in statistically meaningful reverse effect on share returns of exchange rates. Rittenberg (1993) analyzed the issue for Turkey by Granger causality test, he found a casuality driving from equity price level to exchange rate but there existed no feedback causativeness from exchange rate changes to price changes. Anlas (2012) examined the impacts of foreign exchange rates changes on ISE, from January 1999 to November 2011. By applying the techniques of time series analysis he concluded that the changes in domestic U.S. Dollar and Canadian dollar were positively related to changes in ISE 100.

1.5.Economic Activity and Stock Returns

The findings of previous studies about correlation between economic activities and stock returns are contradictory. Abdullah and Hayworth (1993) claimed that economic actions influenced share prices because of their effects on firm incomes.The general opinion regarding this relation is increasing economic activity leads a positive impact on stock returns. Mahdavi and Sohrabian (1991) looked from different point of views and stated that annual stock returns succesfully predicted growth slowdowns or recessions, in other words; GNP follows the trend of share prices. The idea is investestment decision mirrors investors expectation about stock prices thereby future firm profits. Thus level of aggregate domestic and real economic action may be estimated from stock market activity. Kwon and Shin (1999), Nasseh and Strauss (2000) and Binswanger (2004) used industrial production index as a proxy for economic activities. Industrial production index is also used in this paper due to the lack of monthly GDP data.

The correlation among trade balance and stock returns has not been studied much in the literature. However, it is taken into consideration in few article due to growing open economy concept and its implicit relations with other variables, specially exchange rates. Fifield et al. (2002) and Acikalin et al. (2008) analyzed the effect of current account balance and foreign trade balance in their studies and could not find any significant relationship.

1.6.Oil Prices and Stock Returns

Oil prices influences production costs and inflation rates. Hence these prices has direct impact both on stock market returns and real economic activity. The 1973 oil price shock and the subsequent recession led to many studies analyzing the interrelation among economic variables and oil price changes. General opinion about this relationship is that oil prices exercise an adverse influence in stock markets. Filis at all (2011) contributed the topic with the findings that oil prices behaves parallel with stock markets during 2008 global financial crisis. Therefore in the periods of economical turmoil, the oil is an unsecure investment option for hedge against stock market losses. Basher at all (2012) investigated oil price, exchange rates and emerging stock market relations.The findings revealed a positive shocks to oil prices tend to reduce emerging market stock prices and US dollar exchange rates in the short term. The model also emphasized stylized facts concerning movements in oil prices. A positive oil production shock decreased oil prices while a positive shock to real economic activity rose oil prices. Another evidence indicated that increasing emerging market stock prices rose oil prices.

1.7. Effects of Local versus Global Factors on Stock Returns

Previous literature on the subject is mainly concentrated on developed markets. However, a enormous amount of capitals currently moves into emerging stock markets with the aim of efficient asset allocation and enlarged liquidity in these markets thanks to the positive effects of liberalizations. This makes it interesting to explore likely correlations among emerging stock markets and country-specific macroeconomic factors. In this aspect, it has been discussed that local variables rather than global ones are the main source of equity return variation in these markets. Bilson et all (2001) stated that integration level influenced the priority of international versus domestic factors. If we accept that the markets are not perfectly integrated, especially in scope of emerging markets, then it is likely that national factors may be more relevant than global ones. Similarly, Karolyi and Stulz (2003) investigated the international finance literature in order to evaluate impact of international factors on financial asset demands and prices. The results indicated that risk premium of a country and exchange rate risks affect expected returns. In addition to this, anticipating the extent to which home bias affects the asset prices gave idea regarding size of local influences. Moreover, equity flows and cross-country correlations are the signals of global influences on asset prices. Durand at all (2006) searched ‘home grown’ factors’ effects for Australian equity returns by using Fama-French three factor model and found that largest firm in the Australian market was simply part of the larger US market, on the contrary small firm were affected local factors. Cauchie at all (2004) focused on Swiss stock market and concluded that both global and local economic conditions affected stock returns. In the scope of international market integration, Beckers at all (1996) compared national versus global influences on equity returns and found that international effects and countrywide effects had roughly equal status in explanation the common movements in share returns. It was shown that there was a tendency to high integration within European Union, but not universal. Rizwan and Khan (2007) studied stock returns and country and global factors relation in an emerging market Pakistan using VAR model. The results showed that both country and global factors were significant.

1.8. Global Financial Crisis of 2008 and Repercussion of Stock Markets

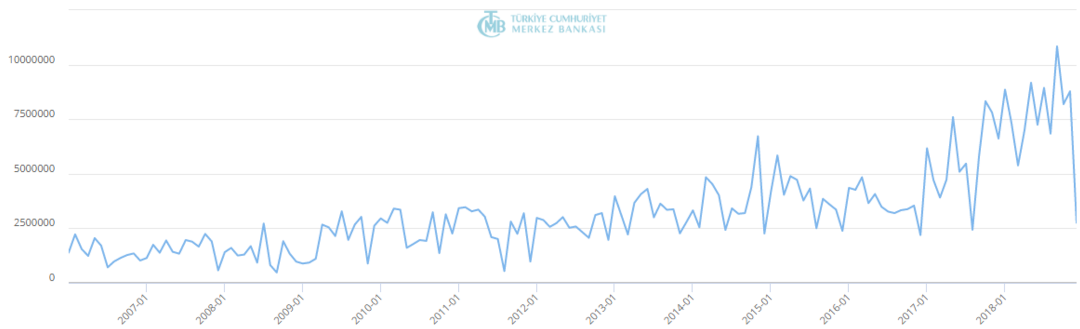
Since sample over 2006-2018 covers global financial crisis of 2008, effects of crisis on stock returns in different markets should be examined. Luchtenberg and Viet (2015) studied global contagion and its causes in time of 2008 financial crisis. It was concluded that contrary to earlier crises contagion subsequent the 2008 global financial crisis was not limited to emerging markets. The United States and other developed financial markets in the sample conveyed and received contagion. In addition, variables were compared as before crisis and during the crises separetely. Interest rate, inflation rate and industrial production contributed to international contagion. Didier at all (2011) stated that countries with fragile banking and corporate sectors showed high percent comovement with US market by analysing period previous and following the bankrupt of Lehman Brothers. This finding showed that comovement was mainly stemmed from financial connections.

Similarly, Bekaert at all (2014) claimed that contagion from the United States was small amount, on the contrary there were considerable contagion from local markets to individual local portfolio, with its pressure that situation gives inversely associated with the economic fundamentals' solidness of a country. This conforms the "wake-up call" hypothesis, with markets focusing more on country-specific characteristics during the crisis. Nikkinen at all (2012) investigated effects of 2008-2009 crisis on Baltic region, countries namely Estonia, Latvia and Lithuania. Previous researches revealed that while mature stock markets were vastly integrated, emerging markets might be segmented. The way this integragration changes in crisis is questioned. The findings indicated that the Baltic stock market were apperantly segmented previously the crisis and they were highly integrated through the crisis. Frankel and Saravelos (2010) investigated leading indicators of financial crisis. For the 2008-09 crisis, they used six different variables to measure crisis incidence: fall of GDP and industrial production, currency depreciation, stock market performance, reserve losses, or participation in an IMF program. The results showed that level of reserves in 2007 appeared as a statistically significant leading indicator of the crisis. In addition to reserves, real appreciation was a statistically significant predictor of devaluation and a measure of exchange market pressure during the crisis.

2. A BRIEF ON ISTANBUL STOCK EXCHANGE

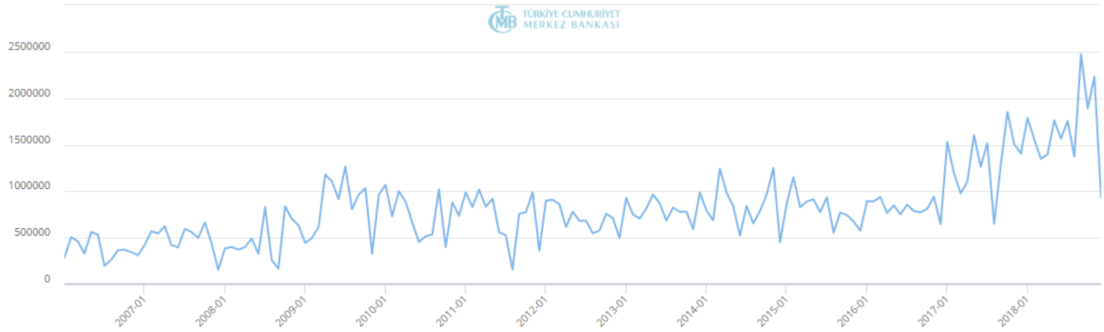
Before 1980, government activities and restrictions ruled Turkish economy. There was no capital market and foreign exchange operations were prohibited in the sense of centralized and state-oriented economy. The early time of 1980s witnessed a remarkable development in the Turkish capital markets, associated with both the legislative framework and the institutions to reach highly liberalized and globally integrated economy. IMF-supported stabilization program had executed in 1980. After thus Turkish economy politics transformed from an inward-oriented strategy to an outward-oriented one. In 1981, the "Capital Market Law" was legalized. The principles regarding operational procedures were agreed in the congress and Istanbul Stock Exchange was officially initiated at the end of 1985. Istanbul Stock Exchange (ISE) as an self-governing, professional organization in the beginning 1986 was started trading with 42 companies. ISE filled a gap as an only establishment for securities exchange in Turkey. This corporation enabled trading in equities, bonds and bills, revenue-sharing certificates, private sector bonds, foreign securities and real estate certificates likewise international securities.

2.1. Total Trading Volume (Thousand TL)



Source: CBRT

Figure 2.2.Total Trading Volume (Thousand)



Source: CBRT

Since 1994 Turkish stocks in the market rose more than 250 times by 1997. Daily trading volume passed over $150 million. In trading volume, ISE was the eighth largest of the twenty-two European stock exchanges by outdistancing Madrid, Copenhagen, Oslo, Brussels and Vienna. Recently, the number of listed companies has reached 489 with market capitalization of $163 billion and the daily trading volume 2 billion.

As it seen figure in 2.1 and 2.2 which shows trading volumes from 2006 to 2018, after 2018, in both figures, a sharp decrease is observed with effect of 2018 ongoing crisis. Another slump in stock performance experienced in gobal financial crisis of 2008. In 2008, substantial falls experienced in world stock markets. The global economic crisis also influenced Turkish economic system. Accordingly the falls of stock markets in worldwide, a significant decrease also observed in ISE. In 31.12.2007, the index was 55.538 point. This score declined 51,62% in 31.12.2008 and reached 26.864 point. Downward trend that occured in ISE had maintained in 2009 and index declined to the point of 23.055 on march 2009.

The comprehensive transformation in Turkish economy was required Foreign Policy Investment (FPI) and Foreign Direct Investment (FDI) measures that regulates foreign investors activities in 1980 and 1989. An empirical result revealed that shares owned by foreigners on the Istanbul Stock Exchange (ISE) had been increasing since 1995 and its was about 50% in 2003. (Gazioglu, 2003). Today, foreign investor share in stock trading is approximately 65%. Akar (2008) stated that there is a dynamic connection between ISE stock price and net foreign trading volume. In addition, the causality running from index price to net foreign trading volume is statistically more powerful.

From market efficiency perspective, previous studies showed that BIST follows random walk hypothesis but exhibits weak form efficiency. (Gozbası, Kucukkaplan and Nazlıoglu, 2014).

Hence, it may be concluded that former price information was reflected on market prices and prices moved independently from each other. In this sense, it is impossible for a trader who benefits from technical analyses by looking former price information to gain more profit than the one who does not have this information and to get above average. (Kılıc and Bugan, 2016)

3.LITERATURE REVIEW

The relationship between macroeconomic factors and change in stock prices has been the subject of many researches so far. In this section, the studies that investigate this relation will be reviewed. Although this relationship has been discussed intensively in many international markets, Turkey scope has been made less interference to evaluate.

One of the early research, Ratanapakorn and Sharma (2007) scrutinized long run and short run relationships among stock index (S&P 500) and six macroeconomic factors over the term 1975:1–1999:4. The Granger causality was utilized and it was found that while stock prices exhibited a reverse relation with long-term interest rate, there were positive impact of money supply, industrial production, inflation, the exchange rate and the short-term interest rate on stock prices.

Humpe and Macmillan (2009) studied the way of macroeconomic variables affect stock prices in the US and Japan. A cointegration analysis was used to figure out the long run relationship between industrial production, the consumer price index, money supply, long-term interest rates and stock prices in the US and Japan. According to results, stock prices were positively correlated with industrial production but negatively correlated with both the consumer price index and the long-term interest rate. Moreover, a trivial (but positive) affiliation between the US stock prices and the money supply was resulted**.** What's more, two cointegrating vectors for the Japanese data was detected where one vector implied a positive relation with industrial production and a reverse relation with money supply. Another cointegrating vector demonstrated that industrial production negatively affected by the consumer price index and a long-term interest rate. These conflicting consequences may be due to the crash in the Japanese economy in the 90s and results of liquidity trap.

Gjerde and Sattem (1999) examined whether relationship between stock returns and macroeconomic variables from major markets are valid in a small, open economy by utilizing the multivariate vector autoregressive (VAR) approach on Norway. It was concluded that coherently with US and Japanese outcomes, real interest rate affected both stock returns and inflation, and the stock market responded accurately to oil price changes. Besides, the stock market displayed a delayed reply to variations in inland real activity.

Asprem (1989) studied on similiar topic for other European countries and explored the connections among stock indices, asset portfolios and macroeconomic factors in selected countries. It was shown that employment, imports, inflation and interest rates were reversely related to stock prices. The relations among stock prices and macroeconomic factors were shown to be the strongest in Germany, the Netherlands, Switzerland and the United Kingdom. An intense correspondence was observed among the above mentioned countries except UK.

Moving to another part of Europe, Samitas and Kenourgios (2007) studied the extent to which current and future domestic and international macroeconomic factors could enlighten long and short term stock returns in east European countries namely Poland, Czech Republic, Slovakia and Hungary. Leading western European countries were included in the empirical analysis, while US was taken as a "foreign global influence". Utilizing the present value model of stock prices including cointegration and causality tests, it was found that stock markets in eastern European were partly integrated with foreign financial markets, while inland economic activity and the leading European countries were more prominent factors on these stock markets than the US global factor.
Another study related to European countries where Papapetrou and Hondroyiannis (2001) analyzed the bilateral relation between indicators of economic activity. How economic activity affected the performance of the stock market in Greece was searched. An empirical finding showed that stock returns did not cause any change in real economic activity but the macroeconomic activity and foreign stock market changes elucidated partly stock market movements. Oil price changes explained stock price movements and had a reverse impact on macroeconomic activity.

Similarly in US, Serfling and Milijkovic (2011) analyzed the relation between dividend yield on the S&P 500 Index, 10 year treasury yield, share price level of

S&P 500 Index, money supply, industrial production and consumer price index (CPI) in the period of January 1959 to December 2009. Vector Error Correction Model (VECM) was employed to examine the possible simultaneous and cross short term relations between the variables and reached that there existed important interactions without lag. Specifically, endogeneity among the the selected factors in a model could be observed to some extent most of the time. One of the main consequence of this study that taking into account only a direct cause and effect relationship between these factors would be inadequate so endogeneity of macroeconomic and firm-specific factors was required to be considered by investors during prediction of econometric models.

Chung and Tai (1999) inspected relation between current economic activities in Korea and stock market returns by utilizing a cointegration test and a Granger causality test. As a result of regression; it was suggested that stock price indices exhibited a cointegration relation with the macroeconomic variables namely, production index, exchange rate, trade balance, and money supply that provides a direct long-run equilibrium relation with each stock price index, i.e. implied long run equilibrium among the variables of interest.

Besides developed countries, there are some articles about developing countries regarding macroeconomic variables and stock returns relations even if they attracted far less attention than the developed ones.

Sing, Mehta and Varsha (2010) studied the casual relation among index returns and certain key macroeconomic factors for Taiwan. The findings revealed that gross domestic product (GDP) influenced returns of all portfolios. In addition, inflation, exchange rate, and money supply inversely affected returns of portfolios in big and medium firms.

Regarding to Latin American markets**,** Abugri and Benjamin (2008) analyzed a very similar topic; practical relation between macroeconomic volatility and stock prices by using VAR model. The chosen variables were key macroeconomic indicators such as exchange rates, interest rates, industrial production and money supply. An emperical evidence showed that the international factors were important in elucidation returns in all markets constantly.

There are several studies that search macroeconomic varibles and stock return causality on Turkey specific. In one of these studies, Erdem & Arslan (2005) searched about volatility of ISE indexes with monthly data from January 1991 to January 2004, using explanatory indicators: exchange rate, interest rate, inflation, industrial production and M1 money supply. The Exponential Generalized Autoregressive Conditional Heteroscedasticity model was employed to check univariate volatility spillovers for macroeconomic factors. According to results, a solid volatility spillover running from inflation and interest rate to stock price indexes were observed in one direction. There were spillovers driving from M1 money supply to financial sector index, and from exchange rate to both ISE 100 and industrial sector index. There existed no volatility spillover from industrial production to any indices.

Having looked at recent studies, Tiryaki, Ceylan & Erdoğan (2018) examined the impacts of industrial production, money supply and real exchange rate on stock returns in Turkey utilizing the non-linear autoregressive distributed lag (NARDL) model over two different time span; 1994:01–2017:05 and 2002:01–2017:05. It was found that the effects of the changes in chosen variables on stock returns were asymmetric, and the asymmetries were bigger after the 2002 sub-period in comparison with the full sample period. The findings suggested that tight monetary policies seemed to impede the stock earnings more than easy monetary policies that stimulate them.

Dayıoğlu & Aydın (2019) also examined the relationship between BIST-100 Index and a set of macroeconomic variables volatility using VAR model. The study found that exchange rate and industrial production had an important influence on stock market volatility.

Demirtaş, Atılgan & Erdoğan (2015) employed an APT model to investigate equity return exposure to various macroeconomic factors. According to findings, there was important reverse relationship among interest rate betas and future equity returns**.** Karakuş and Bozkurt (2017) studied effects of financial indicators and macroeconomic variables on firm value. To that end, firm's quoted in BIST-100 panel data analysis was implemented. It was concluded that there existed reverse relation among debt ratio and stock returns. Otherwise, return on assets and net working capital turnover had a positive effect on stock returns. By considering macroeconomic variables, a inverse correlation among consumer price index and stock returns was identified. Beside, unemployment, gross domestic product, and exchange rates positively influenced stock returns.

Using a multivariate approach, Muradoglu, Taskin and Bigan (2000) analyzed the correlation among stock returns and macrovariables for emerging markets, inclusive of Turkey. For each country, Granger casuality test was employed and it was shown that local factors were important in determining stock returns. The results further suggested that bivariate causality among macroeconomic variables and stock returns occurred with the size of the stock markets, and their integration with the world markets.

