Analyses of the impacts of U.S. macroeconomic announcements on the stock markets of a selection of countries

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ANALYSES OF THE IMPACTS OF U.S. MACROECONOMIC ANNOUNCEMENTS ON THE STOCK MARKETS OF A SELECTION OF COUNTRIES

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MUZAFFAR ABASOV

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Approval of the Graduate School of Social Sciences

_____

Prof. Dr. Tülin Gençöz
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I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science.

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Prof. Dr. Meltem Dayıoğlu Tayfur
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

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ABSTRACT

ANALYSES OF THE IMPACTS OF U.S. MACROECONOMIC ANNOUNCEMENTS ON THE STOCK MARKETS OF A SELECTION OF COUNTRIES

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This thesis analyses various aspects of the impacts of U.S. macroeconomic indicators (as GDP Growth, CPI and unemployment rates) and their scheduled announcements on the stock markets of U.S. and a selection other countries (U.K., Australia, Japan, China, and Brazil) for 10 years between 2007 and 2016. The study includes analyses related to intraday, daily and monthly return rates, and daily trade volumes of selected stock indices. The analyses show that, U.S. stock market is more likely to affect the stock markets of the selected countries, rather than getting affected by them. Among the selected countries, the stock markets of those with lower external debts and higher international reserves in relative to their GDPs are less sensitive to scheduled U.S. macroeconomic indicators and their annoucements. Trade relations with U.S. also have an important role on the volatilities of the selected stock markets. The sizes of the announcement surprises are more important than their signs . Additionally, the return rate volatilities are more likely to get affected by the surprises than return rates themselves. Also, investors tend to misinterpret the information coming from annoucements. The return rates of the

some individual U.S. companies also show sensitivities to the scheduled U.S. macroeconomic announcements as the aggregate index return rates.

Keywords: macroeconomic announcements, stock markets, intraday return rates

ÖZ

ABD MAKROEKONOMİK AÇIKLAMALARININ SEÇİLMİŞ ÜLKELERİN FİNANSAL PİYASALARI ÜZERİNDEKİ ETKİLERİNİN ANALİZİ

Abasov, Muzaffar
Yüksek Lisans, İktisat Bölümü
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Bu tez, ABD'deki makroekonomik göstergelerin (GSYİH Büyümesi, TÜFE ve işsizlik oranları gibi) ABD'nin ve diğer ülkelerin (İngiltere, Avustralya, Japonya, Çin ve Brezilya) hisse senedi piyasalarına etkilerinin çeşitli yönlerini 2007 ve 2016 yılları arasındaki 10 yıl için analiz etmektedir. Çalışma, gün içi, günlük ve aylık getiri oranları ile seçilmiş hisse senedi endekslerinin günlük işlem hacimlerine ilişkin analizleri içermektedir. Analizler, ABD borsalarının, etkilenen ülkelerden etkilenmekten ziyade, seçilmiş ülkelerin borsalarını etkileme olasılığının daha yüksek olduğunu göstermektedir. Analizler, ABD borsasının seçili ülkelerin borsalarından etkilenmekten ziyade onları etkileme olasılığının daha yüksek olduğunu göstermektedir. Çalışma, seçilmiş ülkeler arasında olan daha düşük dış borçlara ve yüksek uluslararası rezervlere sahip ülkelerin borsalarının ABD'den gelen haberlere daha az duyarlı olduğunu, ayrıca, ABD ile olan ticaret ilişkilerinin de borsaların oynaklığı üzerinde bir etkiye sahip olduğunu ortaya koyuyor. Çalışma aynı zamanda sürpriz bilginin büyüklüğünün onun işaretinden daha önemli olduğu sonucuna varmıştır. Ek olarak, getiri oranı volatilitesinin, getiri oranının kendisiyle

karşılaştırıldığında haberlerden etkilenme olasılığı daha yüksektir. Araştırmanın bir diğer bulgusu, hem rasyonel hem de uyarlanabilir beklentileri olan yatırımcıların piyasada var olmaları ve haberlere benzer şekilde cevap vermeleridir. Ayrıca, yatırımcılar gelen bilgileri yanlış yorumlama eğilimindedir. Bundan başka, münferit ABD şirketlerinin geri dönüş oranları da planlanan ABD makroekonomik bildirimlerinden etkileniyor.

Anahtar Kelimeler: makroiktisadi açıklamalar, hisse senedi piyasaları, güç içi getiri oranları

To My Family

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LIST OF ABBREVIATIONS

GDP	Gross Domestic Product
CPI	Consumer Price Index
S&P 500	Standard & Poor's 500 Index
ASX 200	Australian Securities Exchange Index
FTSE 100	The Financial Times Stock Exchange 100
N225	Nikkei 225 Index
SSE	Shanghai Composite Index
BVSP	BOVESPA Index
IMF WEO	International Monetary Fund World Economic Outlook
OLS	Ordinary Least Squares
ARCH	Autoregressive Conditional Heteroscedasticity
GARCH	Generalized Autoregressive Conditional Heteroscedasticity
EGARCH	Exponential GARCH
VAR	Vector Autoregressive
CAPM	Capital Asset Pricing Model
USD	United States Dollar
FOMC	Federal Open Market Committee
CIVETS	Colombia, Indonesia, Vietnam, Egypt, Turkey, and S. Africa
U.S. BEA	United States Bureau of Economic Analysis
WSJ	Wall Street Journal

U.S. BLS	United States Bureau of Labor Statistics
MI	Macroeconomic Indicator
BIC	Bayesian Information Criterion
LM	Lagrange Multiplier
AC	Autocorrelation
AAPL	Apple Inc.
XOM	Exxon Mobil Corp.