Moreover, direction of the relation from macroeconomic factors to stock returns is assumed to be unidirectional. However, it is not the case. Harvey and Bekaert (1998) stated that dynamic links between macrovariables and stock returns in emerging countries had been ignored mainly due to overwhelming infleunce of governments in economic activity and low volume of trade in the markets. Nowadays, with the effects of liberalization and globalization, there are many researches about stock price effects on macrovariables. Gençtürk at all (2011) investigated casual relationship between BIST stock price, USD/TRY exchange rate, consumer price index, interest rates and industrial production employing VECM. It is concluded that the presence of long term relation was solely among BIST stock price and industrial production. A one directional casuality running from stock price to industrial production was found. Buyuksalvarcı and Abdioglu (2010) examined correlations between stock price and macro variables specifically foreign exchange rate, gold price, broad money supply, industrial production index and consumer price index in Turkey. The results showed that there was a one directional long term correlation from stock price the macrovariables. Hence the stock market might be counted as an prominent indicator future growth. Nazlioglu at all (2010) examined the short and long term correlations among stock market performance and economic growth for emerging countries, including Turkey. The findings demonstrated that stock market was an stimulus for economic growth in the short term. In addition to this, the relation among stock market performance and economic growth was varying with the size of stock market. The performed analysis suggested that in markets with comperatively small national market capitalisation like Turkey, causality derived from stock market to economic growth. However, there did not exist such causal link for Brazil and India which have relatively larger market cap. Thus it is concluded that the small stock market performance may be regarded as one of the leading factors of economic growth in these countries. Husain (2006) analyzed the causal relation between key indicators of the real sector of Pakistan economy and stock prices. The results demonstrated the existence of a long term relation among stock prices and the real sector variables. Considering the dynamic links, the findings suggested a unidirectional relation run from the real sector activity to stock market. That is to say, the stock market of Pakistan was not that developed to influence the real sector of the economy. Therefore, the market could not be regarded as the significant sign of the economic activity in Pakistan. Liu and Sinclair (2008) searched link among stock market performance and economic growth in Greater China: mainland China, Hong Kong and Taiwan utilizing a VECM. According to results, unidirectional causality driving from economic growth to stock price in the long term plus from stock price to economic growth in the short term. The results revealed that stock markets perform as a predictor of future economic growth. Filler at all (2000) answered the question of whether financial development causes economic growth or whether it is a consequence of rising economic activity by using Granger causality test. They concluded that stock market development led in currency value of a country. Bakarat at all (2016) examined another two developing market; Egypt and Tunisia in the scope of same subject. The results indicated that the stock market index in

Egypt might be clarified variatios in the CPI, exchange rate and money supply. Whilst stock market index in Tunisia was found to be as an explatanory factor for changes in interest rate. By supporting Harvey and Baekart, Carp (2012) stated that market capitalization and value of trading volume did not have any effect on growth, recalling inadequate stock market development in Romania resulted from weak regulation and insufficient transperancy.

The papers related to 2008 crisis effects on emerging stock market should be searched since the time span of interest covers global subprime crises in 2008. Jin and An (2016) investigated global crisis and developing stock market contagion for BRICS (Brazil, Russia, India, China and South Africa) countries. It was examined that the way of the BRICS' stock markets affected in the context of 2007-2009 global financial crises by employing volatility impulse response. The results revealed that degree of stock market responses to such shocks varies from one market to another, based on the level of integration with the international economy. The stock market highly integrated with the U.S faced with adverse effects.

Segot and Lucey (2009) examined MENA countries in terms of the vulnerability to external financial crises. It was searched about contagion shift to the MENA region for a number of different crises episodes including 2007-2009 financial crisis. According to results, Turkey, Israel and Jordan were the most weak markets in crisis during the period of 1997-2009. The results suggested that MENA basis diversification strategies might be relatively insufficient during period of global turmoil. In addition to this financial perspective, the findings indicated that stock market development brought likely destabilization cost from an economic point of view. Maghyereh at all (2015) examined also MENA countries in the context of dynamic transmissions with US before and after crisis period. According to one evidence of this study, pre crisis relationship between US and MENA stock markets were weak and negligible. The regional comovement and volatility jumped during and after financial crisis. Moreover the effects of U.S. started to revert back and reached initial low level. Thus, it could be interpreted that the Middle East and North African shares were significant diversifiers for investors; specially in the long term. Kassim (2013) studied the effect of the 2007 global crisis on the Islamic stock markets. These stock markets were analyzed for pre crisis 2005-2007 and crisis 2007-2010 period by employing ARDL approach and VECM. The results suggested that 2007-2008 global financial crisis led change in pattern of cointegration level of stocks markets. According to results, the Islamic stock markets did not reveal proof of a long-term equilibrium relation before the crisis but suggest otherwise in the crisis period. This emperical evidence supported time-varying aspect of stock market integration, as proposed by Bekaert and Harvey (1995). Therefore, there were potential diversification oppurtunities between the Islamic stock markets in the non-crisis period, and these diversification oppurtunities weaken in the crisis time. Another study, Mollah at all (2006) examined market integration among the US and other stock market during 2003-2013. It was suggested contagion in developed and developing markets in the both global and Eurozone crises time. The findings further suggested that contagion extent from the US to the other markets in crises period. The spread of bank risk among the US and other countries is the key transfer channel for inter-country relations.

Influences of 2008 crisis on Turkish stock market are widely discussed in the literature. Sekmen and Hatipoglu (2015) investigated the price and volatility behaviours of BIST against subprime crisis with daily data from June 2004 to June 2014. They employed GARCH and EGARCH model to detect volatility in three sub-terms; pre-crisis 2004-2007, crisis 2007-2009 and post crisis 2009-2014. It was found that subprime crisis caused an increase volatility in Turkish Stock Exchange. In addition, the results suggested leverage effects on the volatility of stock returns for full sample was observed and the crisis induced a noteworthy surge in the asymmetric parameter, which revealed that negative announcuments provoked higher effects on future volatility compared to positive ones. Çağıl and Okur (2010) studied effects of 2008 crises on Istanbul Stock Exchange employing a GARCH model for the period of 2004-2010. BIST100 and BIST30 indices were examined with daily returns data. They divided total sample two periods; before the bankruptcy 03-2008/09-2008 and after bankruptcy 09-2008/04.2009. The results indicated that variance values were exhibited a substantial increase in the period of 2007-2010. In addition to this, resistance of volatility shock increased notably in this period. Celikkol at all (2010) analyzed the effects of Lehman Brothers collapse on the volatility structure on BIST-100 stock index by using ARCH-GARCH models. The results suggested that crisis peaked in Turkish stock market and volatility were higher in the bankruptcy annocument period. They also observed that standart deviation indeed volatility of BIST-100 rised for the period of crash. Average returns of the investors also inreased in paralell to higher risk in crisis period.

4.DATA

The hypothesis of this thesis is to demonstrate the relation among the macro indicators and stock returns on sector level for Turkish stock market, modelling the data by using the VAR. The period of interest is between 2006 and 2018. Four domestic and two global variables in the model were carefully selected by searching the relevant literature; consumer price index, exchange rate USD/TL, one year deposit rates-TL, production index as local factors and M2 US money supply and US 10 years treasury yield rate as global factors.

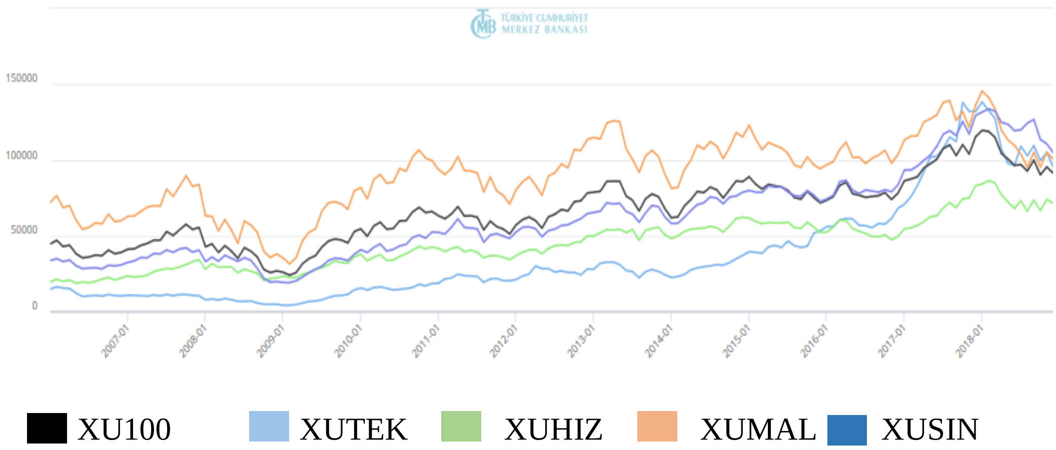
The sector stock indices are namely; services index XUHIZ, financial index XUMAL, industrial index XUSIN and technology index XUTEK. This section contains information about the variables used in the study.

4.1.CHOICE OF VARIABLES

The data of this study were taken from CBRT and FED as monthly-basis. The data includes the stock market values of the BIST 100 and the other sector indices quoted in BIST and selected macrovariables. The sample period covers 144 months during the period 2006 – 2018.

Figure 4.1 shows chosen sector indices' performances between 2006 and 2018. All indices exhibit an upward trend during this period. Although XUMAL is best performer throughout the years, XUTEK has exceled in recent years. In addition, all indices has been affected by 2008 financial crises negatively. Investors's portfolio experinced approximately 50% value lost. By taken consideration Turkish stock market in terms of foreigners' transaction share, the level was more than half, about 66,5% as of November 2009. Therefore, the effects of the crisis deepened with the foreign funds outflows from the country in crisis. Recovery of the crisis had maintained until end of the 2010. Since, after Turkish constitutional referendum in september 2010 less volatile and more stable trend has been observed, stock indices are examined dividing the term 2006-2009 and 2010-2018. Moreover, if macro indicators are examined, it is seen that there are different patterns in behaviour of variables in two periods especially, one year deposit rate, consumer price index, industrial production index and 10 year treasury constant maturity rate.

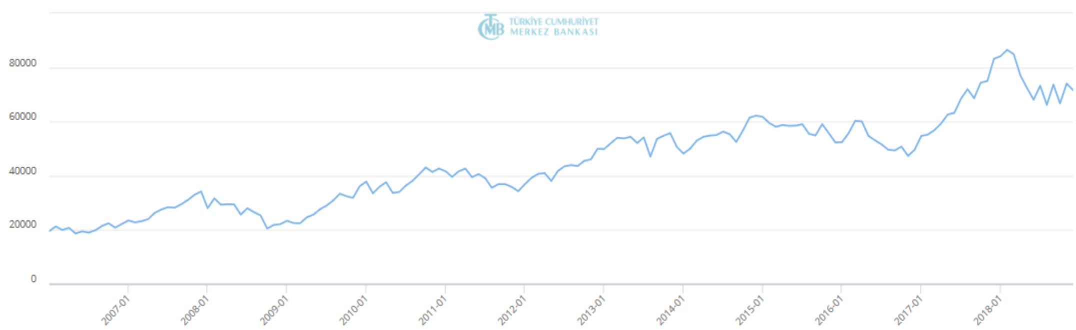
Figure 4.1. All BIST Indices from 2006 to 2018



Source: CBRT

As it is seen on the graph, figure 4.2 demonstrates services index price development in years. Currently, XUHIZ shows performance of 67 companies that serves in energy, transportation, retail, real estate, ready-made clothing sector. This index has employed by BIST since 1996.

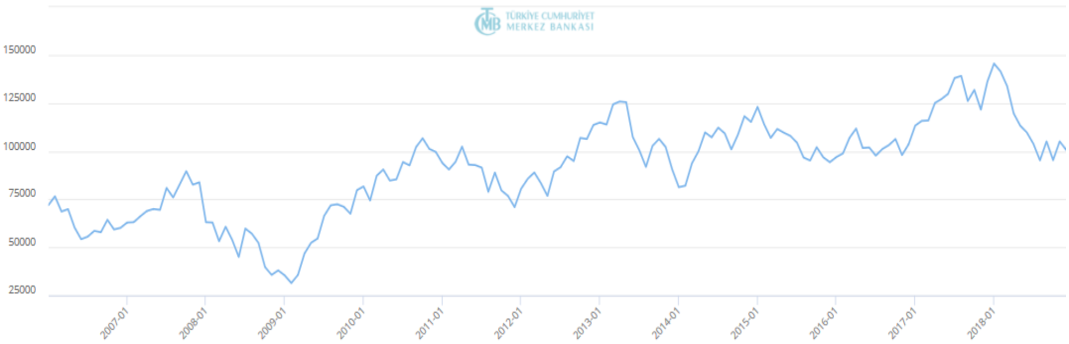
Figure 4.2. XUHIZ Closing Price from 2006 to 2018



Source: CBRT

In figure 4.3, financial services index price development is demonstrated. XUMAL shows performance of 106 companies such as real estate investment, insurance and pension companies, banks and investment conglomerates. This index has used by BIST since 1990 and it is the most damaged index in 2008 financial crises.

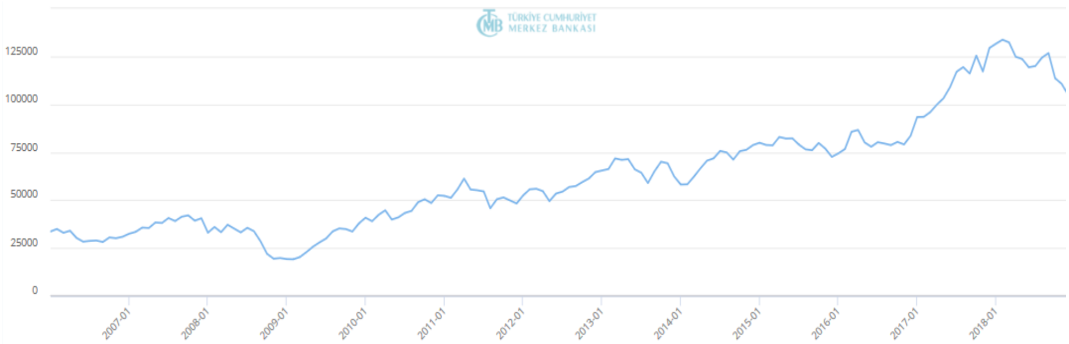
Figure 4.3. XUMAL Closing Price from 2006 to 2018



Source: CBRT

XUSIN represents stock performance of industiral companies quoted in BIST. This indicator includes 169 production company from different sector such as petrochemical, cement, automotive, food, textile industry. This index was integrated to BIST in 1990.

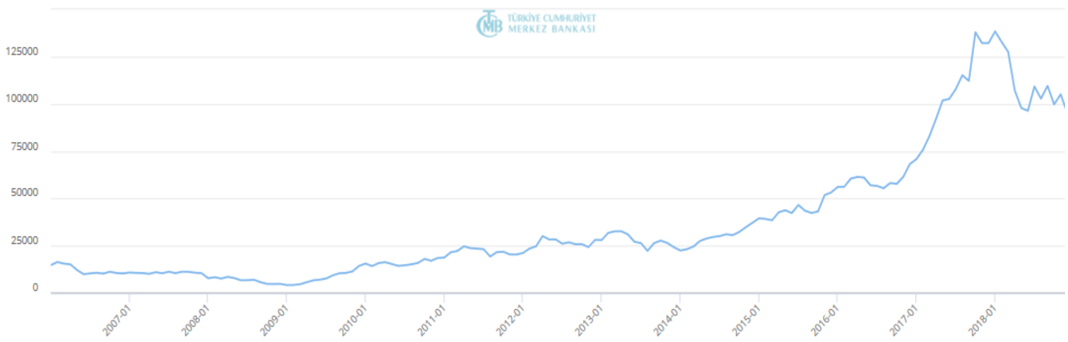
Figure 4.4. XUSIN Closing Price from 2006 to 2018



Source: CBRT

XUTEK denotes stock performance of technology companies quoted in BIST. This index has used since 2000 and represent 17 companies from telecommunication, software and information sector. By differentiating from other indexes, it shown poor performance until 2016 and has exhibited a rapid increase last 2 years.

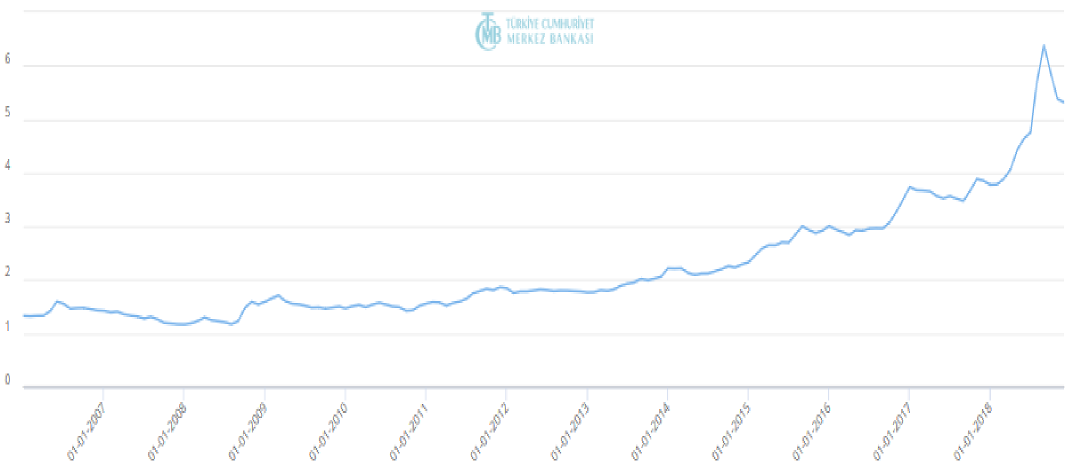
Figure 4.5. XUTEK Closing Price from 2006 to 2018



Source: CBRT

The macrovariables which are taken from CBRT are one-year deposit rate, USD/TRY exchange rate, CPI (as a proxy for inflation) and industral production. Until 2014, f/x rate moved steadily, after then it has showed an upward trend. Exchange rates has slumped in 2018 with devaluation and TRY lost value approximately %40. The external shock caused by negative capital movements first hit the exchange rates in 2018. Ongoing currency crisis in 2018 may be reason of decrease in the BIST stock indices. As it seen on the graph, 2008 crises hardly affected exchange rate negatively.

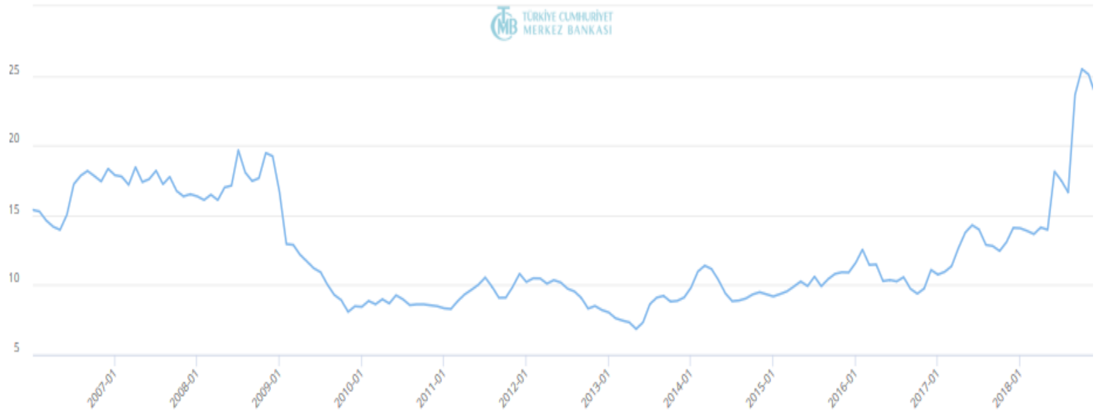
Figure 4.6. USD/TRY Exchange Rate from 2006 to 2018



Source: CBRT

When the changes in interest rates are examined during the sample period, two striking trends are observed. The first is the downward trend that started in 2009 and the upward trend in 2018. As it seen in the figure 7, deposit rates follow different paths in periods 2006-2009 and 2010-2018. Increasing trend of interest rates in 2018 first reached the level before 2009 and even exceed this level later. 1-year deposit rate which was 20% on January 2009, decreased by 50% in one year and was realized as 10%. Interest rates fell as the effects of the 2008 crisis waned and economic recovery started. In the second half of year 2018, it was increased by 10% compared and realized as 25%. It can be explained by the capital outflows from emerging market countries, which is true to Turkey, as well.