CHAPTER 1

INTRODUCTION

It is a very well-known fact that, people make decisions based on their expectations about future. People form their expectations based on the information they have. As everyone else, investors also make their decisions based on their expectations and they are aware that, economic fundamentals have an impact on the revenues and profits of the companies they invest. That is why, when a new information about macroeconomic indicators come, investors take this as an important piece of information. Their decisions about investments backed by expectations have important impacts on financial markets through determining the size of demand and supply of the financial assets. Scheduled macroeconomic announcements take an important part of the expectation determinants. Investors make predictions about the outcomes of macroeconomic changes and consider this prognosis in their actions. Considering these, it is important to analyse the behaviour of financial markets when macroeconomic indicators are announced.

A large literature on this topic is available and deal with the impacts of various indicators on different stock markets, also, cross-country impacts of economic announcements. A detailed literature review regarding this topic is introduced in Chapter 2.

This thesis analyses various aspects of the impacts of macroeconomic announcements of United States on financial markets for 10 years between 2007 and 2016. The focus of the analyses is the United States. Being the largest economy in the world by nominal GDP (World Bank national accounts data), USA plays an important role in the world economy. Any major macroeconomic change in the US might lead to changes in other economies as well. As main macroeconomic

indicators of United States` economy GDP Growth, Consumer Price Index and Unemployment are taken as important variables that may affect domestic stock markets of the United States and as well as other countries' markets.

Australia, Japan, United Kingdom, China, and Brazil are the countries chosen to be analysed along with the United States. The countries are chosen for the analyses based on several reasons, the most important one being data availability. We tried to choose countries those have well established stock markets such that they would respond to the incoming news. Also, having differences in macroeconomic variables is also important to see how stock markets of the countries with different GDP, debt situation, financial reserves etc. respond to the same news.

In Chapter 3 economic situation in these countries are analysed, their external debt, available financial reserves, and trade balance with the U.S. are represented and compared with each other. These are the variables we assume to be important factors in the level of impacts coming from external economies.

To represent the financial markets of the countries, one stock index from each market is chosen. These are S&P 500 for the U.S., ASX 200 for Australia, FTSE 100 for the UK, Nikkei 225 for Japan, SSE Composite Index for China and BVSP for Brazil. Through the thesis, daily trade volumes, intraday, daily and monthly return rates, and intraday return rate volatilities of these indices are analysed. Relations between these indices and how they affect each other are also among our analyses.

Chapter 4 analyses the co-movements between daily return rates of the stock markets taking selected indices as a proxy. Correlations between indices are computed and Vector Autoregressive model is used to analyse co-movements between daily return rates. Also, we use Pairwise Granger Causality test to see which indices affect S&P 500 return rates and vice versa and find out that S&P 500 is more likely to affect other stock indices.

It is expected that investors will have different opinions about the information content of the macroeconomic announcements and it will create positive volume in the stock markets. To test for this idea in Chapter 5 we use dates of the

macroeconomic announcements as dummy variables and analyse the impacts on daily trade volumes of S&P 500, ASX200, N225 and SSE. We also include the publication dates of IMF World Economic Outlook dates as a dummy variable to see if there is any increase in the trade volumes on these dates but impacts are found to be not statistically significant. Different from current literature, Generalized Autoregressive Conditional Heteroscedasticity (GARCH) and Exponential GARCH (EGARCH) models are used in analyses of daily trade volumes.

Chapter 6 tests for the impacts of the information content of macroeconomic announcements on intraday return rates and return rate volatilities of stock indices of 6 countries. We test for the impacts of surprise parts of the announcements and their squares separately. EGARCH model is used for the analyses in this part of the thesis. For most of this part of the thesis, we assume that people build their expectations rationally and we take expected values for the scheduled macroeconomic announcements from International Monetary Fund World Economic Outlook and Wall Street Journal Economic Forecasts database. Then, we find the difference between official announcement and previously expected value to calculate "surprise". Additionally, we repeat the analyses for S&P 500 this time assuming investors think that the next official value of the macroeconomic indicator will be the same as the most recent officially announced value. Then, we compare the results with previous analyses of S&P 500 return rates and return rate volatility and come to a result that there might be both type of investors in the economy. There are examples of literature analysing the impacts assuming rational or adaptive expectations. But to our best knowledge, it is the first thesis among the research works testing impacts of macroeconomic announcements on stock markets to analyse both forms of expectations at the same time and compare results.

Both in Chapter 5 and Chapter 6, the results show that financial markets of the countries with lower external debt and higher financial reserves tend to be affected less by news coming from the US. To test for this claim, in Chapter 7, the impacts of these variables on the average monthly variances of stock indices are analysed along with trade relations with the US. It appears that countries with higher international reserves have a less volatile stock market. Trade relations with the US

also has significant impacts on stock market volatility. To our best knowledge, none of the available research works makes these analyses.

An additional question we raise is that, are the results achieved in previous chapters true in the long run? Do investors evaluate the incoming information correctly? To answer this question, In Chapter 8, we test the impacts of the selected macroeconomic indicators on monthly return rates of the analysed indices. We hypothesise that, if the indicators have significant statistical impacts on monthly return rates like the impacts on intraday 5-minute return rates, then investors of that market are good at evaluating incoming information. According to our best knowledge, none of the available literature analyzing same countries makes analyses on a comparison of short and long-term effects.

Along with stock indices, in Chapter 9, we test the impacts of the same macroeconomic indicators on two of the largest companies of United States, Apple Inc., and Exxon Mobil Corp. In this part of the thesis, we merge the Capital Asset Pricing Model (CAPM) with GARCH and EGARCH models. CAPM is used as the mean equation and GARCH/EGARCH as the variance eqation. This is not a widely used method in the literature and there are only a few examples using these two models together in any form. Results show that seperate companies also get affected by macroeconomic announcements.