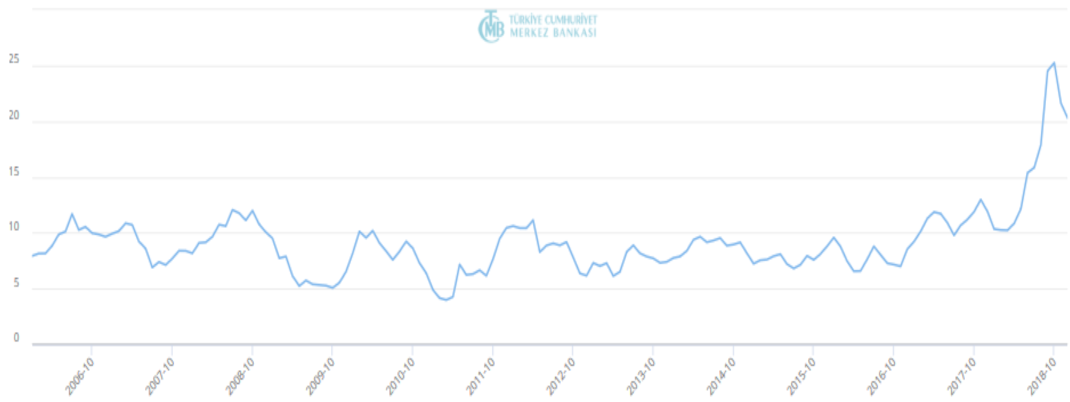
Figure 4.7. One-year Deposit Rate from 2006 to 2018



Source: CBRT

The relation among price level changes and stock prices are represented by changes in consumer price index in the study. Since CPI reflects the price of goods and services merchandised between the companies thus it affects the income of the companies. Moreover, CPI displays price movements that gives sign about supply and demand in the real economy. Although a fluctuating movement is observed before 2009, there is a more stable trend from 2010 utill 2018 in figure 8. From 2006 to 2018, an upward trend is observed which is very similar with M3 money supply in Turkey. In order to prevent endogenity between variables, cpi is choosen as an indicator.

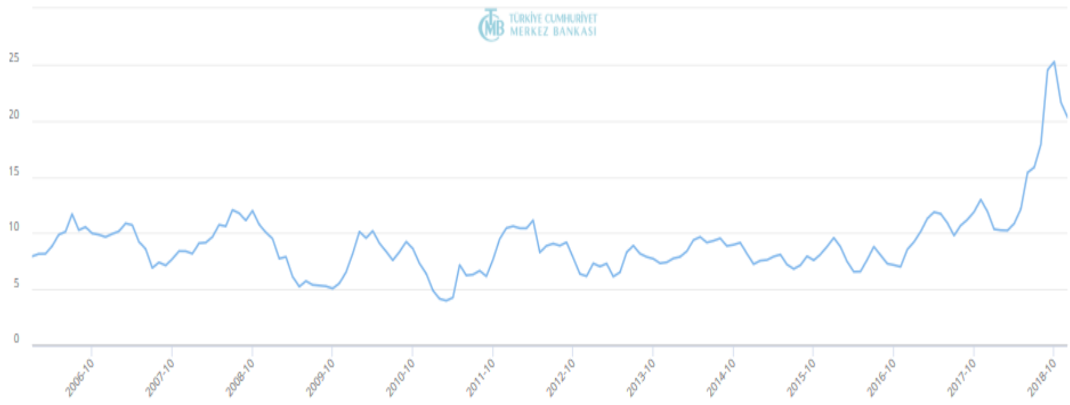
Figure 4.8 Consumer Price Index from 2006 to 2018



Source: CBRT

The industrial sector is a component of GDP and one of the most significant drivers of domestic income and economic growth. The industrial sector, which makes a significant contribution to employment, also gives a significant impetus to growth. Therefore, industry production index acts as a proxy of gdp since it is mostly preferred as an indicator for growth data. Since the industrial production index is announced monthly, IP index is preferred rather than GDP in this study. Financial depression in 2018 also affected on industrial production in Turkey and its effects began in the last months of 2008. Industrial production started to diminish in August. This downward trend continued until March 2009. The contraction in industrial production index was 23.5 % in this term. In third quarter of 2017, with the effect high GDP growth rate, a sharp rise realized in industrial production. In 2018, a fall has started the because of ongoing crisis.

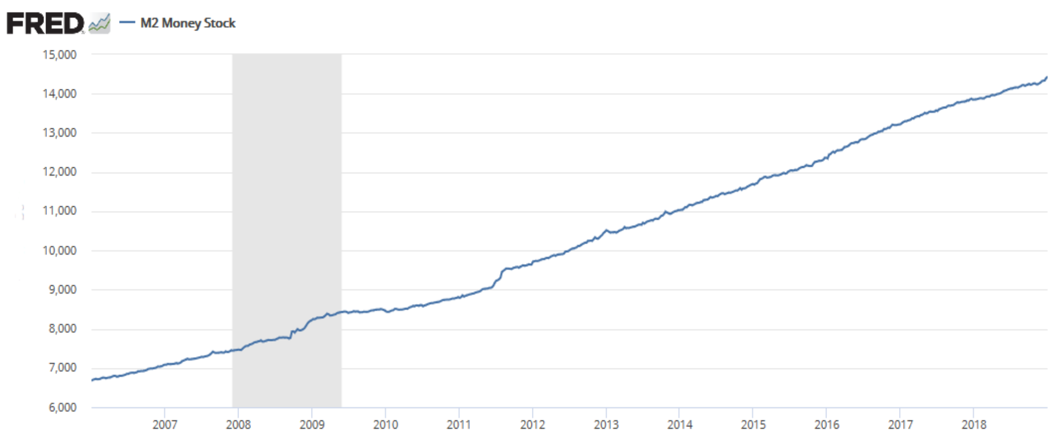
Figure 4.9. Industrial Production Index from 2006 to 2018



Source: CBRT

Apart from local macrovariables, two more indicators are selected globally: US money supply and 10-year treasury constant maturity rate. In general, if money supply increase, interest rate will decrease or vice versa. Central bank controls money in circulation by adjusting the interest rates. Main aim of the interference to money supply is to protect general price level. Money supply, which can also be defined as total purchasing power; important as a provider of investment, production and commercial activities. M2 consists of set of financial assets held principally by households. M2 consists of M1 plus: (1) savings deposits; (2) small-denomination time; and (3) balances in retail money market mutual funds. US money supply exhibits an gradually increasing trend throughout the years.

Figure 4.10. US Money Stock M2 (Billions of Dollars) from 2006 to 2018



Source: Federal Reserve Bank of St.Louis

Federal Reserve Board publishes 10-year treasury constant maturity rate as an index depending on the average yield of a set of treasury securities after adjustment accordingly equivalent of ten years maturity. Yields on treasury securities at fix term are decided by the U.S. Treasury from the daily yield curve. That is based on the closing market-bid yields on actively traded treasury securities in the over-the-counter market. Government bonds maturing in ten years refer to long term interest rate which is one of the determining factor of business investment. While low long-term interest rate incentivizes new investments and high interest rates deters new investment decisions. US interest rates decreased after 2008 crises sharply in the scope of contractionary monetary policy that is seen in the figure 4.11.

Figure 4.11. 10-Year Treasury Constant Maturity Rate (%) from 2006 to 2018

Source: Federal Reserve Bank of St.Louis

4.2.DESCRIPTIVE STATISTICS

The descriptive analysis delivers a primary depiction of nature and volatility of the variables. Simultaneously, it compares the basic performance indicators of the variables, enabling an description about the way of interdependence among factors varies. Descriptive statistics will be useful to analysis the variables further. The mean, median, max., min., standart deviation, skewness, kurtosis and Jarque-Bera are shown for macrovariables in Table 4.1 and for stock indices in Table 4.2 in the years of 2006-2018.

Table 4.1: Descriptive Statistics of Macrovariables

Descriptive Statistics	CPI	1 year Deposit Rate	USD/TRY	IP	US M2	10 year Treasury Yield
Mean	9.09	12.32	2.22	85.24	10,218	1.23
Median	8.70	10.78	1.80	83.98	10,001	0.19
Maximum	25.24	25.50	6.38	129.99	14,363	5.26
Minimum	3.99	6.85	1.18	50.45	6,707	0.07
Std. Dev.	3.10	3.95	1.06	19.16	2,350	1.75
Skewness	2.51	1.02	1.59	0.32	0.20	1.46
Kurtosis	12.61	3.45	5.37	2.07	1.74	3.57
Jarque-Bera	764.89	28.42	102.24	8.24	11.33	57.21

Table 4.2.Descriptive Statistics of BIST Indices at Log Level

	BIST 100	XUHIZ	XUMAL	XUSIN	XUTEK
Mean	11.04285	10.63401	11.37267	10.9272	10.1189
Median	11.09573	10.67539	11.45449	10.93978	10.10378
Maximum	11.69131	11.3677	11.88824	11.80355	11.83726
Minimum	10.08692	9.836098	10.35647	9.859394	8.344845
Std. Dev.	0.359164	0.395703	0.309298	0.482799	0.894145
Skewness	-0.517008	-0.305134	-1.010106	-0.124973	0.147876
Kurtosis	2.694581	2.087522	3.841429	2.273339	2.232209
Jarque-Bera	7.556051	7.832771	31.13018	3.838309	4.400325
Probability	0.022868	0.019913	0.000000	0.146731	0.110785

Firstly, all the original time series are transformed the logarithmic form and then analysis are performed. The statistics about logged data of BIST indices are presented in table 4.2 in regards to mean, standard deviation, skewness and kurtosis etc. All stock returns except XUTEK are negatively skewed according to skewness values for all series. However, the skewness and kurtosis results are not diverging significantly from 0 and 3 respectively. Therefore, the deviation from normal distribution can not severely impact on the test of cointegration.

Table 4.3.Descriptive Statistic of BIST Indices at Log Difference

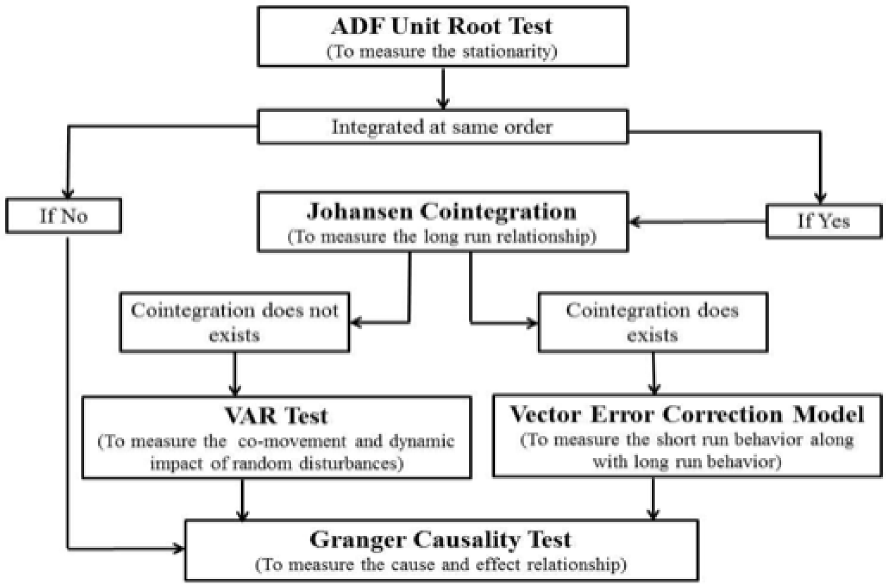
	BIST 100	XUHIZ	XUMAL	XUSIN	XUTEK
Mean	0.004621	0.008373	0.002171	0.007343	0.012026
Median	0.007427	0.012486	0.007716	0.014305	0.014636
Maximum	0.205785	0.130594	0.282732	0.119840	0.227620
Minimum	-0.262928	-0.211065	-0.284144	-0.261826	-0.295083
Std. Dev.	0.074991	0.062572	0.088947	0.065577	0.088878
Skewness	-0.423576	-0.729926	-0.016951	-0.895664	-0.368641
Kurtosis	3.973489	3.660752	3.888299	4.639806	3.707812
Jarque-Bera	10.75536	16.58344	5.103528	38.09009	6.746255
Probability	0.004619	0.000251	0.077944	0.000000	0.034282

Table 4.3 presents summary of descriptive statistics of prices of the stock returns i.e. stock prices in first difference for selected indices. During 12 years period among the BIST, XUTEK has earned highest average monthly return of 0.0120, followed by XUHIZ 0.0083, XUSIN 0.0073, BIST100 0.0046 and XUMAL 0.0021. The result that XUTEK provided highest returns among the all indices confroms theory of finance; riskier the market, greater would be the revenues. This theory is backed by standart deviation, where XUTEK recorded highest i.e. 0.088. Additionally, skewness values in the table explores that all stock indices are negatively skewed.

5.METHODOLOGY

The methodology used in the analysis will be elaborated in this section. First of all, an overview of VAR methodology is presented. Then prerequest of VAR model are detailed. Augmented Dickey Fuller test is performed to test the stationarity of the data and Johansen's cointegration test to decide on integration of the choosen variables, respectively. Simultaneously, lag length criteria should be correctly selected to build a model with high accuracy. This is because Johansen test results are very delicate to selection of lag length. Johansen test results shape the model depending on information about variables cointegration; VAR or VECM model is preferred according to findings. If there exists an cointegration vector among the factors, VECM is applicable. Otherwise, VAR model is employed. The below figure shows an summary of the course of methodology.

Figure 5.1. Econometric Research Methodology



5.1.THE VAR METHODOLOGY

Vector Autoregression model (VAR) was pioneered by Chris Sims about 25 years ago, have acquired a permanent place in the applied macroeconomists by analyzing multivariate time series.

A simple univariate regression can be represented as;

$$Y_t = \alpha + \beta_1 + \beta_2 Y_{t-1} + \beta_3 Y_{t-2} + \beta_i Y_{t-m} + U_t \qquad \text{(Eq.5.1.1)}$$

where;

- Yt refers to the stok indices, vector of each endogenous variables at time t.
- M denotes to the # of lags and βi is the nxn coefficient matrix of each lag.
- Ut represents white noise error term and α is an nx1 vector of constants.

All variables in this technique have an equation describing its progression depending on its own lag, the lag of the other model variables, and an error term. VAR model requires prior knowledge about list of variables which may influence each other intertemporally. Endogenous and exegoneous variables should be specified in order to reach more accurate results.

In VAR model, each variable is regressed on its own and other variables' lag values. The lag length of the variables is determined so that no auto-correlation among error terms exists. That is, lag length is small enough not to create any problem but large enough also not to cause auto-correlation among error terms.

The effects of variables on dependent variable is difficult to observe in VAR model, so it may count as an weakness. In addition, financial series are generally nonstationary; VAR model requires stationarity and absence of cointegration. Otherwise, Vector Error Correction model (VECM) should be employed. The VECM is a restricted VAR to use with non-stationary series that are known to be co-integrated. Cointegration implies linearly independent combinations of the nonstationary variables are stationary. The cointegration relations are framed with some specifications. Thus, it confines long term movements of endogeneous variables to converge to a value while permitting for short term adjusment dynamics. Since the deviation from long term is corrected progressively with short-run adjustments, cointegration term is called as error correction term. . Thus ECMs directly predicts the speed at which a dependent variable returns to equilibrium after a change in other variables. A negative and significant coefficient indicates that any short term relations among the independent variables and the dependent variable will emerge a steady long run relationship between variables. The advantage of ECM comes from property of capturing both short run and long run equilibrium relationships. Durr (1993) states that if the dependent variable reveals short run changes against to changes in the independent variables ECM is appropriate.

Engle and Granger (1987) shows that there exists always error correction representation where changes in dependent variable is a function of behaviours of error correction term and changes in other explanatory variables as far as variables X_t and Y_t are cointegrated. A simple VECM is represented by following equations;

$$\Delta Y_t = \alpha_0 + \sum \beta_i \Delta X_{t-1} + \sum \chi_j \Delta Y_{t-1} + \Upsilon_i \, ECT_{t-1} + U_t \qquad \text{(Eq.5.1.2)}$$

$$\Delta X_t = \alpha_0 + \sum \beta_i \Delta Y_{t-1} + \sum \chi_j \Delta X_{t-1} + \Upsilon_i \, ECT_{t-1} + U_t \qquad \text{(Eq.5.1.3)}$$

$$ECT = Y_t - \delta X_t \qquad \text{(Eq.5.1.4)}$$

Where (X_t , Y_t) are the variables. Δ and U_t indicate diffence operator, random error term with mean of zero, respectively. α_0, β_i, and χ_j represent coefficient of independent variables which are calculated in VAR regression. Moreover, δ and γ shows the cointegration factor and coefficient of error correction term, (ECT_{t-1}), in turn. ECT is also named as speed of adjustment. Equation 5.1.2 tests causality from X_t to Y_t and equation 5.1.3 may be used to test casuality from Y_t to X_t.

Additionally, if the error term is significant, and expected to be between -1 and 0, it implies that past values of variables have impact on dependent variable. As it approaches to -1, variables converges to mean quicker since errors are corrected faster. The variables are deviating from equilibrium rather than co-movement towards it as far as the error correction term is positive.

5.2.TEST OF STATIONARITY

A stationary series are identified as one with a constant mean, constant variance and constant autocovariances for all lagged values. In systems with stationary series, 'shocks' will progressively wane. That may contrast with the case of non-stationary data, where the persistence of shocks will always be infinite. Thus the effect of a shock during time t will not have a smaller effect as time passes in a non-stationary series. (Brooks 2004) The employing of non-stationary series usually generates counterfeit regressions. In a regression with a non-stationary data, end results could be seem ‘good’ when important key coefficients and a high R2 are checked however it does not imply any significance statisticly. Such a model can be called as ‘spurious regression’.

Two main models are preferred widely in order to identify the nonstationarity, the random walk model with drift

$$Y_t = \mu + Y_{t-1} + U_t \qquad \text{(Eq.5.2.1)}$$

and the trend-stationary process. The reason of name this way is about being stationary around a linear trend.

$$Y_t = \alpha + \beta_t + U_t \qquad \text{(Eq.5.2.2)}$$

where Ut represents a white noise disturbance term.

In order to reach stationary data, de-trending is required. A regression can be run by subracting one estimation by its subsequent to eliminate trend. Thus stationarity has been induced by ‘differencing once’. In other words, one unit root is extracted. If there is more than one unit root, differencing two time is necessary two eliminate two roots. After subraction, a moving average in the errors may emerge and it is an undesirable property of new created series.

There are 3 different unit root test that mainly used; Augmented Dickey Fuller (ADF), Phillips Perron (PP) and KPSS test. Main drawback of ADF is that the larger the break in data and the smaller the sample may reduce the power of the test. While Perron (1989) created a different approach where PP test to solve problem arising from existence of structural breaks. However significant restriction of this approach is that break date should be known beforehand.(Brooks,2004)

ADF is employed in this paper. The equation of ADF test is represented as:

$$\Delta Y_t = \Psi\, Y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-i} + U_t \qquad \text{(Eq.5.2.3)}$$

And H0: ψ =0 is tested against H1: ψ<0.

Where Yt represents the dependent variable, p, Ut and t are the number of lags, white noise error terms and time index, respectively. If H0 is rejected, it means that yt does not contain a unit root and it is stationary. In this model, all variables are stationary in their first differences except industrial production which is in second differences. In the table 5.1 ADF test results of BIST indices and in table 5.2 results of macrovariables are presented.