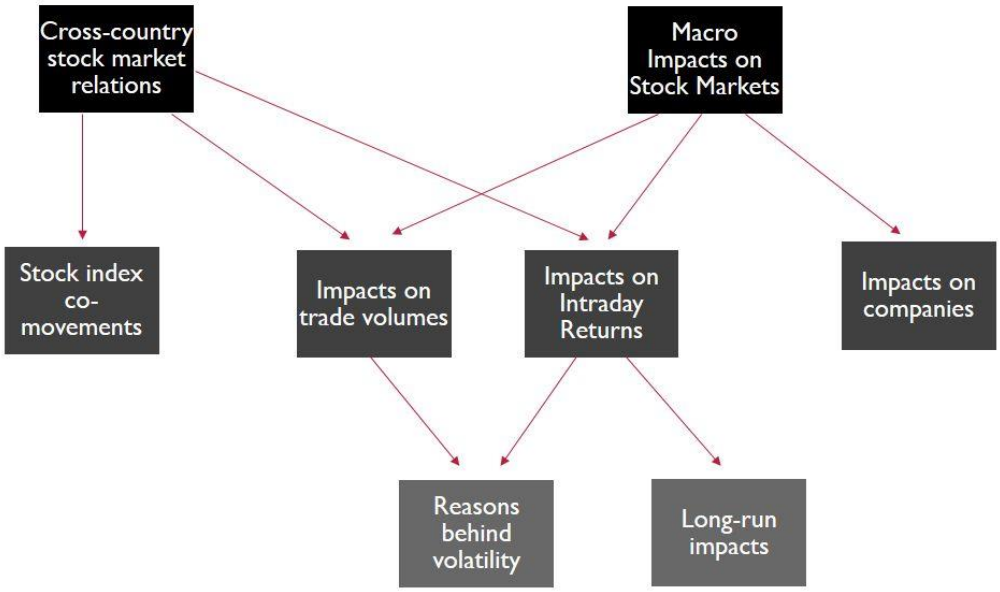


Figure 1.1. Areas of the analyses and relation between them

In Figure 1.1., topics of all chapters of the thesis are represented including their relations with each other.

Data sources, models, and methods used in the analyses and any other relevant information are available in each Chapter separately.

This thesis has several important findings and contributions to the current literature. Co-movement analyses show that S&P 500 has more impact on other selected stock indices than they have on S&P 500. We find from daily trade volume analyses that stock markets of selected economies have lower trade volumes during US Macro announcement days which can be due to a similar interpretation of news by most investors and it needs a further research to identify the reasons behind. Another important finding of this research is that intraday return rate volatilities get affected by incoming news more than return rates and this finding is supported by current literature. From the analyses, we also find that size of the surprise is more important than its sign. Analyses regarding the comparison of adaptive and rational expectation formulations which is new to the literature show that both forms of expectations exist in the market and they lead to similar results. Additionally, this thesis finds out that, countries with higher reserves and lower debt get affected less

by US macroeconomic news. Further analyses based on this idea show that higher reserves and trade balance with the US lead to less volatile market, while higher trade with the US leads to more volatile market. Analyzing the impacts of macroeconomic variables on monthly return rates and comparing them to intraday impacts, we find out that investors tend to misinterpret news.

CHAPTER 2

LITERATURE REVIEW

2.1. Overview of the literature

This part of the study will give an insight to the previous literature on the research topic of this thesis and identify gaps and potential improvement areas.

Studies related to macroeconomic news impacts on financial and money markets are relatively new. Generally, literature in this specific area of research consists of empirical studies. However, some studies take the topic from the theoretical perspective and build models on how investors and markets respond to the macroeconomic news. A study by Kim and Verrecchia (1991) analyse the price and trade volume reactions to public news releases and relation between them. The characteristics of the announcement and the announcement time is also taken into consideration and links to the price and trade volume reactions are investigated theoretically. Authors suggest a pure exchange market model with a continuum of traders and three periods. According to the model, trading occurs during the 1st and 2nd period while consumption occurs in the 3rd period. The study proposes that investors reach their optimal portfolios before the news release according to their pre-announcement knowledge. Announced news affects the investor's thoughts and the enter to a new round of trading. As traders have different expectations about the announcement, they react differently to the announcement and it increases the trading volume.

The study suggests that price reaction to a public announcement can be represented as follows:

$$P_2 - P_1 = \frac{n}{K_2}(Surprise + Noise)$$

In the equation above, $P_2 - P_1$ is the price change after the announcement, *n* is the precision of the information, K_2 is the precision of other available information prior to the announcement, thus, $\frac{n}{K_2}$ represents the importance of the incoming information.

The study proposes that the volume reaction to a public announcement is dependent both on the absolute price change and the precision of individual traders:

$$Volume = \left(\frac{1}{2}\int r_i|s_i - s|di\right)|P_2 - P_1|$$

In the equation above, $\int r_i|s_i - s|di$ is a measure of differential precision across traders. s_i is the individual precision of investors, while s represents the average precision of all investors. r_i on the other hand, shows the risk tolerance of individuals.

The study comes up with three important results. First, price move at announcement time is proportional to unexpected part and previously expected part of the announcement. Second, and the most important, the volume is proportional to price change. Third, the expected variance of absolute price change and trade volume are decreasing functions of the quantity of available information before the announcement and increasing functions of the accuracy of the release.