Table 5.1. Augmented Dickey Fuller Test of BIST indices

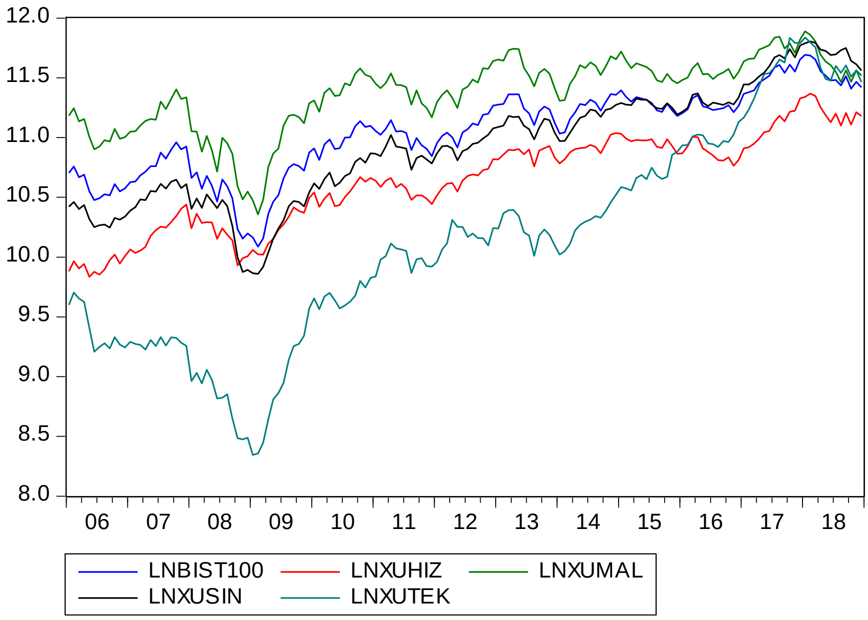
	P values	T-statistics
XU 100	0.6500	-1.253958
ΔXU 100	0.0000	-12.39455
XUHIZ	0.5634	-1.435799
ΔXUHIZ	0.0000	-14.58455
XUMAL	0.3724	-1.814542
ΔXUMAL	0.0000	-12.42220
XUSIN	0.8533	-0.655822
ΔXUSIN	0.0000	-10.94117
XUTEK	0.9698	0.168323
ΔXUTEK	0.0000	-6.764813

Table 5.2. Augmented Dickey Fuller Test of Macrovariables

	P values	T-statistics
Consumer Price Index	0.0976	-2.588084
Δ Consumer Price Index	0.0000	-7.5558
1 year Deposit Rate	0.8724	-0.570865
Δ 1 year Deposit Rate	0.0000	-10.4660
Exchange Rate USD/TL	0.9990	1.3987
Δ Exchange Rate USD/TL	0.0000	-9.3341
US 10 year Treasury Yield Rate	0.5699	-1.4227
Δ US 10 year Treasury Yield Rate	0.0000	-7.9909
US Money Supply M2	0.7791	-0.9219
Δ US Money Supply M2	0.0000	-9.6715
Industrial Production Index	0.7908	-0.884544
Δ Industrial Production Index*	0.0000	-11.3800

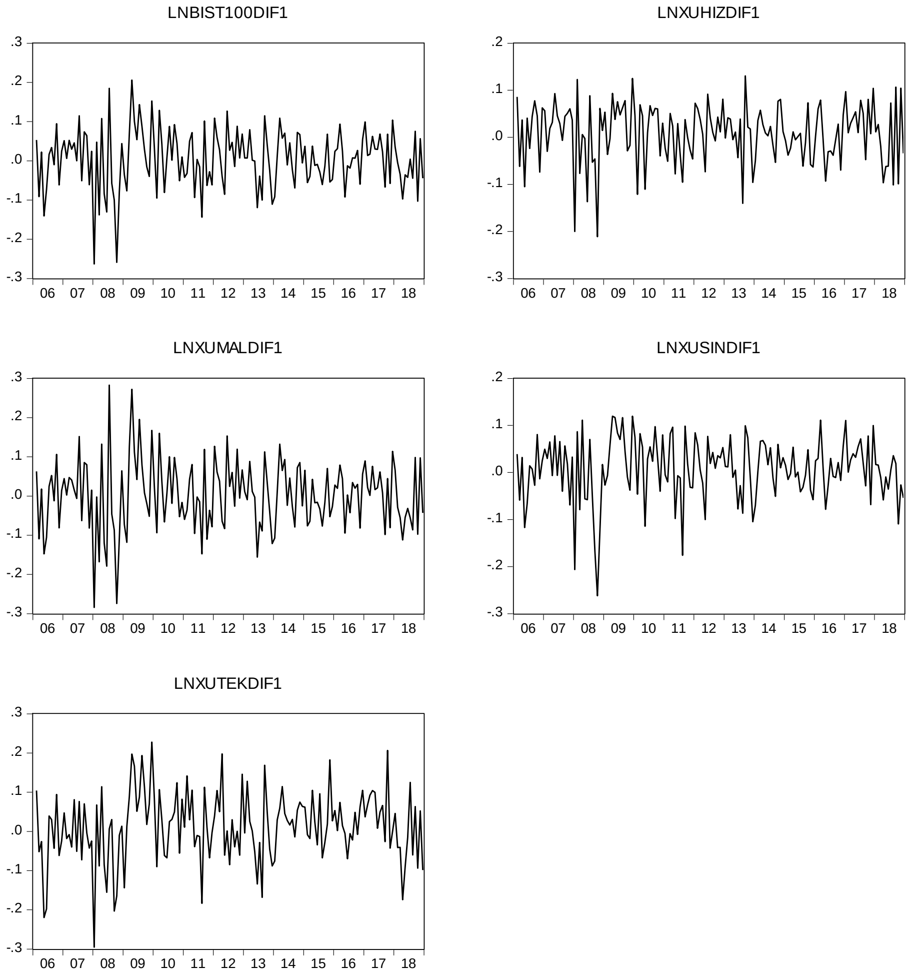
Note *: Since the industrial production index is stationary at second difference, difference result is presented.

Figure 5.2. All BIST Indices in log level



Source: Eviews

Figure 5.3. All BIST Indices in First Differences



Source: Eviews

5.3.DETERMINING LAG LENGTH CRITERIA

As detailed in Enders (2004), it is significant to decide the proper lag length. Different lag lengths for each variable in each equation can be chosen but to conserve the symmetry of the system and to be able to use OLS efficiently, an optimal lag length is frequently preferred for all equations.

The system is misspecified when lag length is too small. If it is too large, degrees of freedom are wasted in the model. In order to find appropriate lag length, one can start with the longest possible length. It is common to use 4 for quarterly data and

12 for the monthly data literally. In this paper, it is taken as 8 which is given by Eviews.

Two different method can be used to find optimal lag number: cross-equation restrictions and information criteria. (Brooks, 2004) Since information criteria is more common, it is taken into account in this study. Akaike information criterion (AIC), Schwarz's Bayesian information criterion and Hannan-Quinn criterion (HQ) are the most widely preferred in the literature. Schwarz Information Criteria is used in this model.

A simplified multivariate form of information criteria can be represented as follows;

$$AIC = log|\Sigma| + 2k'/T \qquad \text{(Eq.5.3.1)}$$

$$SBIC = log|\Sigma| + \frac{k'}{T}\log(T) \qquad \text{(Eq.5.3.2)}$$

$$HQIC = log|\Sigma| + \frac{2k'}{T}\log(\log(T)) \qquad \text{(Eq.5.3.3)}$$

where $|\Sigma|$, T and k show variance–covariance matrix of residuals, number of observations and number of regressors, respectively.

For this model calculated optimal lags are showed in table 5.3.

Table 5.3. Lag Length Test (SIC)

Period	SIC value	Lag length
2006-2018	-19.55846	0
2006-2009	-16.73499	0
2010-2018	-20.65813	0

5.4 TESTING FOR COINTEGRATION

Engle and Granger introduced cointegration analysis in the beginning of 1980s, enhancements and additions continued in following years. The economical time series are stationary only after differencing but a linear combination of their levels may be stationary, then the series are said to be cointegrated. Integrated of order 1, written as I(1), means the series becomes stationary later differentiating it once.

There are two different cointegration methods that are broadly used in the analysis; Engle-Grangers Two Step Estimation Method and Johansen's Maximum Likelihood Method. Either the Trace Statistic and/or the Maximum Eigenvalue Statistic can be used to evaluate presence of cointegration. In this study, Johansen Test is used considering supremacy against Engle-Grangers Two Step Estimation Method. This method can be conducted easily, but large sample size is needed to avoid possible estimation errors. Besides, it can only be used with a maximum of two variables. (Brooks 2008)

The Johansen cointegration test designates cointegration rank of a VAR process, predicts the trace and the eigen values. In the VECM, the long-run equilibrium coefficients, the adjustment coefficients, the covariance matrix of the errors, and the R-squares for each of the equations are estimated. This model captures the short-run dynamic properties as well as the long-run equilibrium pattern of many non-stationary series.

A shock to a random variable is not only directly influences the this variable but is also transferred to all the other endogenous variables through the lag structure of the VAR. If there are n variables which all have unit roots, at most n-1 cointegrating vectors can form in the model. The Johansen test estimates all cointegrating vectors. As well as the Dickey-Fuller test, the existence of unit roots implies that standard asymptotic distributions do not apply. In this test, null hypothesis is presence of unit root which implies no cointegration. (H0: r = 0) If trace or eigen value is higher than critical value, the null hypothesis is rejected and accepting alternative hypothesis that refers the existence of cointegration vector between the variables. (H1: r > 0).

Johansen estimation model is as follow;

$$\Delta X_t = \mu + \sum_{i=1}^{p} \Gamma_i \Delta X_{t-i} + \alpha\beta'^{X_{t-i}} + U_t \qquad \text{(Eq.5.4.1)}$$

Where;

X= (nx1) vector of all the non-stationary indices in the model

Γ= (nxn) matrix of coefficients

α = (nxr) matrix of error correction coefficients where r is the number of cointegrating relationships in the variables, so that $0 < r < n$. This measures the speed at which the variables adjust to their equilibrium.

B = (nxr) matric of r cointegrating vectors, so that $0 < r < n$. This is what represents the long-run cointegrating relationship between the variables.

The Trace test is a joint test that tests the null hypothesis of no cointegration.The Maximum Eigenvalue test conducts tests on each eigenvalue separately and tests the null hypothesis that the number of cointegrating vectors is equal to r against the alternative of r+1 cointegrating vectors. (Brooks, 2008)

$$\lambda_{trace}\,(r) = -T\ \sum_{i=r+1}^{g} \ln(1-\lambda_i) \qquad \text{(Eq.5.4.2)}$$

$$\lambda_{max}\,(r, r+1) = -T\ln(1-\lambda_i) \qquad \text{(Eq.5.4.3)}$$

Where;

r = number of cointegrating factors under the null

λ_i = estimated ith ordered eigenvalue from the αβ' matrices.

However, cointegration does not specify the direction of causality among variables. This direction of the Granger (or temporal) causality can be detected through VECM derived from the long-run co-integrating vectors.

Structural breaks may manipulate the cointegration accuracy. Although all the variables cointegrated in same order used in VAR, cointegration number was higher than the number of the variables which is not possible in a VAR model. A break in the cointegrating relation introduces a spurious unit root that leads to a rejection of necessary cointegration. Therefore, structural breaks should be eliminated from data. The structural breaks are mainly related with crises time.

Dummy variables are used with purpose elimination of structural break in this condition . Johansen Cointegration test results are presented in table 5.4.1 and 5.4.2.

Table 5.4. Johansen Cointegration Trace Test Results

Period		r=0	r≤1	r≤2	r≤3	r≤4
2006-2018	**statistic value**	100.9361*	58.60689*	32.05249*	16.66558*	4.150267*
	critical value	69.81889	47.8563	29.79707	15.49471	3.841466
2006-2009	**statistic value**	87.21564*	51.35053*	29.49795	12.4004	2.024661
	critical value	69.81889	47.85613	29.79707	15.49471	3.841466
2010-2018	**statistic value**	101.1419*	60.57163*	29.39502	8.31511	1.865443
	critical value	69.81889	47.85613	29.79707	15.49471	3.841466

Table 5.5. Johansen Cointegration Maximum Eigen Test Results

Period		r=0	r≤1	r≤2	r≤3	r≤4
2006-2018	**statistic value**	42.32916*	26.5544	15.38691	12.51532	4.150267*
	critical value	33.87687	27.58434	21.13162	14.2646	3.841466
2006-2009	**statistic value**	35.8651	21.85258	17.09755	10.37574	2.024661
	critical value	33.87687	27.58434	21.13162	14.2646	3.841466
2010-2018	**statistic value**	40.57031*	31.17662*	21.07991	6.449667	1.865443
	critical value	33.87687	27.58434	21.13162	14.2646	3.841466

6. EMPIRICAL RESULTS

The analysis is conducted over 5 different stock returns taking into account the different sectors. In this study, VAR is used in order to verify relations which exist among the stock market indices and macrovariables namely; consumer price index, industrial production index, 1-month deposit rate, USD/TRY exchange rate, US fund rates and US money supply.

All BIST indices are selected as endogenous variables, while the other variables are selected as exogenous variables in model. Results of VAR for all indices will be evaluated in the following headings.

Table 6.1 shows abbreviations which are used in VAR model in Evies. All variables are in natural log form. Model statistical test results of all dependent variables are presented in the table 6.2 Breusch-Pagan-Godfrey Heteroscedasticity Test, Breusch-Godfrey Serial Correlation LM Test and Histogram Normality Test are applied in Eviews to ensure accuracy of the model.

In Breusch-Pagan-Godfrey Heteroscedasticity Test, null hypothesis is that there is heteroscedasticity in residuals. If the p value is greater than 5%, null hypotehesis is rejected and homoscedasticiy is accepted which implies constant variance. In Breusch-Godfrey Serial Correlation LM Test, the null hypothesis is that serial correlation is found in residuals. The presence of serial correlation of residuals in time series leads errors associated with a given period carry over into future periods. An overestimate in one month may cause overestimates in succeeding months which is not desirable. Once p value is higher than 5%, alternative hypotesis is accepted and it can be said that there is no serial correlation. Histogram normality test measure fitting of regression line to the data such that mean of the residuals are zero. Normal distribuiton of residuals is one of the important assumptions of linear regression. As in heteroscedasticiy and serial correlation test, when probability is greater than 5%, null hypothesis is rejected, i.e. residuals are normally distributed.

Generally, according to the p-values of chi-square tests which test the null hypothesis of normal distribution of errors, no serial correlation and homoscedastic errors succeed to reject the null hypothesis implying that well specification of the models, normally distributed errors with no serial correlation and homoscedastic variances. Moreover, cumulative sum of recursive residual (CUSUM) and cumulative sum of squares of recursive residual (CUSUMQ) of the model statistics are well within the critical bounds that implies 5% significance.

Table 6.1. Glossary of the Variables

Symbol	Variable	Explanation
LNBIST100DIF1	BIST100 stock price first difference	Logarithmic
LNXUHIZDIF1	XUHIZ stock price first difference	Logarithmic
LNXUMALDIF1	XUMAL stock price first difference	Logarithmic
LNXUSINDIF1	XUSIN stock price first difference	Logarithmic
LNXUTEKDIF1	XUTEK stock price first difference	Logarithmic
LNCPIDIF1	Consumer price index first difference	Logarithmic
LNDEPOSITDIF1	1-year deposit rate first difference	Logarithmic
LNFXDIF1	Exchange rate first difference	Logarithmic
LNIPDIF2	Industrial production index first difference	Logarithmic
LNUSFRDIF1	US 10-year treasury yield first difference	Logarithmic
LNUSM2DIF1	US M2 money supply first difference	Logarithmic

Table 6.2.Model Statistical Test Results

Dependent Var: XU100	2006-2009	2010-2018	2006-2018
Tests	Probability		
Normality	0.6990	0.6772	0.9098
Heteroscedasticity	0.4342	0.4898	0.6755
Serial Correlation	0.3152	0.4517	0.2016
CUSUM	stable		
CUSUMSQ	stable		

Dependent Var: XUHIZ	2006-2009	2010-2018	2006-2018
Tests	Probability		
Normality	0.0002*	0.8158	0.1787
Heteroscedasticity	0.8259	0.0898	0.0811
Serial Correlation	0.9599	0.5671	0.2265
CUSUM	stable		
CUSUMSQ	stable		

Dependent Var: XUMAL	2006-2009	2010-2018	2006-2018
Tests	Probability		
Normality	0.6274	0.6937	0.4929
Heteroscedasticity	0.3646	0.6216	0.6063
Serial Correlation	0.4668	0.4450	0.1620
CUSUM	stable		
CUSUMSQ	stable		nonstable*

Dependent Var: XUSIN	2006-2009	2010-2018	2006-2018
Tests	Probability		
Normality	0.4015	0.7493	0.4186
Heteroscedasticity	0.2010	0.3213	0.5144
Serial Correlation	0.2807	0.4382	0.6633
CUSUM	stable		
CUSUMSQ	stable		

Dependent Var: XUTEK	2006-2009	2010-2018	2006-2018
Tests	Probability		
Normality	0.5086	0.5568	0.9671
Heteroscedasticity	0.5204	0.1696	0.9264
Serial Correlation	0.3890	0.3194	0.0251*
CUSUM	stable		
CUSUMSQ	stable		

Note*: Marked values can not fit the significance level.

6.1. VAR RESULTS : XU100

Since the BIST 100 index is the variable of interest, XU100 index as an endogenous variable in VAR. Estimated VAR model with 0 lags and no co-integrating presented below for all time periods.

Table 6.3. XU100: Results of VAR for All Periods

	2006-2018		2006-2009		2010-2018	
	Coefficient	P Values	Coefficient	P Values	Coefficient	P Values
LNBIST100DIF1(-1)	1.427962	0.2411	-1.542005	0.5545	4.571914	0.0016 ***
LNBIST100DIF1(-2)	1.448779	0.2186	1.394265	0.5958	1.884516	0.1552
LNXUHIZDIF1(-1)	-0.583222	0.0305 **	0.062608	0.9068	-1.198834	0.0005 ***
LNXUHIZDIF1(-2)	-0.332447	0.1994	-0.154214	0.7792	-0.532315	0.0930
LNXUMALDIF1(-1)	-0.914167	0.1926	0.813355	0.5847	-2.772975	0.0011 ***
LNXUMALDIF1(-2)	-0.884903	0.1875	-1.199589	0.4275	-0.966765	0.2025
LNXUSINDIF1(-1)	-0.202680	0.5879	0.066400	0.9419	-0.895029	0.0303 **
LNXUSINDIF1(-2)	-0.524458	0.1454	0.070187	0.9367	-0.895745	0.0236 **
LNXUTEKDIF1(-1)	-0.023275	0.7915	0.374839	0.2817	-0.068735	0.4685
LNXUTEKDIF1(-2)	0.247909	0.0046 ***	0.226852	0.4124	0.251778	0.0050 ***
C	0.022665	0.0194 **	0.008823	0.7247	0.031389	0.0025 ***
LNCPIDIF1	-0.041590	0.4114	-0.113271	0.4618	-0.011071	0.8221
LNDEPOSITDIF1	-0.097707	0.2932	0.269846	0.2943	-0.266413	0.0093 ***
LNFXDIF1	-0.797528	0.0000 ***	-0.750444	0.0729 *	-0.857646	0.0000 ***
LNIPDIF2	-0.003388	0.9200	-0.035309	0.7916	0.03086	0.3336
LNUSFRDIF1	-0.004749	0.8839	0.060997	0.5747	0.036364	0.3666
LNUSM2DIF1	-1.391800	0.3639	3.593472	0.3859	-3.013893	0.0637 **
DUMMY1	-0.197009	0.0001 ***	-0.182388	0.0310 **	-	-
R-squared	0.373673		0.596057		0.367504	
Adj. R-squared	0.294802		0.341722		0.256296	
Prob(F-statistic)	0.000000		0.023285		0.000153	

Notes: *** , **, * indicates %1, %5, and %10 confidence level, respectively.

According to table 6.3, by taking significant variables into account;

During 2006-2018 period, XUHIZ(-1) and XUTEK(-2) are statistically significant at conficendence level 5% and 1%, repectively. BIST 100 returns does not affected by changes in it’s own lag and also XUSIN and XUMAL indices. By considering the all macrovariables, only USD/TRY exchange rate (0) is statistically significant at 1% confidence level. A 1% increase in exchange rate, the effect on BIST 100 index will be 79,7% negatively.

During 2006-2009 period, BIST100 returns are not significantly affected by the its own lag and the other indices statistically. USD/TRY exchange rate is important at

10% confidence level. A 1% increase in foreign exchange rate, the effect on BIST 100 index will be 75% negatively.

During 2010-2018 period, BİST100 returns are influenced by its first lag, XUHIZ (-1), XUMAL (-1), XUTEK (-2) at 1% confidence level and XUSIN (-1), (-2) at confidence level 5%. 1-year deposit rate and exchange rate are significant at level 1%, US M2 money supply is statistically significant at confidence level 10%. All significant macrovariables have negative impact on BIST returns. BIST100 returns will decrease 26,6% and 85,7%, in the case of 1% increase in 1-year deposit rate and exchange rate respectively. If money supply rise %1 in US, BIST100 returns will be affected 300% negatively.

In all periods, exchange rate is the only significantly important macrovariable and negative impact on XU100 price. Dummies are significantly important as it should be. In addition, f-statistics of VAR model are significantly important which reveals the results does not happen by chance. R-squared value is really close to each other for period 2006-2018 and 2010-2018. It is about 37%. Between 2006 and 2009, R-squared is higher than other two period which is approximately 60%. R-squared assumes every independent variable in the model explains the variation in the dependent variable. It shows the percentage of explained variation as if all independent variables in the model affect the dependent variable. In the real world, this one-to-one relationship rarely happens. Therefore, evaluating adjusted R-squared to describe model success is more meaningful. Adjusted R-squared gives the percentage of variation explained by only those independent variables that affect the dependent variable. It implies that 35% of the variance of BIST returns can be explained by these selected independent variables variance between 2006-2009.

6.2. VAR RESULTS : XUHIZ

Table 6.4. XUHIZ: Results of VAR for All Periods

	2006-2018		2006-2009		2010-2018	
	Coefficient	P Values	Coefficient	P Values	Coefficient	P Values
LNBIST100DIF1(-1)	1.395290	0.1636	-0.326941	0.8649	3.633123	0.0068***
LNBIST100DIF1(-2)	1.984148	0.0412	2.899889	0.1423	1.754784	0.1554
LNXUHIZDIF1(-1)	-0.610155	0.0061***	-0.325349	0.4128	-0.34522	0.0009***
LNXUHIZDIF1(-2)	-0.348705	0.1019*	-0.460898	0.2620	-1.053356	0.2404
LNXUMALDIF1(-1)	-0.690730	0.2305	0.336025	0.7594	-2.049838	0.0088***
LNXUMALDIF1(-2)	-1.008771	0.0682*	-1.591503	0.1594	-0.937505	0.1848
LNXUSINDIF1(-1)	-0.372873	0.2260	-0.129435	0.8475	-0.796693	0.0383**
LNXUSINDIF1(-2)	-0.902481	0.0026***	-1.025972	0.1240	-0.863024	0.0194**
LNXUTEKDIF1(-1)	-0.051445	0.4773	0.138841	0.5862	-0.050631	0.5663
LNXUTEKDIF1(-2)	0.167705	0.0191**	0.173127	0.3972	0.191218	0.0212**
C	0.030717	0.0001***	0.033180	0.0811*	0.031679	0.0011***
LNCPIDIF1	-0.013894	0.7380	-0.043408	0.7015	-0.00387	0.9328
LNDEPOSITDIF1	-0.042833	0.5743	0.168934	0.3727	-0.143669	0.1274
LNFXDIF1	-0.576568	0.0000***	-0.293550	0.3318	-0.756800	0.0000***
LNIPDIF2	0.028586	0.3035	-0.031043	0.7532	0.053209	0.0753*
LNUSFRDIF1	-0.014351	0.5914	0.038306	0.6330	0.020878	0.5774
LNUSM2DIF1	-2.174880	0.0854	0.332918	0.9128	-2.96219	0.0507 **
DUMMY1	-0.174068	0.0000***	-0.184925	0.0042***	-	-
R-squared	0.390009		0.594353		0.356965	
Adj. R-squared	0.313195		0.338945		0.243904	
Prob(F-statistic)	0.000000		0.024197		0.000269	

Notes: *** , **, * indicates %1, %5, and %10 confidence level, respectively.

In the table 6.4, service sector index returns are explained via VAR model for 3 periods. In between 2006 and 2009, none of the independent variables are significantly important that might be resulted from different patterns in the stock market caused by crisis effect in 2008.

In between 2006 and 2018, XUHIZ is affected by its own lags and also second lag of XUMAL, XUSIN and XUTEK. A 1% increase in XUMAL, XUSIN and XUTEK 2 months ago will influence service sector index returns 100,8%, 90,2% negatively and 167,7% positively, respectively. By checking macroeconomic factors, it may be observed that exchange rate USD/TRY is the only significant one. A %1 increase may lead an decrease 57,6% in XUHIZ returns.

In between 2010 and 2018, service sector index returns are affected by first lag of all indices except XUTEK and second lag of XUTEK and XUHIZ significantly.

Beside that USD/TR exchange rate, industrial production index and US M2 money supply are statistically important macroeconomic variables. While exchange rate and money supply have negative impact, industrial production has positive impact. A 1% increase in fx rate and money supply may lead an fall in XUHIZ returns about 75% and 296%, respectively. On the contrary, industrial production index affects 5,3% positively.

For all periods, f statistics values are significant at 5% confidence level. R squared values shows same pattern as in BIST100 returns model. When test statistics are checked, the residuals of XUHIZ returns equation in between 2006-2009 are not normally distributed, although other periods are complying with a well specified model properties.

6.3. VAR RESULTS : XUSIN

Table 6.5. XUSIN: Results of VAR for All Periods

	2006-2018		2006-2009		2010-2018	
	Coefficient	P Values	Coefficient	P Values	Coefficient	P Values
LNBIST100DIF1(-1)	1.870768	0.0898*	-0.673962	0.7547	3.990210	0.0040***
LNBIST100DIF1(-2)	0.577288	0.5863	0.852392	0.6952	0.619879	0.6246
LNXUHIZDIF1(-1)	-0.480770	0.0479**	0.071587	0.8716	-0.963947	0.0031***
LNXUHIZDIF1(-2)	-0.208585	0.3718	-0.125924	0.7824	-0.348902	0.2496
LNXUMALDIF1(-1)	-1.174412	0.0646*	0.244917	0.8422	-2.327102	0.0041***
LNXUMALDIF1(-2)	-0.413981	0.4937	-0.881173	0.4813	-0.242458	0.7381
LNXUSINDIF1(-1)	-0.335084	0.3218	-0.183284	0.8083	-0.852270	0.0317**
LNXUSINDIF1(-2)	-0.224247	0.4892	0.346413	0.6367	-0.495780	0.1879
LNXUTEKDIF1(-1)	-0.042443	0.5936	0.340784	0.2386	-0.044218	0.6269
LNXUTEKDIF1(-2)	0.231831	0.0034***	0.127638	0.5766	0.234283	0.0065***
C	0.026886	0.0023***	0.003592	0.8625	0.035866	0.0004***
LNCPIDIF1	-0.002722	0.9525	-0.029945	0.8136	0.004544	0.9235
LNDEPOSITDIF1	-0.183349	0.0300**	-0.007679	0.9710	-0.252407	0.0102***
LNFXDIF1	-0.505520	0.0008***	-0.717128	0.0405**	-0.438104	0.0163**
LNIPDIF2	0.003730	0.9025	0.013228	0.9049	0.026499	0.3870
LNUSFRDIF1	0.003178	0.9138	0.094141	0.2994	-0.002443	0.9495
LNUSM2DIF1	-2.469482	0.0757*	3.582723	0.2983	-3.938467	0.0123**
DUMMY1	-0.195584	0.0000***	-0.148100	0.0343**	-	-
R-squared	0.335730		0.619687		0.278939	
Adj. R-squared	0.252082		0.380231		0.152159	
Prob(F-statistic)	0.000002		0.013268		0.010145	

Notes: *** , **, * indicates %1, %5, and %10 confidence level, respectively.

Industry sector index VAR results are presented in Table 6.5.

In the years of 2006-2018, XUSIN is not affected by its own lag and influenced by BIST100(-1), XUHIZ(-1), XUMAL(-1) and XUTEK(-2) are statistically important. Industry sector return has positive correlation with BIST100 and techonology indices and also negative correlation with service sector index and financial index. A %1 increase in XUTEK 2 months ago lead 23,1% increase in industrial sector index. By considering macroeconomic factors, it can be said that 1 year deposit rate and exchange rate are significant at 5% confidence level and US M2 money supply at 10% confidence level. All significant macroeconomic variables are negative impact on XUSIN returns. XUSIN returns will fall 18,3% and 50,5% in the case of 1% increase in 1 year deposit rate and exchange rate, respectively.

In years of 2006-2009, the only factor significant at 5% confidence level is exchange rate. In the case of 1% rise of exchange rate will cause an effect negatively, 71,7%. None of the BIST indices has an significant effect on industry sector index. Even its own lag does not have an significant effect on returns of XUSIN returns.

In the years of 2010-2018, XUSIN return is affected by first lag of all indices except XUTEK and second lag of XUTEK significantly. There is a positive correlation between industry sector index and BIST100. 1-year deposit rate is significantly important at %1 confidence level. In addition to this, exchange rate and US M2 money supply are significant at 5% confidence level. If deposit rates is increased 1%, industry sector returns will decrease 25,2%. Moreover, there is negative correlation between exchange rates and XUSIN index.

For all periods, f statistics are significant at 5% confidence level. The negative correlation with exchange rate is observed in all 3 periods. R-squared exhibits same behaviour like in BIST100 and XUHIZ index.

6.4. VAR RESULTS : XUMAL

Table 6.6. XUMAL: Results of VAR for All Periods

	2006-2018		2006-2009		2010-2018	
	Coefficient	P Values	Coefficient	P Values	Coefficient	P Values
LNBIST100DIF1(-1)	1.124303	0.4417	-2.383773	0.4801	4.929496	0.0027***
LNBIST100DIF1(-2)	1.692816	0.2322	1.647110	0.6275	2.336703	0.1212
LNXUHIZDIF1(-1)	-0.612241	0.0581**	0.160645	0.8161	-1.344977	0.0006***
LNXUHIZDIF1(-2)	-0.327183	0.2927	-0.15272	0.8298	-0.561934	0.1182
LNXUMALDIF1(-1)	-0.780254	0.3540	1.252112	0.5153	-3.034362	0.0016***
LNXUMALDIF1(-2)	-1.066761	0.1861	-1.485809	0.4466	-1.207411	0.1616
LNXUSINDIF1(-1)	-0.052792	0.9065	0.306039	0.7949	-0.920802	0.0493**
LNXUSINDIF1(-2)	-0.589984	0.1726	0.141437	0.9014	-1.093996	0.0152**
LNXUTEKDIF1(-1)	-0.001643	0.9876	0.488966	0.2771	-0.069926	0.5161
LNXUTEKDIF1(-2)	0.263357	0.0119**	0.244010	0.4941	0.271258	0.0077***
C	0.018285	0.1146	0.004307	0.8940	0.029068	0.0129**
LNCPIDIF1	-0.068737	0.2590	-0.167062	0.4016	-0.024853	0.9571
LNDEPOSITDIF1	-0.045437	0.6836	0.436580	0.1916	-0.260354	0.0246**
LNFXDIF1	-1.012584	0.0000***	-0.855022	0.1114	-1.111306	0.0000***
LNIPDIF2	-0.013932	0.6337	-0.051813	0.7641	0.016959	0.6394
LNUSFRDIF1	-0.003999	0.9185	0.068516	0.6253	0.051554	0.2605
LNUSM2DIF1	-0.726193	0.6930	4.808256	0.3694	-2.604016	0.1568
DUMMY1	-0.192423	0.0018***	-0.179876	0.0938*	-	-
R-squared	0.357264		0.542996		0.387088	
Adj. R-squared	0.276327		0.255253		0.279323	
Prob(F-statistic)	0.000000		0.068113		0.000051	

Notes: *** , **, * indicates %1, %5, and %10 confidence level, respectively.

In table 6.6, results of financial sector index are shown. Between 2006-2009, the choosen variables are not significant at all.

Between 2006 and 2018, XUMAL return is influenced by XUHIZ(-1) and XUTEK(-2) at 5% confidence level. A 1% increase in service sector index 1 month ago induces 61,2% negative impact. On the contrary, a increase in technology index may drive 26.3% rise in returns of financial sector after 2 month. Only exchange rate among all selected variables is meaningful to explain returns of financial index. It has an negative impact on XUMAL index.

Between 20010-2018, first lag of all indeces except XUTEK is significantly important at 5% confidence level. Although, a negative relationships between financial index returns and XUSIN & XUHIZ are observed, there is a positive correlation with BIST100 and XUTEK. XUMAL may be positioned in same portfolio with XUSIN and XUHIZ rather than BIST100 and XUTEK for hedging purposes. 1 year deposit rate and UDS/TRY exchange rate influence negatively financial index significantly. In the case of 1% rise of deposit rate, 26% decrease is expected in XUMAL returns at 5% confidence level.

F-statistic is at 1% significance level for 2006-2018 and 2010-2018 but it shows %10 significance in 2006-2009. By taking into consideration R-squared and adjusted R-squared values, while R-squared implies more explanatory model between 2006-2009, adjusted R-squared reveals that other periods are slightly more succesful in terms of explanatoriness. Although cumulative sum (CUSUM) of financial index returns model in all periods implies a stability, cumulative sum square (CUSUMQ) in period 2006-2018 shows a nonstability since it exceeds critical bounds. Since CUSUM test identifies systematic changes in the regression coefficients and results fall inside the critical bands, it indicates the absence of any stability problem of coefficients. If CUSUMQ statistic is checked, since CUSUMQ detects sudden change from the constancy of regression coefficient, there exists a nonstability over the sample period 2006-2018.

6.5. VAR RESULTS : XUTEK

Table 6.7. XUTEK: Results of VAR for All Periods

	2006-2018		2006-2009		2010-2018	
	Coefficient	P Values	Coefficient	P Values	Coefficient	P Values
LNBIST100DIF1(-1)	1.052667	0.5094	1.390191	0.6716	2.743403	0.1692
LNBIST100DIF1(-2)	1.385476	0.3693	0.611647	0.8530	0.5684667	0.7592
LNXUHIZDIF1(-1)	-0.473602	0.1783	-0.275613	0.6825	-0.943005	0.0455**
LNXUHIZDIF1(-2)	-0.340754	0.3156	-0.439068	0.5273	-0.024896	0.9551
LNXUMALDIF1(-1)	-0.558116	0.5434	-0.772727	0.6796	-1631175	0.1617
LNXUMALDIF1(-2)	-0.984859	0.2632	-0.93741	0.6211	-0.46782	0.6598
LNXUSINDIF1(-1)	-0.233753	0.6339	-1.664509	0.1545	-0.260008	0.6506
LNXUSINDIF1(-2)	-0.266260	0.5859	1.172225	0.2967	-0.337579	0.5390
LNXUTEKDIF1(-1)	0.061479	0.5949	0.85979	0.0555**	-0.033645	0.8006
LNXUTEKDIF1(-2)	0.259551	0.0231**	-0.127167	0.7137	0.240203	0.0542**
C	0.027114	0.0328**	0.018898	0.5500	0.03522	0.0149**
LNCPIDIF1	-0.023648	0.7216	-0.070948	0.7132	0.007961	0.9085
LNDEPOSITDIF1	-0.118610	0.3308	-0.21205	0.5101	-0.21979	0.1226
LNFXDIF1	-0.604633	0.0054***	-0.70974	0.1723	-0.713613	0.0078***
LNIPDIF2	0.009827	0.8243	-0.07222	0.6680	0.025302	0.5724
LNUSFRDIF1	-0.017191	0.6872	0.052051	0.7032	0.04065	0.4727
LNUSM2DIF1	-1.812170	0.3677	-0.845357	0.8704	-2.670489	0.2401
DUMMY1	-0.175747	0.0088***	-0.099363	0.3336	-	-
R-squared	0.234441		0.491564		0.189549	
Adj. R-squared	0.138038		0.171437		0.047052	
Prob(F-statistic)	0.002456		0.155340		0.196555	

Notes: *** , **, * indicates %1, %5, and %10 confidence level, respectively.

In the table 6.7, technology index results are presented for three periods.

During 2006-2018, technology index return is only affected by its own second lag. A 1% rise in XUTEK 2 month ago derive an increase 25,9% in returns. Other indices are not significantly important statistically. As in XUTEK(-2), exchange rate is also only important varaiable among the macroeconomic factors. In the case of 1% depreciation exchange rate, technology index returns will be affected 60,4% negatively.

During 2006-2009, XUTEK returns are influenced by only its first lag. Macroeconomic variables does not matter significantly in this period.

During 2010-2018, technology index returns is affected by its own lag as in other periods. Besides XUTEK, XUHIZ(-1) is significant at 5% confidence level. Similar with 2006-2018 period, exchange rate is only significant factor. There is a negative correlation with exchange rate 71,6%.

For all periods, it is observed that other indices does not have an impact on technology index. F statistic is significanly important at 1% confidence level for 2006-2018 period. The results of other two periods perform in less confidence interval. There is serial correlation between 2006-2018, although there is no such a case for other two periods.

CONCLUSION

This thesis explores the relation among the BIST sector indices' returns and macroeconomic factors, by employing data from both the Turkish and US economy covering years from 2006 and 2018. In addittion, 2010 Turkish constituonal referendum is used as a landmark for dividing two different terms and analyzed the effects on stock price developments. Thus, the results have been examined in 3 different terms; 2006-2018, 2006-2009 and 2010-2018.

A VAR approach has utilized throughout the paper. In order to apply a VAR model; Augmented Dickey-Fuller test and Johansen co-integraton test are performed. Main finding of Johansen co-integration test is that for all three periods, BIST indices are not cointegrated and does not converge thourugh a equilibrium point in long run therefore examinations are maintained with VAR model instead of VECM.

By considering macroeconomic indicators's effects on sector level, BIST service index is mainly affected by exchange rate, industrial production index and US money supply. BIST industrial index is influenced by deposit rate, exchange rate and US money supply. BIST financial index is affected by the economical factors namely, exchange rate and deposit rate. Finally, BIST techonology index is only influenced by the exchange rate among the all macrovariables. The signs of exchange rate, deposit rate and US money supply are statistically significant and negative and the sign of industrial production index is positive. Thus, it can be said that while exchange rate has an impact on all selected BIST sector indices, consumer price index and 10 year treasury yield has no impact at all.

As observed from emperical results, the past moves of XUHIZ, XUSIN and XUMAL have negative effects on the current changes in ISE indices, on the contrary XUTEK has positive effects. These findings may have significant implications for decision-making, being useful for portfolio diversification strategies as well as achieving better risk-return tradeoffs.

Emperical results exhibit different patterns in different periods. These results are presented in below;

- In 2006-2018 period, there is no a dynamic relationship between BIST100 stock index and other sector indices. While there is a correlation running from XUHIZ and XUTEK to BIST100 index, an effect running from BIST100 index to XUSIN index is observed. The casuality relation extending from exchange rate to all selected indices are significant at 1% confidence level. Beside exchange rate, 1-year deposit rate and US M2 money supply also significant factors in this term. All statistically significant variables exhibit negative correlation with stock returns.
- In 2006-2009 period, neither of the indices has significant effect on each other, only XUTEK is affected significantly by its own lag. Thus, there is no dynamic relationship among the indices. Moreover, neither of the macroeconomic factors are statistically important for XUTEK, XUMAL and XUHIZ. Only exchange rate is significant factor for BIST100 stok index and industry stock index.
- In 2010-2018 period, there is a dynamic relationship between BIST100 and all sector index except XUTEK.There is one way relationship extending from XUTEK to BIST100 stock index. Exchange rate, 1-year deposit rate, industrial production index and US M2 money supply are statistically significant variables although IP index affects significantly only service sector returns. Exchange rate, 1-year deposit rate and US M2 money supply have an negative impact on stock returns, on the contrary, industrial production index the returns positively.