As mentioned before, most of the studies in this specific area are dealing with the empirical analysis of the macroeconomic news impacts on financial markets. Some of the empirical studies analyse domestic news impacts on local stock and money markets while some analyse the impacts of macroeconomic news announcements of major economies on foreign stock exchange and money markets. Most of the studies under the latter category also include the analyses of the impacts on local markets. Besides these, there are also some studies investigating co-movements or correlations between two or more stock markets.

2.2. The literature about domestic news impacts on local markets

In this category investigation of impacts of United States Macroeconomic news announcements on U.S. stock, money and foreign exchange markets are the most common topic.

Relatively older studies in this area mainly focus on the impacts of macroeconomic variables on the stock markets rather than news announcements. A paper by Chen, Roll and Ross (1986) tests for the effects of macroeconomic variables on stock markets. Authors take several macroeconomic indicators as possible factors to affect stock markets return rates. Long and short interest rate spread, industrial production, the difference between low and high-grade bond rates, expected and unexpected inflation are considered to have an impact. The study concludes that these variables which are possible sources of risk have significant impacts on the markets. Another finding of the investigation is that oil price risk does not have an impact as a separate source of risk.

Kim, McKenzie, Faff (2004) study the effect of scheduled government announcements of six different macroeconomic indicators on three major United States financial markets. The study investigates the impacts on risk and return rate of the markets. The stock market is represented by Dow John's Industrial Average, while JPY/USD and DEM/USD are proxies for the forex market. Return rates for the three markets are modelled as a GARCH process. The result of the analyses suggests that any of these markets are not affected by the release of the news, instead, they react to the information content of the announcement. The study concludes that bond market reacts mostly to the trade balance, while forex market is mostly affected by the internal economic news. Consumer and producer prices, on the other hand, are found to be significantly affecting the stock market.

Birz and Lott (2008) use newspaper headlines as an interpretation of macroeconomic analyses. This study suggests that economic news can be understood and interpreted differently based on the perspective of the analyser. To eliminate this, news headlines are a good way to interpret the news content. The

study uses News Confidence Index to identify the net impacts of economic news on stock return rates. Results of the analyses show that GDP and unemployment rate have an impact on stock return rates. Also, study finds out that stock market's response to the news concerning GDP is higher when the top ten newspapers are used as the source of interpretation.

Another study about U.S. news announcement impacts on U.S. bond market by Balduzzi, Elton, and Green (2001) investigates the effect of news on prices, volatility and bid-ask spread using intraday bond market data. The investigation founds out that, surprise news releases are effecting at least one of the bond market intruments significantly. Based on the maturity of the instrument, the impacts vary. An important portion of the price volatility can be explained by the news right after the public announcement and prices generally adjust to the news within a minute. Both return rate volatility and trading volume face a significant increase after the economic announcements, while bid-ask spreads only widen after the announcements for 5 to 15 minutes and the go back to its initial level.

Brenner, Pasquariello, and Subrahmanyam (2009) study short-term expectations and reactions of United States Treasury, corporate bond and stock markets to the announcement of macroeconomic variables. The paper focuses on the comovement and volatility reactions of these three markets to the news. The model used in the research is GARCH-DCC model of Engle (2002). The sudy finds out that, both relations between these markets and the way prices are formulated depends on the macroeconomic fundamentals. Analyses also reveal that there is a significant division between the response of the bond and stock markets to the unexpected news.

A working paper by Goldberg and Grisse (2013) investigate the time variation in the reaction of exchange rates and yield curves to the macroeconomic news. The data range used in the analyses are between 2000 and 2011. Results of the study indicate that time variantion of news imacts is significant for the announcements with greatests impacts on asset prices. These variations can be explained by

economic conditions. Policy rate during the announcement time and risks related to government bonds are some of these conditions.

2.3. The literature about the United States and European Union impacts on foreign markets

Studies related to macroeconomic news impacts on stock markets of emerging economies have recently become popular. A research by Nowak et al. (2011) is an example of the studies of this type. The paper studies the volatility dynamics in bond markets of Brazil, Mexico, Russia, and Turkey, and investigate how the prices and volatility react to both local and external macroeconomic news. The United States and Germany are used as external news sources. The study considers standardized surprise of macroeconomic indicators as a determinant of price and volatility reactions. The standardized surprise is calculated as follows:

$$S_{kt} = \frac{Actual_{kt} - Expectation_{kt}}{\widehat{\sigma_k}}$$

Where S_{kt} is the standardized surprise related to the macroeconomic indicator k at time t. $Actual_{kt}$ and $Expectation_{kt}$ are the officially announced and the previously expected values of an economic indicator respectively. $\widehat{\sigma_k}$ represents the standard deviation of all surprises.

Results of the study by Nowak et al. (2011) suggest that the return rates and return rate volatilities of bonds in emerging markets are affected by external surprises about macroeconomic indicators just like in mature bond markets. Additionally, the impacts of surprises are found to be more significant on volatility rather than prices.

A study by Nikkinen and Sahlström (2001) analyse the effect of United States macroeconomic news releases on local and Finnish stock markets. The investigation analyses the implied volatilities of both markets during the announcement dates of

U.S Producer Price Index, Consumer Price Index and employment reports. Based on the analyses, the study concludes that the implied volatility of stock markets goes up before the macroeconomic news announcements and goes down after the release. This hypothesis is confirmed for both United States and Finnish markets. Authors conclude that uncertainty about the release of U.S. macroeconomic indicators is also reflected in external markets along with the local market. Another finding of the study is that employment report has the most significant impacts on uncertainty which is in line with other researches on this topic.