As a result, the nature of the long term relation among BIST indices and macroeconomic variables has evolved after the outbreak of global financial crisis. After the change in economic conditions resulted from the global crisis, long-run dynamics of BIST 100 and other sector indices has changed drastically.

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APPENDIX

Appendix 1: Augmented Dickey-Fuller Tests, E-View

Augmented Dickey-Fuller Unit Root Test on LNBIST100

Null Hypothesis: LNBIST100 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.253958	0.6500
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNBIST100)
Method: Least Squares
Date: 12/01/19 Time: 20:30
Sample (adjusted): 2006M02 2018M12
Included observations: 155 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNBIST100(-1)	-0.021067	0.016800	-1.253958	0.2118
C	0.237210	0.185581	1.278202	0.2031

R-squared	0.010173	Mean dependent var	0.004621
Adjusted R-squared	0.003703	S.D. dependent var	0.074991
S.E. of regression	0.074852	Akaike info criterion	-2.333777
Sum squared resid	0.857242	Schwarz criterion	-2.294507
Log likelihood	182.8677	Hannan-Quinn criter.	-2.317826
F-statistic	1.572410	Durbin-Watson stat	1.983599
Prob(F-statistic)	0.211770		

Augmented Dickey-Fuller Unit Root Test on D(LNBIST100)

Null Hypothesis: D(LNBIST100) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.39455	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNBIST100,2)
Method: Least Squares
Date: 12/01/19 Time: 20:27
Sample (adjusted): 2006M03 2018M12
Included observations: 154 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNBIST100(-1))	-1.005356	0.081113	-12.39455	0.0000
C	0.004334	0.006087	0.711935	0.4776

R-squared	0.502658	Mean dependent var	-0.000632
Adjusted R-squared	0.499386	S.D. dependent var	0.106537
S.E. of regression	0.075379	Akaike info criterion	-2.319661
Sum squared resid	0.863674	Schwarz criterion	-2.280220
Log likelihood	180.6139	Hannan-Quinn criter.	-2.303640
F-statistic	153.6248	Durbin-Watson stat	1.975283
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on LNXUHIZ

Null Hypothesis: LNXUHIZ has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.435799	0.5634
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNXUHIZ)
Method: Least Squares
Date: 12/01/19 Time: 20:31
Sample (adjusted): 2006M02 2018M12
Included observations: 155 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNXUHIZ(-1)	-0.018286	0.012736	-1.435799	0.1531
C	0.202766	0.135483	1.496619	0.1366

R-squared	0.013295	Mean dependent var	0.008373
Adjusted R-squared	0.006846	S.D. dependent var	0.062572
S.E. of regression	0.062357	Akaike info criterion	-2.699053
Sum squared resid	0.594930	Schwarz criterion	-2.659783
Log likelihood	211.1766	Hannan-Quinn criter.	-2.683102
F-statistic	2.061519	Durbin-Watson stat	2.300491
Prob(F-statistic)	0.153101		

Augmented Dickey-Fuller Unit Root Test on D(LNXUHIZ)

Null Hypothesis: D(LNXUHIZ) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-14.58455	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNXUHIZ,2)
Method: Least Squares
Date: 12/01/19 Time: 20:32
Sample (adjusted): 2006M03 2018M12
Included observations: 154 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNXUHIZ(-1))	-1.162924	0.079737	-14.58455	0.0000
C	0.009279	0.005029	1.845005	0.0670

R-squared	0.583229	Mean dependent var	-0.000777
Adjusted R-squared	0.580487	S.D. dependent var	0.095450
S.E. of regression	0.061823	Akaike info criterion	-2.716187
Sum squared resid	0.580953	Schwarz criterion	-2.676746
Log likelihood	211.1464	Hannan-Quinn criter.	-2.700166
F-statistic	212.7090	Durbin-Watson stat	1.966985
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on LNXUMAL

Null Hypothesis: LNXUMAL has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.814542	0.3724
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNXUMAL)
Method: Least Squares
Date: 12/01/19 Time: 20:33
Sample (adjusted): 2006M02 2018M12
Included observations: 155 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNXUMAL(-1)	-0.041636	0.022946	-1.814542	0.0716
C	0.475640	0.261027	1.822190	0.0704

R-squared	0.021067	Mean dependent var	0.002171
Adjusted R-squared	0.014668	S.D. dependent var	0.088947
S.E. of regression	0.088292	Akaike info criterion	-2.003506
Sum squared resid	1.192720	Schwarz criterion	-1.964236
Log likelihood	157.2717	Hannan-Quinn criter.	-1.987555
F-statistic	3.292562	Durbin-Watson stat	1.968505
Prob(F-statistic)	0.071553		

Augmented Dickey-Fuller Unit Root Test on D(LNXUMAL)

Null Hypothesis: D(LNXUMAL) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-12.42220	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNXUMAL,2)
Method: Least Squares
Date: 12/01/19 Time: 20:35
Sample (adjusted): 2006M03 2018M12
Included observations: 154 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNXUMAL(-1))	-1.006868	0.081054	-12.42220	0.0000
C	0.001794	0.007206	0.248909	0.8038

R-squared	0.503772	Mean dependent var	-0.000689
Adjusted R-squared	0.500508	S.D. dependent var	0.126483
S.E. of regression	0.089392	Akaike info criterion	-1.978676
Sum squared resid	1.214612	Schwarz criterion	-1.939235
Log likelihood	154.3581	Hannan-Quinn criter.	-1.962656
F-statistic	154.3111	Durbin-Watson stat	1.976795
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on LNXUSIN

Null Hypothesis: LNXUSIN has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.655822	0.8533
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNXUSIN)
Method: Least Squares
Date: 12/01/19 Time: 20:37
Sample (adjusted): 2006M02 2018M12
Included observations: 155 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNXUSIN(-1)	-0.007209	0.010992	-0.655822	0.5129
C	0.086083	0.120179	0.716288	0.4749

R-squared	0.002803	Mean dependent var	0.007343
Adjusted R-squared	-0.003714	S.D. dependent var	0.065577
S.E. of regression	0.065698	Akaike info criterion	-2.594665
Sum squared resid	0.660391	Schwarz criterion	-2.555395
Log likelihood	203.0865	Hannan-Quinn criter.	-2.578714
F-statistic	0.430102	Durbin-Watson stat	1.752933
Prob(F-statistic)	0.512924		

Augmented Dickey-Fuller Unit Root Test on D(LNXUSIN)

Null Hypothesis: D(LNXUSIN) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.94117	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNXUSIN,2)
Method: Least Squares
Date: 12/01/19 Time: 20:37
Sample (adjusted): 2006M03 2018M12
Included observations: 154 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNXUSIN(-1))	-0.883237	0.080726	-10.94117	0.0000
C	0.006232	0.005316	1.172359	0.2429

R-squared	0.440578	Mean dependent var	-0.000605
Adjusted R-squared	0.436898	S.D. dependent var	0.087295
S.E. of regression	0.065506	Akaike info criterion	-2.600438
Sum squared resid	0.652244	Schwarz criterion	-2.560997
Log likelihood	202.2337	Hannan-Quinn criter.	-2.584417
F-statistic	119.7092	Durbin-Watson stat	2.001706
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on LNXUTEK

Null Hypothesis: LNXUTEK has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.168323	0.9698
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNXUTEK)
Method: Least Squares
Date: 12/01/19 Time: 20:38
Sample (adjusted): 2006M02 2018M12
Included observations: 155 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNXUTEK(-1)	0.001358	0.008069	0.168323	0.8666
C	-0.001705	0.081890	-0.020825	0.9834

R-squared	0.000185	Mean dependent var	0.012026
Adjusted R-squared	-0.006350	S.D. dependent var	0.088878
S.E. of regression	0.089159	Akaike info criterion	-1.983965
Sum squared resid	1.216256	Schwarz criterion	-1.944695
Log likelihood	155.7573	Hannan-Quinn criter.	-1.968014
F-statistic	0.028333	Durbin-Watson stat	1.744642
Prob(F-statistic)	0.866551		

Augmented Dickey-Fuller Unit Root Test on D(LNXUTEK)

Null Hypothesis: D(LNXUTEK) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.764813	0.0000
Test critical values:	1% level	-3.473382	
	5% level	-2.880336	
	10% level	-2.576871	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNXUTEK,2)
Method: Least Squares
Date: 12/01/19 Time: 20:39
Sample (adjusted): 2006M04 2018M12
Included observations: 153 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNXUTEK(-1))	-0.720508	0.106508	-6.764813	0.0000
D(LNXUTEK(-1),2)	-0.173986	0.080440	-2.162935	0.0321
C	0.008384	0.007195	1.165149	0.2458

R-squared	0.451646	Mean dependent var	-0.000309
Adjusted R-squared	0.444334	S.D. dependent var	0.117393
S.E. of regression	0.087508	Akaike info criterion	-2.014757
Sum squared resid	1.148651	Schwarz criterion	-1.955336
Log likelihood	157.1289	Hannan-Quinn criter.	-1.990619
F-statistic	61.77284	Durbin-Watson stat	1.988950
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on LNCPI

Null Hypothesis: LNCPI has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.588084	0.0976
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCPI)
Method: Least Squares
Date: 12/01/19 Time: 20:40
Sample (adjusted): 2006M03 2018M12
Included observations: 154 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNCPI(-1)	-0.084225	0.032543	-2.588084	0.0106
D(LNCPI(-1))	0.283991	0.081058	3.503567	0.0006
C	0.185783	0.070615	2.630921	0.0094

R-squared	0.090493	Mean dependent var	0.005928
Adjusted R-squared	0.078447	S.D. dependent var	0.114323
S.E. of regression	0.109747	Akaike info criterion	-1.561987
Sum squared resid	1.818711	Schwarz criterion	-1.502825
Log likelihood	123.2730	Hannan-Quinn criter.	-1.537955
F-statistic	7.512039	Durbin-Watson stat	2.028751
Prob(F-statistic)	0.000776		

Augmented Dickey-Fuller Unit Root Test on D(LNCPI)

Null Hypothesis: D(LNCPI) has a unit root
Exogenous: Constant
Lag Length: 11 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.555811	0.0000
Test critical values:	1% level	-3.476472	
	5% level	-2.881685	
	10% level	-2.577591	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNCPI,2)
Method: Least Squares
Date: 12/01/19 Time: 20:44
Sample (adjusted): 2007M02 2018M12
Included observations: 143 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNCPI(-1))	-1.940244	0.256788	-7.555811	0.0000
D(LNCPI(-1),2)	1.124505	0.238391	4.717056	0.0000
D(LNCPI(-2),2)	1.032479	0.225670	4.575162	0.0000
D(LNCPI(-3),2)	0.996953	0.215348	4.629498	0.0000
D(LNCPI(-4),2)	0.786005	0.203923	3.854426	0.0002
D(LNCPI(-5),2)	0.848997	0.187764	4.521614	0.0000
D(LNCPI(-6),2)	0.873629	0.174536	5.005430	0.0000
D(LNCPI(-7),2)	0.836602	0.159492	5.245428	0.0000
D(LNCPI(-8),2)	0.733838	0.135107	5.431534	0.0000
D(LNCPI(-9),2)	0.633393	0.118852	5.329260	0.0000
D(LNCPI(-10),2)	0.535428	0.102010	5.248772	0.0000
D(LNCPI(-11),2)	0.519943	0.079921	6.505685	0.0000
C	0.007216	0.008220	0.877830	0.3817

Augmented Dickey-Fuller Unit Root Test on LNDEPOSITRATE

Null Hypothesis: LNDEPOSITRATE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.570865	0.8724
Test critical values:	1% level	-3.472813	
	5% level	-2.880088	
	10% level	-2.576739	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNDEPOSITRATE)
Method: Least Squares
Date: 12/01/19 Time: 20:51
Sample (adjusted): 2006M02 2018M12
Included observations: 155 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNDEPOSITRATE(-1)	-0.010540	0.018463	-0.570865	0.5689
C	0.028682	0.045752	0.626899	0.5317

R-squared	0.002125	Mean dependent var	0.002746
Adjusted R-squared	-0.004397	S.D. dependent var	0.067017
S.E. of regression	0.067164	Akaike info criterion	-2.550544
Sum squared resid	0.690180	Schwarz criterion	-2.511274
Log likelihood	199.6672	Hannan-Quinn criter.	-2.534594
F-statistic	0.325886	Durbin-Watson stat	1.663015
Prob(F-statistic)	0.568929		

Augmented Dickey-Fuller Unit Root Test on D(LNDEPOSITRATE)

Null Hypothesis: D(LNDEPOSITRATE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.46597	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNDEPOSITRATE,2)
Method: Least Squares
Date: 12/01/19 Time: 20:51
Sample (adjusted): 2006M03 2018M12
Included observations: 154 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNDEPOSITRATE(-1))	-0.840683	0.080325	-10.46597	0.0000
C	0.002309	0.005372	0.429789	0.6680

R-squared	0.418819	Mean dependent var	-0.000357
Adjusted R-squared	0.414996	S.D. dependent var	0.087068
S.E. of regression	0.066594	Akaike info criterion	-2.567489
Sum squared resid	0.674093	Schwarz criterion	-2.528048
Log likelihood	199.6966	Hannan-Quinn criter.	-2.551468
F-statistic	109.5365	Durbin-Watson stat	1.984590
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on LNFXUSD

Null Hypothesis: LNFXUSD has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.398694	0.9990
Test critical values:	1% level	-3.473382	
	5% level	-2.880336	
	10% level	-2.576871	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNFXUSD)
Method: Least Squares
Date: 12/01/19 Time: 20:52
Sample (adjusted): 2006M04 2018M12
Included observations: 153 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNFXUSD(-1)	0.010534	0.007532	1.398694	0.1640
D(LNFXUSD(-1))	0.421668	0.078795	5.351434	0.0000
D(LNFXUSD(-2))	-0.313916	0.082193	-3.819261	0.0002
C	0.000741	0.005859	0.126466	0.8995

R-squared	0.195912	Mean dependent var	0.009030
Adjusted R-squared	0.179722	S.D. dependent var	0.038754
S.E. of regression	0.035099	Akaike info criterion	-3.835488
Sum squared resid	0.183560	Schwarz criterion	-3.756261
Log likelihood	297.4148	Hannan-Quinn criter.	-3.803304
F-statistic	12.10100	Durbin-Watson stat	1.931826
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on D(LNFXUSD)

Null Hypothesis: D(LNFXUSD) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.334070	0.0000
Test critical values:	1% level	-3.473382	
	5% level	-2.880336	
	10% level	-2.576871	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNFXUSD,2)
Method: Least Squares
Date: 12/01/19 Time: 20:53
Sample (adjusted): 2006M04 2018M12
Included observations: 153 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNFXUSD(-1))	-0.850310	0.091097	-9.334070	0.0000
D(LNFXUSD(-1),2)	0.286035	0.079993	3.575755	0.0005
C	0.007811	0.002974	2.626744	0.0095

R-squared	0.381784	Mean dependent var	-0.000125
Adjusted R-squared	0.373542	S.D. dependent var	0.044487
S.E. of regression	0.035211	Akaike info criterion	-3.835515
Sum squared resid	0.185970	Schwarz criterion	-3.776095
Log likelihood	296.4169	Hannan-Quinn criter.	-3.811378
F-statistic	46.31690	Durbin-Watson stat	1.920630
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on LNUSFUNDSRATE

Null Hypothesis: LNUSFUNDSRATE has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.422723	0.5699
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNUSFUNDSRATE)
Method: Least Squares
Date: 12/01/19 Time: 20:54
Sample (adjusted): 2006M03 2018M12
Included observations: 154 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNUSFUNDSRATE(-1)	-0.012448	0.008750	-1.422723	0.1569
D(LNUSFUNDSRATE(-1))	0.411155	0.073800	5.571233	0.0000
C	-0.013905	0.015172	-0.916507	0.3609

R-squared	0.177919	Mean dependent var	-0.004429
Adjusted R-squared	0.167031	S.D. dependent var	0.176020
S.E. of regression	0.160649	Akaike info criterion	-0.799906
Sum squared resid	3.897007	Schwarz criterion	-0.740744
Log likelihood	64.59274	Hannan-Quinn criter.	-0.775874
F-statistic	16.34010	Durbin-Watson stat	1.946742
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on D(LNUSFUNDSRATE)

Null Hypothesis: D(LNUSFUNDSRATE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.990944	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNUSFUNDSRATE,2)
Method: Least Squares
Date: 12/01/19 Time: 20:55
Sample (adjusted): 2006M03 2018M12
Included observations: 154 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNUSFUNDSRATE(-1))	-0.591520	0.074024	-7.990944	0.0000
C	-0.002658	0.012993	-0.204545	0.8382

R-squared	0.295824	Mean dependent var	-9.25E-05
Adjusted R-squared	0.291191	S.D. dependent var	0.191457
S.E. of regression	0.161189	Akaike info criterion	-0.799577
Sum squared resid	3.949246	Schwarz criterion	-0.760136
Log likelihood	63.56742	Hannan-Quinn criter.	-0.783556
F-statistic	63.85519	Durbin-Watson stat	1.940773
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on LNUSM2

Null Hypothesis: LNUSM2 has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.921871	0.7791
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNUSM2)
Method: Least Squares
Date: 12/01/19 Time: 20:55
Sample (adjusted): 2006M03 2018M12
Included observations: 154 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNUSM2(-1)	-0.001159	0.001257	-0.921871	0.3581
D(LNUSM2(-1))	0.230726	0.079229	2.912138	0.0041
C	0.014460	0.011616	1.244784	0.2151

R-squared	0.061096	Mean dependent var	0.004919
Adjusted R-squared	0.048661	S.D. dependent var	0.003657
S.E. of regression	0.003567	Akaike info criterion	-8.414940
Sum squared resid	0.001921	Schwarz criterion	-8.355778
Log likelihood	650.9503	Hannan-Quinn criter.	-8.390908
F-statistic	4.912935	Durbin-Watson stat	2.045515
Prob(F-statistic)	0.008568		

Augmented Dickey-Fuller Unit Root Test on D(LNUSM2)

Null Hypothesis: D(LNUSM2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.671456	0.0000
Test critical values:	1% level	-3.473096	
	5% level	-2.880211	
	10% level	-2.576805	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNUSM2,2)
Method: Least Squares
Date: 12/01/19 Time: 20:56
Sample (adjusted): 2006M03 2018M12
Included observations: 154 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNUSM2(-1))	-0.763399	0.078933	-9.671456	0.0000
C	0.003760	0.000482	7.809015	0.0000

R-squared	0.380949	Mean dependent var	2.28E-05
Adjusted R-squared	0.376876	S.D. dependent var	0.004516
S.E. of regression	0.003565	Akaike info criterion	-8.422314
Sum squared resid	0.001932	Schwarz criterion	-8.382873
Log likelihood	650.5182	Hannan-Quinn criter.	-8.406293
F-statistic	93.53706	Durbin-Watson stat	2.049297
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on LNINDUSTRIALPRODUCTION