Nikkinen and Sahlström (2004) also investigate the impacts of news announcements on stock markets from the investor perspective. The study analyses the behaviour of investors in European stock markets to see whether they take the scheduled announcements of the United States and local macroeconomic indicators as an important piece of information when valuating equities. Finland and Germany's stock markets have been taken as representatives in this research. The study analyses implied volatilities of stock markets of Germany and Finland to identify the importance of local and U.S. economic announcements. The findings of the investigation suggest that Federal Open Market Committee (FOMC) meeting days and U.S. employment report effects both German and Finnish stock markets. However, domestic announcements of macroeconomic indicators seem to be unimportant to investors. Investors take U.S. macroeconomic announcements as an important source for stock valuations rather than local market announcements.

Another study by Nikkinen et al. (2006) in related research area analyses how global stock markets react to scheduled United States macroeconomic news announcements. Data for 35 countries in six different regions of the world is taken for investigation. For identifying the impacts, the study analyses the behaviour of GARCH volatilities of 35 different stock markets. Ten major macroeconomic news announcements are used for the analyses. Stock market indices are used as representatives of stock markets. The time interval for the analyses is from July 1995 to March 2002. The cross-sectional regression model is used to analyse how volatilities in stock markets of different regions respond to the macroeconomic news. GARCH volatilities are separately estimated for each of the investigated

regions. The study identifies different reactions to news announcements in different regions of the world and suggests possible reasons for this difference. Authors propose that international trade size and dependence on trade, market size, foreign ownership in the country and economic structures can be probable reasons for the difference. However, these possible reasons are not investigated in the paper.

Research by Andersen et al. (2007) investigates how stock, bond and foreign exchange markets of Great Britain, Germany and United States react to the real-time macroeconomic news announcements of United States. To run analyses authors, use a high-frequency dataset. The study finds that news announcements result in immediate changes in conditional mean and it shows that, variables related to stock, bond and foreign exchange markets have links to fundamentals. The business cycle is found to have an impact on how the equity markets react to the news, as a result, average stock and bond return rates have low correlation on average. The investigation also concludes that the bond market is the most responsive market among these three and this finding coincides with previous research. Along with this, stock and forex markets seem to be equally responsive.

Another study investigating news impacts on stock markets is by Hanousek and Kocenda (2011) which focuses on three emerging European Union countries – Czech Republic, Hungary and Poland. The paper investigates stock market co-movements and news impacts between countries, also external news impacts on these markets. Intraday data with five-minute frequency is used for stock market return rates which are represented by index return rates is used in the research and European Union and United States macroeconomic news announcements for the 2004-2007 period is taken as a source of impacts on stock markets. The study takes into consideration the difference of each announcement from its initial expectation and analyses impacts of these announcements both on intraday and daily data. Results of the investigation show that intraday changes in stock market indices are significantly affected by stock markets of European Union and the United States and the news announcements related to them.

A newly completed research by Wallenius, Fedorova1, and Collan (2017) try to find the impacts of European Macroeconomic news announcements about eight indicators on CIVETS markets which are Colombia, Indonesia, Vietnam, Egypt, Turkey, and South Africa. The integration level of these markets into the world is also an object of analyses. The data used in the research belongs to the 2007-2012 period and the EGARCH method is employed for analyses. The research claim that, if a market responds to international news surprises, it is an integrated market. The results of the analyses show that there are linkages between CIVETS and European Union markets and news surprises have an impact on stock market volatilities and in some cases on stock return rates.

2.4. The literature on co-movements of stock markets

Linkages between the United States and United Kingdom stock markets are investigated by Becker, Finnerty, and Friedman (1995) to see how intraday price movements of future contracts in this two markets are related to each other. The research finds that, during the first half hour after news announcements in the United States, the reaction of United Kingdom stock prices reacts to these announcements significantly and like the reaction of United States stock prices. This once again supports the hypothesis that traders in foreign stock markets respond to the public information released in the United States.

A study by Connolly and Wang (2001) the co-movements of return rates in international equity markets. United States, United Kingdom, and Japan are used as representative markets to analyse the co-movements. The investigation focuses on the distinction between contagion and economic fundamentals. Conditional mean and conditional volatility models are used in the study. Outcomes of the research show that intraday and overnight return rates of the equity markets cannot be grounded on economic fundamentals. Instead, external stock market return rates affect domestic market return rates significantly. The study also suggests that, instead of publicly available information, future research about stock market co-

movements can be done to analyse the distinction between private information of traders and contagion.

Korkmaz, Çevik, and Atukeren (2012) analyse volatility and return rate spillovers between stock markets of Colombia, Indonesia, Vietnam, Egypt, Turkey, and South Africa (CIVETS). The research employs causality-in-variance and causality-in-mean test to analyse these spillovers. GARCH model is used for causality tests. For causality-in-mean tests, the standardized residuals are derived from the respective GARCH models. Empirical findings from the analyses suggest that simultaneous spillover effects are low most of the time. However, these markets may sometimes experience a high level of co-movements.

CHAPTER 3

COUNTRIES

This chapter is dedicated to the representation of macroeconomic data of the analysed countries and their comparison. For the United States, data related to its CPI rate, quarterly GDP growth, and the unemployment rate is represented, while data for other countries include their external debts, international reserves and trade relations with the US.

3.1. Country analyses

USA is the largest economy in the world by nominal GDP and the main analyses object of this thesis.

Figure 3.1., Figure 3.2. and Figure 3.3. represent monthly CPI, quarterly GDP Growth, and monthly unemployment rates respectively. These are the rates used to determine whether announcement dates and contents of U.S. macroeconomic indicators effect stock markets of the U.S. and other economies or not.