Null Hypothesis: LNINDUSTRIALPRODUCTION has a unit root
Exogenous: Constant
Lag Length: 13 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.884544	0.7908
Test critical values:	1% level	-3.476805	
	5% level	-2.881830	
	10% level	-2.577668	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNINDUSTRIALPRODUCTION)
Method: Least Squares
Date: 12/01/19 Time: 20:58
Sample (adjusted): 2007M03 2018M12
Included observations: 142 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNINDUSTRIALPRODUCTION(-1)	-0.020168	0.022800	-0.884544	0.3781
D(LNINDUSTRIALPRODUCTION(-1))	-0.673813	0.084344	-7.988848	0.0000
D(LNINDUSTRIALPRODUCTION(-2))	-0.115953	0.089747	-1.291996	0.1987
D(LNINDUSTRIALPRODUCTION(-3))	-0.079684	0.088928	-0.896052	0.3719
D(LNINDUSTRIALPRODUCTION(-4))	-0.070106	0.084951	-0.825262	0.4108
D(LNINDUSTRIALPRODUCTION(-5))	-0.011419	0.085058	-0.134245	0.8934
D(LNINDUSTRIALPRODUCTION(-6))	0.008628	0.083536	0.103290	0.9179
D(LNINDUSTRIALPRODUCTION(-7))	0.000146	0.083799	0.001737	0.9986
D(LNINDUSTRIALPRODUCTION(-8))	-0.105691	0.083952	-1.258955	0.2104
D(LNINDUSTRIALPRODUCTION(-9))	-0.121131	0.084419	-1.434867	0.1538
D(LNINDUSTRIALPRODUCTION(-10))	-0.240505	0.084209	-2.856063	0.0050
D(LNINDUSTRIALPRODUCTION(-11))	-0.121624	0.086994	-1.398066	0.1645
D(LNINDUSTRIALPRODUCTION(-12))	0.656758	0.086840	7.562882	0.0000
D(LNINDUSTRIALPRODUCTION(-13))	0.393914	0.082466	4.776673	0.0000
C	0.094112	0.100515	0.936294	0.3509

Augmented Dickey-Fuller Unit Root Test on D(LNINDUSTRIALPRODUCTION)

Null Hypothesis: D(LNINDUSTRIALPRODUCTION) has a unit root
Exogenous: Constant
Lag Length: 12 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.513204	0.1145
Test critical values:	1% level	-3.476805	
	5% level	-2.881830	
	10% level	-2.577668	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNINDUSTRIALPRODUCTION,2)
Method: Least Squares
Date: 12/01/19 Time: 20:59
Sample (adjusted): 2007M03 2018M12
Included observations: 142 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNINDUSTRIALPRODUCTION(-1))	-1.679708	0.668353	-2.513204	0.0132
D(LNINDUSTRIALPRODUCTION(-1),2)	-0.013405	0.642935	-0.020850	0.9834
D(LNINDUSTRIALPRODUCTION(-2),2)	-0.151545	0.590679	-0.256561	0.7979
D(LNINDUSTRIALPRODUCTION(-3),2)	-0.251482	0.539837	-0.465847	0.6421
D(LNINDUSTRIALPRODUCTION(-4),2)	-0.338819	0.495701	-0.683515	0.4955
D(LNINDUSTRIALPRODUCTION(-5),2)	-0.367213	0.451667	-0.813017	0.4177
D(LNINDUSTRIALPRODUCTION(-6),2)	-0.374012	0.409961	-0.912312	0.3633
D(LNINDUSTRIALPRODUCTION(-7),2)	-0.389749	0.365289	-1.066961	0.2880
D(LNINDUSTRIALPRODUCTION(-8),2)	-0.511420	0.315391	-1.621543	0.1074
D(LNINDUSTRIALPRODUCTION(-9),2)	-0.647628	0.261710	-2.474598	0.0146
D(LNINDUSTRIALPRODUCTION(-10),2)	-0.901192	0.204600	-4.404660	0.0000
D(LNINDUSTRIALPRODUCTION(-11),2)	-1.034318	0.144744	-7.145844	0.0000
D(LNINDUSTRIALPRODUCTION(-12),2)	-0.387474	0.082074	-4.721009	0.0000
C	0.005325	0.005279	1.008580	0.3151

Augmented Dickey-Fuller Unit Root Test on D(LNINDUSTRIALPRODUCTION,2)

Null Hypothesis: D(LNINDUSTRIALPRODUCTION,2) has a unit root
Exogenous: Constant
Lag Length: 11 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.37995	0.0000
Test critical values:	1% level	-3.476805	
	5% level	-2.881830	
	10% level	-2.577668	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LNINDUSTRIALPRODUCTION,3)
Method: Least Squares
Date: 12/01/19 Time: 21:00
Sample (adjusted): 2007M03 2018M12
Included observations: 142 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNINDUSTRIALPRODUCTION(-1),2)	-16.43527	1.444230	-11.37995	0.0000
D(LNINDUSTRIALPRODUCTION(-1),3)	13.81728	1.399834	9.870654	0.0000
D(LNINDUSTRIALPRODUCTION(-2),3)	12.20974	1.329685	9.182432	0.0000
D(LNINDUSTRIALPRODUCTION(-3),3)	10.64975	1.237268	8.607473	0.0000
D(LNINDUSTRIALPRODUCTION(-4),3)	9.139625	1.116764	8.184026	0.0000
D(LNINDUSTRIALPRODUCTION(-5),3)	7.739017	0.973137	7.952652	0.0000
D(LNINDUSTRIALPRODUCTION(-6),3)	6.462104	0.809913	7.978764	0.0000
D(LNINDUSTRIALPRODUCTION(-7),3)	5.299512	0.637893	8.307834	0.0000
D(LNINDUSTRIALPRODUCTION(-8),3)	4.146299	0.472064	8.783348	0.0000
D(LNINDUSTRIALPRODUCTION(-9),3)	2.991959	0.319377	9.368111	0.0000
D(LNINDUSTRIALPRODUCTION(-10),3)	1.720702	0.187668	9.168874	0.0000
D(LNINDUSTRIALPRODUCTION(-11),3)	0.463031	0.077927	5.941823	0.0000
C	-0.001612	0.004592	-0.351137	0.7261

Appendix 2. Lag Length, Schwarz Information Criterion (SIC), E-Views

Period 2006-2018

VAR Lag Order Selection Criteria
Endogenous variables: LNBIST100DIF1 LNXUHIZDIF1 LNXUMALDIF1 LNXUSINDIF1 LNXUTEKDIF1
Exogenous variables: C LNCPIDIF1 LNDEPOSITDIF1 LNFXDIF1 LNIPDIF2 LNUSFRDIF1 LNUSM2D...
Date: 12/01/19 Time: 22:13
Sample: 2006M01 2018M12
Included observations: 147

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1537.355	NA	9.78e-16*	-20.37218*	-19.55846*	-20.04156*
1	1557.459	36.65124	1.05e-15	-20.30556	-18.98326	-19.76830
2	1584.828	48.03535*	1.02e-15	-20.33779	-18.50692	-19.59389
3	1601.025	27.32580	1.16e-15	-20.21803	-17.87857	-19.26748
4	1618.491	28.27759	1.29e-15	-20.11552	-17.26749	-18.95833
5	1637.733	29.84616	1.42e-15	-20.03719	-16.68058	-18.67336
6	1655.046	25.67398	1.61e-15	-19.93259	-16.06741	-18.36213
7	1675.994	29.64083	1.75e-15	-19.87747	-15.50370	-18.10036
8	1696.935	28.20685	1.92e-15	-19.82225	-14.93991	-17.83850

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Period 2006-2009

VAR Lag Order Selection Criteria
Endogenous variables: LNBIST100DIF1 LNXUHIZDIF1 LNXUMALDIF1 LNXUSINDIF1 LNXUTEKDIF1
Exogenous variables: C LNCPIDIF1 LNDEPOSITDIF1 LNFXDIF1 LNIPDIF2 LNUSFRDIF1 LNUSM2D...
Date: 12/01/19 Time: 22:25
Sample: 2006M01 2009M12
Included observations: 43

Lag	LogL	LR	FPE	AIC	SC	HQ
0	435.0263	NA	7.37e-15*	-18.37332	-16.73499*	-17.76915*
1	448.8911	19.34619	1.33e-14	-17.85540	-15.19312	-16.87363
2	473.4493	28.55608	1.63e-14	-17.83485	-14.14862	-16.47548
3	522.2363	45.38321*	7.61e-15	-18.94122	-14.23104	-17.20425
4	554.4774	22.49382	1.03e-14	-19.27802*	-13.54388	-17.16345

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Period 2010-2018

VAR Lag Order Selection Criteria
Endogenous variables: LNBIST100DIF1 LNXUHIZDIF1 LNXUMALDIF1 LNXUSINDIF1 LNXUTEKDIF1
Exogenous variables: C LNCPIDIF1 LNDEPOSITDIF1 LNFXDIF1 LNIPDIF2 LNUSFRDIF1 LNUSM2D...
Date: 12/01/19 Time: 22:28
Sample: 2010M01 2018M12
Included observations: 108

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1197.476	NA	3.08e-16*	-21.52734	-20.65813*	-21.17491*
1	1220.414	40.77773	3.21e-16	-21.48914	-19.99907	-20.88497
2	1248.074	46.61231	3.09e-16	-21.53840*	-19.42747	-20.68250
3	1262.042	22.24554	3.84e-16	-21.33411	-18.60231	-20.22646
4	1280.989	28.42000	4.41e-16	-21.22201	-17.86935	-19.86263
5	1307.128	36.78831	4.48e-16	-21.24310	-17.26958	-19.63198
6	1338.206	40.86227*	4.22e-16	-21.35567	-16.76127	-19.49281
7	1354.529	19.95093	5.33e-16	-21.19499	-15.97973	-19.08039
8	1373.487	21.41500	6.55e-16	-21.08309	-15.24697	-18.71676

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Appendix 3. Johansen Cointegration Test), E-Views

Period 2006-2018

Johansen Cointegration Test

Date: 12/01/19 Time: 22:42
Sample (adjusted): 2006M02 2018M12
Included observations: 155 after adjustments
Trend assumption: Linear deterministic trend
Series: LNBIST100 LNXUHIZ LNXUMAL LNXUSIN LNXUTEK
Exogenous series: LNCPI LNDEPOSITRATE LNFXUSD D(LNINDUSTRIALPRODUCTION) LNUS...
Warning: Critical values assume no exogenous series
Lags interval (in first differences): No lags

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.238977	100.9361	69.81889	0.0000
At most 1 *	0.157447	58.60689	47.85613	0.0036
At most 2 *	0.094502	32.05249	29.79707	0.0270
At most 3 *	0.077570	16.66558	15.49471	0.0332
At most 4 *	0.026421	4.150267	3.841466	0.0416

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.238977	42.32916	33.87687	0.0039
At most 1	0.157447	26.55440	27.58434	0.0673
At most 2	0.094502	15.38691	21.13162	0.2627
At most 3	0.077570	12.51532	14.26460	0.0928
At most 4 *	0.026421	4.150267	3.841466	0.0416

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

Period 2006-2009

Johansen Cointegration Test

Date: 12/01/19 Time: 23:14
Sample (adjusted): 2006M02 2009M12
Included observations: 47 after adjustments
Trend assumption: Linear deterministic trend
Series: LNBIST100 LNXUHIZ LNXUMAL LNXUSIN LNXUTEK
Exogenous series: LNCPI LNDEPOSITRATE LNFXUSD D(LNINDUSTRIALPRODUCTION) LNUS...
Warning: Critical values assume no exogenous series
Lags interval (in first differences): No lags

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.533775	87.21564	69.81889	0.0011
At most 1 *	0.371833	51.35053	47.85613	0.0226
At most 2	0.304954	29.49795	29.79707	0.0541
At most 3	0.198091	12.40040	15.49471	0.1387
At most 4	0.042163	2.024661	3.841466	0.1548

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.533775	35.86511	33.87687	0.0286
At most 1	0.371833	21.85258	27.58434	0.2280
At most 2	0.304954	17.09755	21.13162	0.1674
At most 3	0.198091	10.37574	14.26460	0.1884
At most 4	0.042163	2.024661	3.841466	0.1548

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

Period 2010-2018

Johansen Cointegration Test

Date: 12/01/19 Time: 23:21
Sample: 2010M01 2018M12
Included observations: 108
Trend assumption: Linear deterministic trend
Series: LNBIST100 LNXUHIZ LNXUMAL LNXUSIN LNXUTEK
Exogenous series: LNCPI LNDEPOSITRATE LNFXUSD D(LNINDUSTRIALPRODUCTION) LNUS...
Warning: Critical values assume no exogenous series
Lags interval (in first differences): No lags

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.313158	101.1419	69.81889	0.0000
At most 1 *	0.250742	60.57163	47.85613	0.0021
At most 2	0.177317	29.39502	29.79707	0.0556
At most 3	0.057971	8.315110	15.49471	0.4323
At most 4	0.017124	1.865443	3.841466	0.1720

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.313158	40.57031	33.87687	0.0069
At most 1 *	0.250742	31.17662	27.58434	0.0165
At most 2	0.177317	21.07991	21.13162	0.0508
At most 3	0.057971	6.449667	14.26460	0.5562
At most 4	0.017124	1.865443	3.841466	0.1720

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Appendix 4: VAR Results, E-Views

Period 2006-2018

Vector Autoregression Estimates

Vector Autoregression Estimates
Date: 12/01/19 Time: 16:03
Sample (adjusted): 2006M04 2018M12
Included observations: 153 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LNBIST100...	LNXUHIZDIF1	LNXUMALDIF1	LNXUSINDIF1	LNXUTEKDIF1
LNBIST100DIF1(-1)	1.427962	1.395290	1.124303	1.870768	1.052667
	(1.21268)	(0.99616)	(1.45716)	(1.09498)	(1.59139)
	[1.17753]	[1.40067]	[0.77157]	[1.70850]	[0.66148]
LNBIST100DIF1(-2)	1.448779	1.984148	1.692816	0.577288	1.385476
	(1.17201)	(0.96276)	(1.40830)	(1.05826)	(1.53803)
	[1.23615]	[2.06091]	[1.20203]	[0.54551]	[0.90081]
LNXUHIZDIF1(-1)	-0.583222	-0.610155	-0.612406	-0.480770	-0.473602
	(0.26672)	(0.21910)	(0.32049)	(0.24084)	(0.35002)
	[-2.18663]	[-2.78482]	[-1.91081]	[-1.99626]	[-1.35308]
LNXUHIZDIF1(-2)	-0.332447	-0.348705	-0.327183	-0.208585	-0.340754
	(0.25778)	(0.21175)	(0.30975)	(0.23276)	(0.33828)
	[-1.28966]	[-1.64675]	[-1.05629]	[-0.89614]	[-1.00731]
LNXUMALDIF1(-1)	-0.914167	-0.690730	-0.780254	-1.174412	-0.558116
	(0.69810)	(0.57346)	(0.83885)	(0.63035)	(0.91612)
	[-1.30950]	[-1.20449]	[-0.93015]	[-1.86311]	[-0.60922]
LNXUMALDIF1(-2)	-0.884903	-1.008771	-1.066761	-0.413981	-0.984859
	(0.66797)	(0.54871)	(0.80264)	(0.60314)	(0.87658)
	[-1.32476]	[-1.83845]	[-1.32907]	[-0.68638]	[-1.12353]
LNXUSINDIF1(-1)	-0.202680	-0.372873	-0.052792	-0.335084	-0.233753
	(0.37317)	(0.30654)	(0.44841)	(0.33695)	(0.48971)
	[-0.54313]	[-1.21638]	[-0.11773]	[-0.99445]	[-0.47733]
LNXUSINDIF1(-2)	-0.524458	-0.902481	-0.589984	-0.224247	-0.256626
	(0.35810)	(0.29416)	(0.43029)	(0.32334)	(0.46993)
	[-1.46457]	[-3.06799]	[-1.37113]	[-0.69353]	[-0.54609]
LNXUTEKDIF1(-1)	-0.023275	-0.051445	-0.001643	-0.042443	0.061479
	(0.08789)	(0.07219)	(0.10560)	(0.07936)	(0.11533)
	[-0.26483]	[-0.71260]	[-0.01555]	[-0.53485]	[0.53306]

LNXUTEKDIF1(-2)	0.247909	0.167705	0.263573	0.231831	0.259551
	(0.08607)	(0.07071)	(0.10343)	(0.07772)	(0.11295)
	[2.88018]	[2.37186]	[2.54839]	[2.98288]	[2.29783]
C	0.022665	0.030717	0.018285	0.026886	0.027114
	(0.00958)	(0.00787)	(0.01151)	(0.00865)	(0.01257)
	[2.36548]	[3.90268]	[1.58816]	[3.10768]	[2.15642]
LNCPIDIF1	-0.041590	-0.013894	-0.068737	-0.002722	-0.023648
	(0.05047)	(0.04146)	(0.06064)	(0.04557)	(0.06623)
	[-0.82408]	[-0.33514]	[-1.13345]	[-0.05972]	[-0.35705]
LNDEPOSITDIF1	-0.097707	-0.042833	-0.045437	-0.183349	-0.118610
	(0.09260)	(0.07606)	(0.11126)	(0.08361)	(0.12151)
	[-1.05519]	[-0.56312]	[-0.40837]	[-2.19293]	[-0.97610]
LNFXDIF1	-0.797528	-0.576568	-1.012584	-0.505520	-0.604633
	(0.16309)	(0.13397)	(0.19596)	(0.14726)	(0.21402)
	[-4.89024]	[-4.30379]	[-5.16718]	[-3.43291]	[-2.82517]
LNIPDIF2	-0.003388	0.028560	-0.019315	0.003730	0.009827
	(0.03366)	(0.02765)	(0.04045)	(0.03039)	(0.04417)
	[-0.10067]	[1.03292]	[-0.47756]	[0.12274]	[0.22249]
LNUSFRDIF1	-0.004749	-0.014351	-0.003999	0.003178	-0.017191
	(0.03246)	(0.02667)	(0.03901)	(0.02931)	(0.04260)
	[-0.14631]	[-0.53815]	[-0.10251]	[0.10843]	[-0.40355]
LNUSM2DIF1	-1.391800	-2.174880	-0.726193	-2.469482	-1.812170
	(1.52778)	(1.25500)	(1.83579)	(1.37950)	(2.00490)
	[-0.91100]	[-1.73297]	[-0.39558]	[-1.79013]	[-0.90387]
DUMMY1	-0.197087	-0.174068	-0.192423	-0.195584	-0.175747
	(0.05034)	(0.04135)	(0.06049)	(0.04545)	(0.06606)
	[-3.91513]	[-4.20943]	[-3.18115]	[-4.30291]	[-2.66039]
R-squared	0.373673	0.390009	0.357264	0.335730	0.234441
Adj. R-squared	0.294802	0.313195	0.276327	0.252082	0.138038
Sum sq. resids	0.535189	0.361140	0.772736	0.436345	0.921661
S.E. equation	0.062963	0.051721	0.075657	0.056852	0.082626
F-statistic	4.737791	5.077339	4.414100	4.013573	2.431871
Log likelihood	215.5537	245.6454	187.4539	231.1740	173.9716
Akaike AIC	-2.582401	-2.975757	-2.215084	-2.786589	-2.038845
Schwarz SC	-2.225879	-2.619235	-1.858562	-2.430067	-1.682322
Mean dependent	0.004933	0.008325	0.002502	0.007565	0.011838
S.D. dependent	0.074978	0.062410	0.088936	0.065739	0.088997
Determinant resid covariance (dof adj.)		6.45E-16			
Determinant resid covariance		3.45E-16			
Log likelihood		1638.170			
Akaike information criterion		-20.23752			
Schwarz criterion		-18.45491			

Period 2006-2009

Vector Autoregression Estimates

Vector Autoregression Estimates
Date: 12/01/19 Time: 16:08
Sample (adjusted): 2006M04 2009M12
Included observations: 45 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	LNBIST100...	LNXUHIZDIF1	LNXUMALDIF1	LNXUSINDIF1	LNXUTEKDIF1
LNBIST100DIF1(-1)	-1.542005	-0.326941	-2.383773	-0.673962	1.390191
	(2.57651)	(1.90303)	(3.32864)	(2.13513)	(3.24367)
	[-0.59849]	[-0.17180]	[-0.71614]	[-0.31565]	[0.42859]
LNBIST100DIF1(-2)	1.394265	2.899889	1.647110	0.852392	0.611647
	(2.59736)	(1.91842)	(3.35557)	(2.15241)	(3.26991)
	[0.53680]	[1.51160]	[0.49086]	[0.39602]	[0.18705]
LNXUHIZDIF1(-1)	0.062608	-0.325349	0.160645	0.071587	-0.275613
	(0.52952)	(0.39110)	(0.68409)	(0.43881)	(0.66663)
	[0.11824]	[-0.83187]	[0.23483]	[0.16314]	[-0.41344]
LNXUHIZDIF1(-2)	-0.154214	-0.460898	-0.152720	-0.125924	-0.439068
	(0.54463)	(0.40227)	(0.70362)	(0.45133)	(0.68566)
	[-0.28315]	[-1.14575]	[-0.21705]	[-0.27900]	[-0.64036]
LNXUMALDIF1(-1)	0.813355	0.336025	1.252112	0.244917	-0.772727
	(1.47022)	(1.08591)	(1.89940)	(1.21836)	(1.85092)
	[0.55322]	[0.30944]	[0.65921]	[0.20102]	[-0.41748]
LNXUMALDIF1(-2)	-1.199589	-1.591503	-1.485809	-0.881173	-0.937410
	(1.48906)	(1.09983)	(1.92374)	(1.23397)	(1.87463)
	[-0.80560]	[-1.44705]	[-0.77236]	[-0.71410]	[-0.50005]
LNXUSINDIF1(-1)	0.066400	-0.129435	0.306039	-0.183284	-1.664509
	(0.90249)	(0.66658)	(1.16594)	(0.74788)	(1.13618)
	[0.07357]	[-0.19418]	[0.26248]	[-0.24507]	[-1.46501]
LNXUSINDIF1(-2)	0.070187	-1.025972	0.141437	0.346413	1.172225
	(0.87494)	(0.64624)	(1.13035)	(0.72506)	(1.10150)
	[0.08022]	[-1.58761]	[0.12513]	[0.47777]	[1.06421]
LNXUTEKDIF1(-1)	0.374839	0.138841	0.488966	0.340784	0.859790
	(0.34121)	(0.25202)	(0.44081)	(0.28276)	(0.42956)
	[1.09856]	[0.55092]	[1.10924]	[1.20522]	[2.00156]

LNXUTEKDIF1(-2)	0.226852	0.173127	0.244010	0.127638	-0.127167
	(0.27247)	(0.20125)	(0.35201)	(0.22580)	(0.34303)
	[0.83256]	[0.86025]	[0.69318]	[0.56528]	[-0.37072]
C	0.008823	0.033180	0.004307	0.003592	0.018898
	(0.02479)	(0.01831)	(0.03203)	(0.02055)	(0.03121)
	[0.35584]	[1.81183]	[0.13445]	[0.17481]	[0.60542]
LNCPIDIF1	-0.113271	-0.043408	-0.167062	-0.029945	-0.070948
	(0.15173)	(0.11207)	(0.19602)	(0.12574)	(0.19102)
	[-0.74653]	[-0.38733]	[-0.85227]	[-0.23816]	[-0.37142]
LNDEPOSITDIF1	0.269846	0.168934	0.436580	-0.007679	-0.212050
	(0.25230)	(0.18635)	(0.32595)	(0.20908)	(0.31763)
	[1.06954]	[0.90654]	[1.33940]	[-0.03673]	[-0.66760]
LNFXDIF1	-0.750444	-0.293550	-0.855022	-0.717128	-0.709740
	(0.40215)	(0.29703)	(0.51955)	(0.33326)	(0.50628)
	[-1.86607]	[-0.98828]	[-1.64571]	[-2.15186]	[-1.40186]
LNIPDIF2	-0.035309	-0.031043	-0.051813	0.013228	-0.072220
	(0.13230)	(0.09772)	(0.17092)	(0.10964)	(0.16656)
	[-0.26688]	[-0.31768]	[-0.30314]	[0.12066]	[-0.43360]
LNUSFRDIF1	0.060997	0.038306	0.068516	0.094141	0.052051
	(0.10737)	(0.07930)	(0.13871)	(0.08898)	(0.13517)
	[0.56810]	[0.48303]	[0.49394]	[1.05804]	[0.38507]
LNUSM2DIF1	3.593472	0.332918	4.808256	3.582723	-0.845357
	(4.07687)	(3.01120)	(5.26697)	(3.37846)	(5.13251)
	[0.88143]	[0.11056]	[0.91291]	[1.06046]	[-0.16471]
DUMMY1	-0.182388	-0.184925	-0.179876	-0.148100	-0.099363
	(0.08016)	(0.05921)	(0.10356)	(0.06643)	(0.10092)
	[-2.27528]	[-3.12335]	[-1.73691]	[-2.22947]	[-0.98460]
R-squared	0.596057	0.594353	0.542996	0.619687	0.491564
Adj. R-squared	0.341722	0.338945	0.255253	0.380231	0.171437
Sum sq. resids	0.180722	0.098591	0.301634	0.124107	0.286430
S.E. equation	0.081813	0.060428	0.105696	0.067798	0.102998
F-statistic	2.343592	2.327076	1.887085	2.587894	1.535528
Log likelihood	60.29053	73.92514	48.76487	68.74645	49.92854
Akaike AIC	-1.879579	-2.485562	-1.367328	-2.255398	-1.419046
Schwarz SC	-1.156914	-1.762897	-0.644663	-1.532733	-0.696381
Mean dependent	0.004619	0.013124	0.003339	0.003102	-0.001819
S.D. dependent	0.100837	0.074322	0.122477	0.086119	0.113153

Determinant resid covariance (dof adj.)	2.72E-15
Determinant resid covariance	2.11E-16
Log likelihood	492.8351
Akaike information criterion	-17.90378
Schwarz criterion	-14.29046

Period 2010-2018

Vector Autoregression Estimates

Vector Autoregression Estimates
Date: 12/01/19 Time: 16:12
Sample: 2010M01 2018M12
Included observations: 108
Standard errors in ( ) & t-statistics in [ ]

	LNBIST100...	LNXUHIZDIF1	LNXUMALDIF1	LNXUSINDIF1	LNXUTEKDIF1
LNBIST100DIF1(-1)	4.571914	3.633123	4.929496	3.990210	2.743403
	(1.40740)	(1.31116)	(1.59890)	(1.35149)	(1.97978)
	[3.24848]	[2.77092]	[3.08306]	[2.95245]	[1.38571]
LNBIST100DIF1(-2)	1.884516	1.754784	2.336703	0.619879	0.568467
	(1.31466)	(1.22477)	(1.49354)	(1.26244)	(1.84932)
	[1.43346]	[1.43275]	[1.56454]	[0.49102]	[0.30739]
LNXUHIZDIF1(-1)	-1.198834	-1.053356	-1.344977	-0.963947	-0.943005
	(0.33063)	(0.30803)	(0.37562)	(0.31750)	(0.46510)
	[-3.62586]	[-3.41971]	[-3.58067]	[-3.03605]	[-2.02753]
LNXUHIZDIF1(-2)	-0.532315	-0.345220	-0.561934	-0.348902	-0.024896
	(0.31360)	(0.29215)	(0.35627)	(0.30114)	(0.44114)
	[-1.69744]	[-1.18164]	[-1.57728]	[-1.15860]	[-0.05644]
LNXUMALDIF1(-1)	-2.772975	-2.049838	-3.034362	-2.327102	-1.631175
	(0.82182)	(0.76563)	(0.93364)	(0.78918)	(1.15605)
	[-3.37418]	[-2.67733]	[-3.25002]	[-2.94877]	[-1.41099]
LNXUMALDIF1(-2)	-0.966765	-0.937505	-1.207411	-0.242580	-0.467820
	(0.75310)	(0.70161)	(0.85558)	(0.72319)	(1.05939)
	[-1.28371]	[-1.33622]	[-1.41123]	[-0.33543]	[-0.44160]
LNXUSINDIF1(-1)	-0.895029	-0.796693	-0.920802	-0.852270	-0.260008
	(0.40676)	(0.37895)	(0.46211)	(0.39060)	(0.57219)
	[-2.20039]	[-2.10239]	[-1.99262]	[-2.18194]	[-0.45441]
LNXUSINDIF1(-2)	-0.895745	-0.863024	-1.093996	-0.495780	-0.337579
	(0.38917)	(0.36256)	(0.44212)	(0.37371)	(0.54744)
	[-2.30168]	[-2.38037]	[-2.47441]	[-1.32664]	[-0.61665]
LNXUTEKDIF1(-1)	-0.068735	-0.050631	-0.069926	-0.044218	-0.033645
	(0.09441)	(0.08796)	(0.10726)	(0.09066)	(0.13281)
	[-0.72801]	[-0.57563]	[-0.65193]	[-0.48771]	[-0.25333]

LNXUTEKDIF1(-2)	0.251778	0.191218	0.271258	0.234283	0.240203
	(0.08756)	(0.08157)	(0.09947)	(0.08408)	(0.12317)
	[2.87553]	[2.34418]	[2.72696]	[2.78641]	[1.95020]
C	0.031389	0.031679	0.029068	0.035866	0.035220
	(0.01009)	(0.00940)	(0.01146)	(0.00969)	(0.01419)
	[3.11132]	[3.37064]	[2.53624]	[3.70220]	[2.48178]
LNCPIDIF1	-0.011071	-0.003870	-0.024853	0.004544	0.007961
	(0.04911)	(0.04575)	(0.05579)	(0.04716)	(0.06908)
	[-0.22543]	[-0.08458]	[-0.44545]	[0.09634]	[0.11523]
LNDEPOSITDIF1	-0.266413	-0.143669	-0.260354	-0.252407	-0.219790
	(0.10024)	(0.09339)	(0.11388)	(0.09626)	(0.14101)
	[-2.65762]	[-1.53837]	[-2.28612]	[-2.62205]	[-1.55865]
LNFXDIF1	-0.857646	-0.756800	-1.111306	-0.438104	-0.713613
	(0.18637)	(0.17362)	(0.21173)	(0.17896)	(0.26216)
	[-4.60190]	[-4.35884]	[-5.24879]	[-2.44799]	[-2.72203]
LNIPDIF2	0.030860	0.053209	0.016959	0.026499	0.025302
	(0.03175)	(0.02958)	(0.03607)	(0.03049)	(0.04466)
	[0.97200]	[1.79895]	[0.47018]	[0.86917]	[0.56654]
LNUSFRDIF1	0.036364	0.020878	0.051554	-0.002443	0.040650
	(0.04008)	(0.03734)	(0.04553)	(0.03848)	(0.05637)
	[0.90738]	[0.55919]	[1.13233]	[-0.06348]	[0.72106]
LNUSM2DIF1	-3.013893	-2.962190	-2.604016	-3.938467	-2.670489
	(1.60540)	(1.49563)	(1.82384)	(1.54163)	(2.25831)
	[-1.87734]	[-1.98057]	[-1.42776]	[-2.55474]	[-1.18252]
R-squared	0.367504	0.356965	0.387088	0.278939	0.189549
Adj. R-squared	0.256296	0.243904	0.279323	0.152159	0.047052
Sum sq. resids	0.257481	0.223472	0.332317	0.237432	0.509499
S.E. equation	0.053193	0.049555	0.060430	0.051080	0.074826
F-statistic	3.304655	3.157277	3.591969	2.200183	1.330196
Log likelihood	172.8574	180.5070	159.0797	177.2350	136.0034
Akaike AIC	-2.886248	-3.027908	-2.631106	-2.967315	-2.203767
Schwarz SC	-2.464061	-2.605721	-2.208919	-2.545127	-1.781580
Mean dependent	0.005063	0.006325	0.002154	0.009424	0.017528
S.D. dependent	0.061681	0.056991	0.071184	0.055474	0.076651

Determinant resid covariance (dof adj.)	1.49E-16
Determinant resid covariance	6.31E-17
Log likelihood	1248.074
Akaike information criterion	-21.53840
Schwarz criterion	-19.42747

Appendix 5. Model Statistic Test, Eviews (BIST100)

2006-2009

Heteroskedasticity Test: Breusch-Pagan-Godfrey

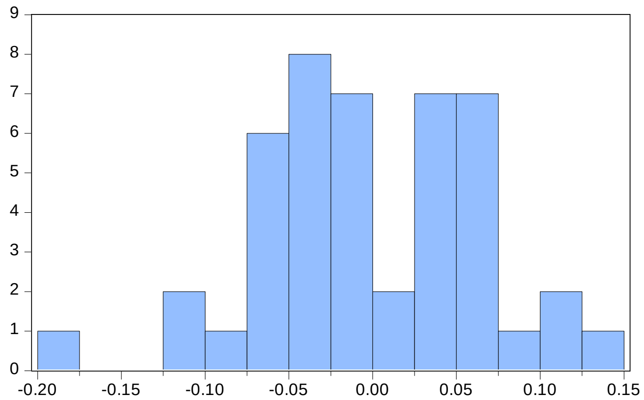
F-statistic	0.991985	Prob. F(17,27)	0.4939
Obs*R-squared	17.30059	Prob. Chi-Square(17)	0.4342
Scaled explained SS	7.077362	Prob. Chi-Square(17)	0.9825

Test Equation:

Breusch-Godfrey Serial Correlation LM Test:

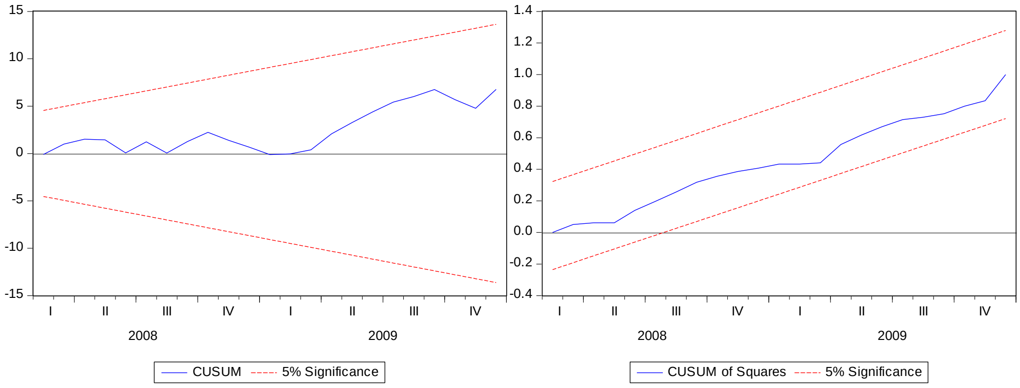
F-statistic	0.676069	Prob. F(2,25)	0.5177
Obs*R-squared	2.308966	Prob. Chi-Square(2)	0.3152

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/06/19 Time: 00:44
Sample: 2006M04 2009M12
Included observations: 45



Series: Residuals
Sample 2006M04 2009M12
Observations 45

Mean	3.70e-18
Median	-0.003847
Maximum	0.132498
Minimum	-0.187486
Std. Dev.	0.064088
Skewness	-0.277295
Kurtosis	3.272678
Jarque-Bera	0.716107
Probability	0.699036



2010-2018

Heteroskedasticity Test: Breusch-Pagan-Godfrey

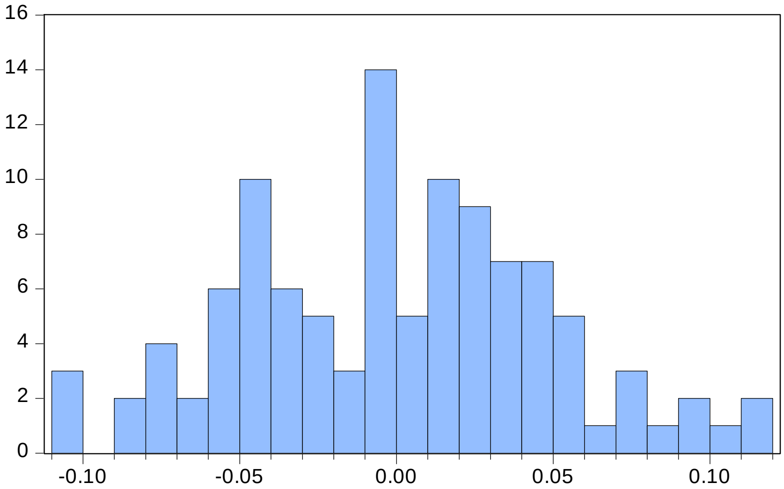
F-statistic	0.951628	Prob. F(16,91)	0.5151
Obs*R-squared	15.48033	Prob. Chi-Square(16)	0.4898
Scaled explained SS	8.900302	Prob. Chi-Square(16)	0.9175

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 12/06/19 Time: 00:55
Sample: 2010M01 2018M12
Included observations: 108

Breusch-Godfrey Serial Correlation LM Test:

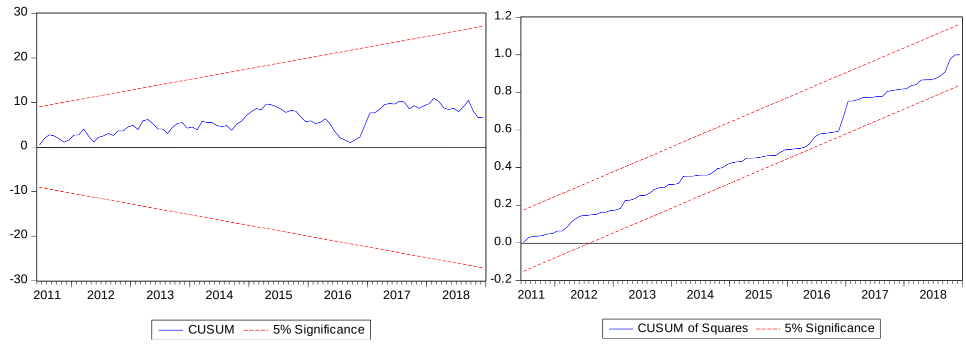
F-statistic	0.664797	Prob. F(2,89)	0.5169
Obs*R-squared	1.589690	Prob. Chi-Square(2)	0.4517

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/06/19 Time: 00:56
Sample: 2010M01 2018M12
Included observations: 108



Series: Residuals
Sample 2010M01 2018M12
Observations 108

Mean	-1.51e-17
Median	-0.002243
Maximum	0.119110
Minimum	-0.108242
Std. Dev.	0.049055
Skewness	0.084441
Kurtosis	2.619643
Jarque-Bera	0.779366
Probability	0.677271

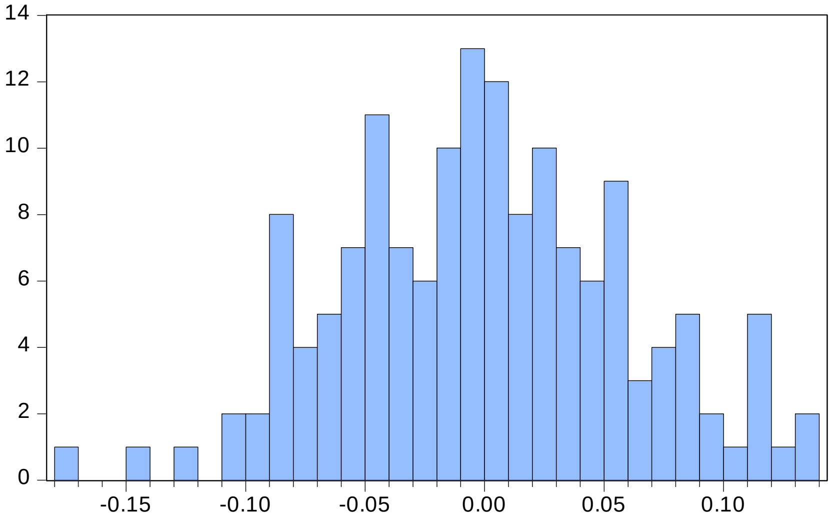


2006-2018

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.421736	Prob. F(2,133)	0.2449
Obs*R-squared	3.202592	Prob. Chi-Square(2)	0.2016

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 12/06/19 Time: 00:52
Sample: 2006M04 2018M12
Included observations: 153



Series: Residuals
Sample 2006M04 2018M12
Observations 153

Mean	9.07e-20
Median	-0.000872
Maximum	0.132844
Minimum	-0.173625
Std. Dev.	0.059338
Skewness	0.028281
Kurtosis	2.837397
Jarque-Bera	0.188948
Probability	0.909851