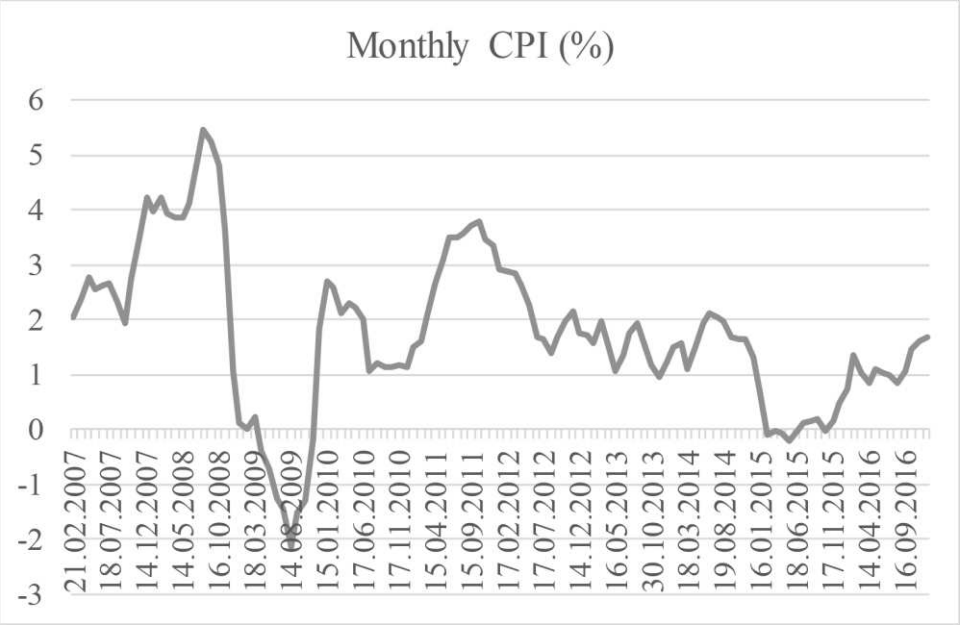


Figure 3.1. Monthly CPI rate of US. Source: U.S. Bureau of Labor Statistics

CPI rate has been higher and more volatile before 2010 and became a bit lower and less volatile during last few years.

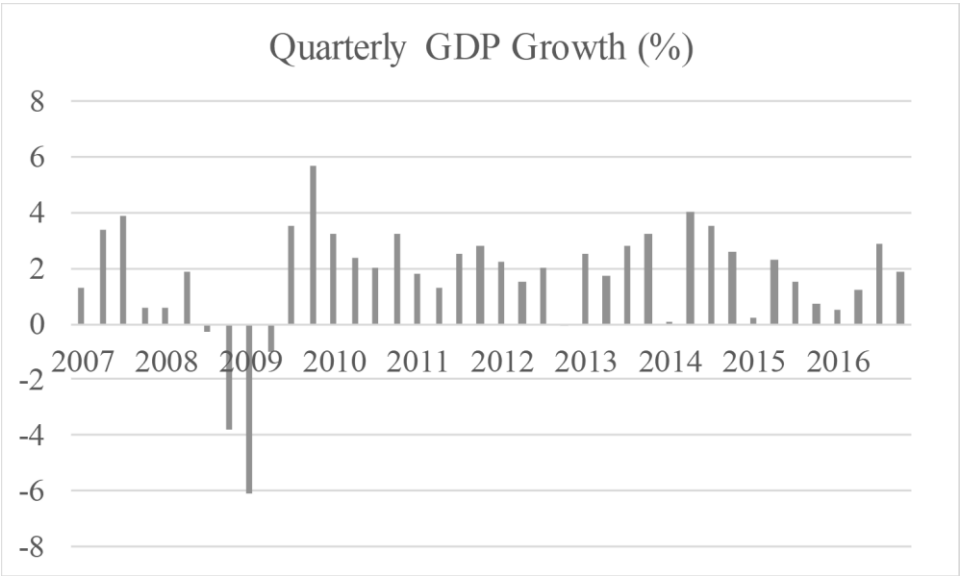


Figure 3.2. Quarterly GDP Growth Rates of US. Source: U.S. Bureau of Economic Analyses

Quarterly GDP Growth has mostly been positive except for four terms during 2009 and it is due to the financial crisis.

Figure 3.3. Monthly Unemployment rates for the US. Source: U.S. Bureau of Labor Statistics

Unemployment rate of the U.S. was continuously increasing untill 2010, but starting from then it has a decreasing trend.

Australia is one of the top 20 countries by nominal GDP. According to the data represented in Figure 3.4., Australia has had a negative trade balance with the US every year between 2007-2016.

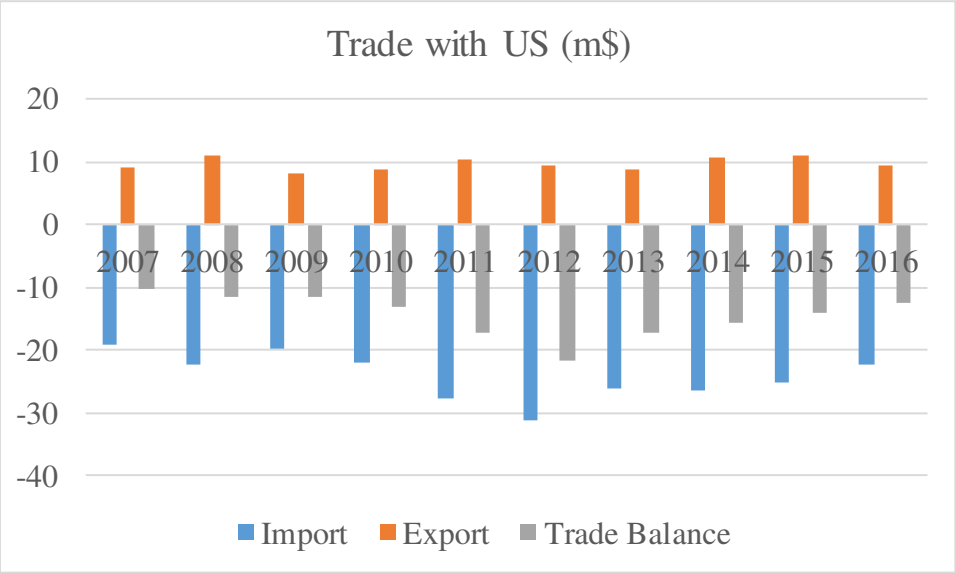


Figure 3.4. Import, Export and Trade Balance of Australia with the US. Source: World Bank

Figure 3.5. shows that, Australia has very little reserves when compared to its external debt.

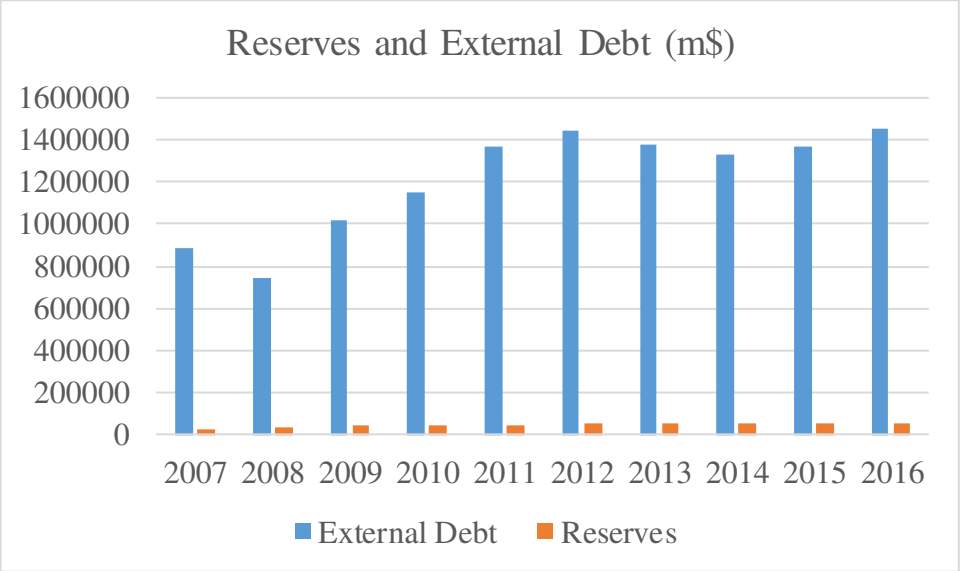


Figure 3.5. External Debt and Total Reserves of Australia. Source: World Bank, Australian Bureau of Statistics

Japan is the third largest economy in the world by nominal GDP and its stock market is represented by N225 in this thesis.

Japan has successful trade relations with the US with very high positive trade balance, as it can be seen from Figure 3.6.

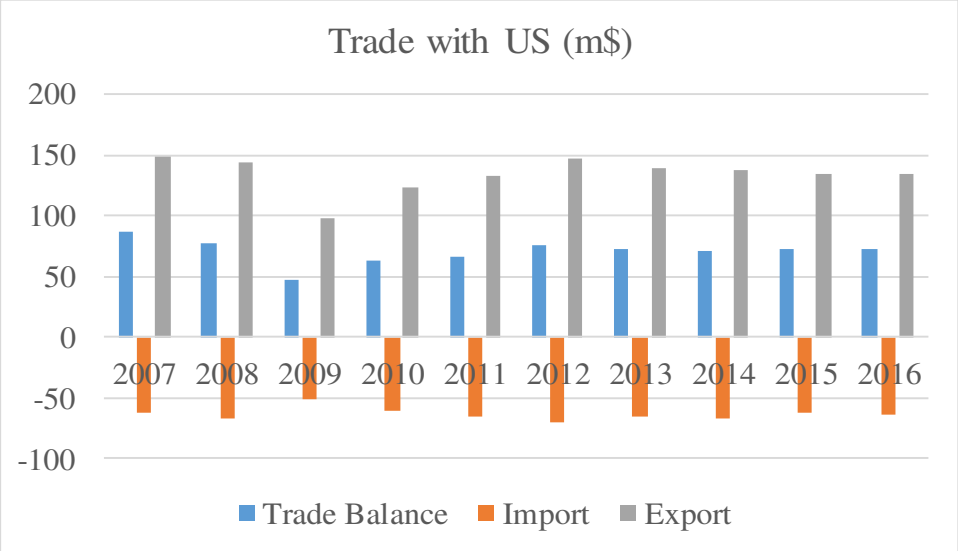


Figure 3.6. Import, Export and Trade Balance of Japan with the US. Source: World Bank

External debt of Japan is quite high when compared to its available reserves. But its situation is not as critical as Australia or U.K. Figure 3.7. shows related data.

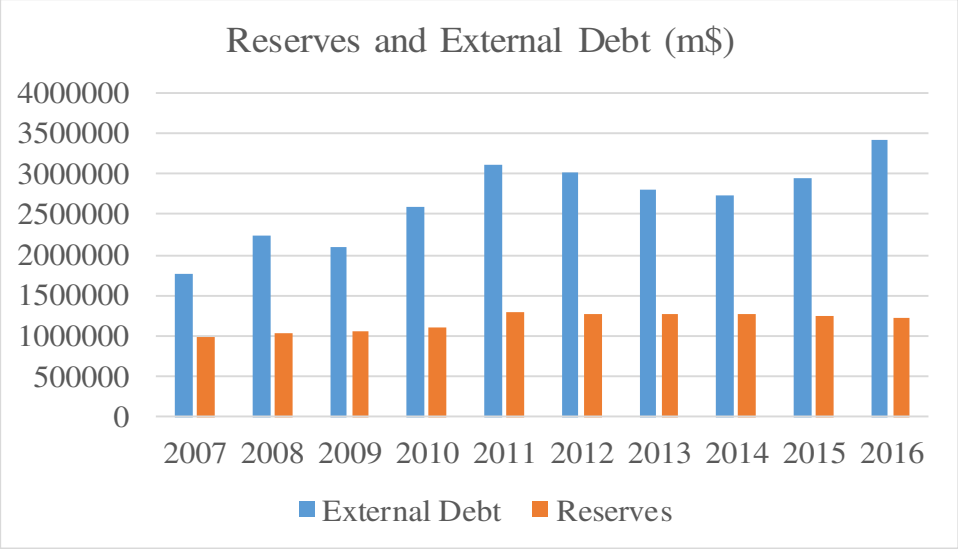


Figure 3.7. External Debt and Total Reserves of Japan. Source: World Bank

The UK is one of the top 10 economies of the world. FTSE 100 index represents the stock market of the country.

Figure 3.8. shows that, imports of UK from US and exports to the US are very close. Trade Balance has been very small during the 10 years between 2007-2016 and positive most of the time.

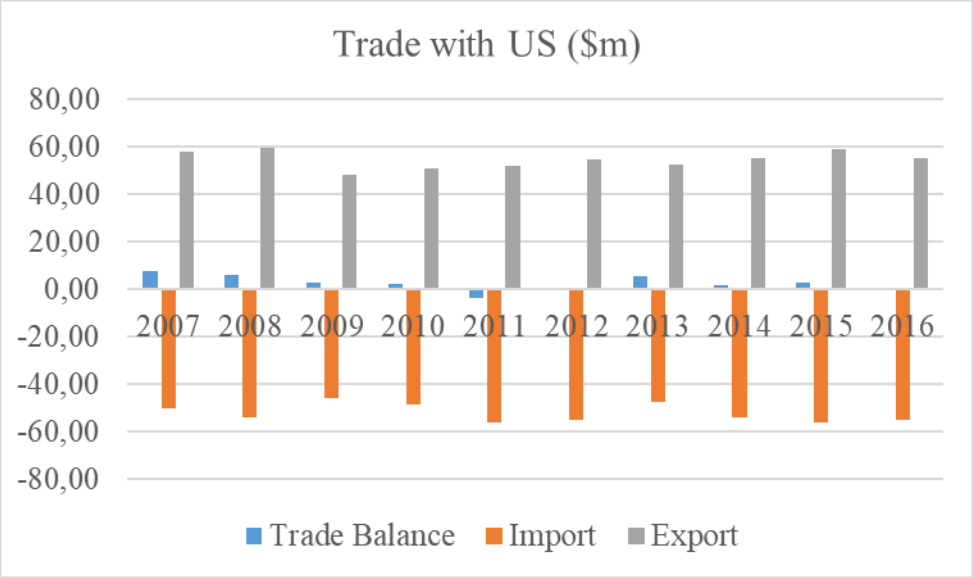


Figure 3.8. Import, Export and Trade Balance of UK with the US. Source: World Bank

Figure 3.9. shows that, UK's situation with its external debts is not good at all. Reserves are very little in comarison with its reserves.

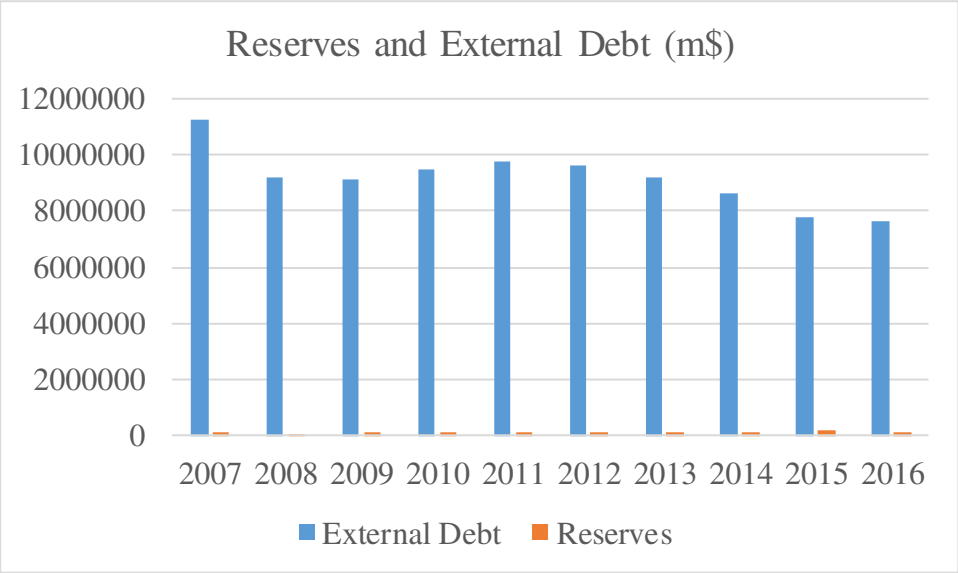


Figure 3.9. External Debt and Total Reserves of UK. Source: World Bank, UK Office for National Statistics

By nominal GDP, China is the second largest economy in the world following the USA. But, it is still not considered as a developed country because of its low GDP per capita and Human Development Index. Shanghai Composite Index (SSE) is the proxy for Chinese stock market.

Figure 3.10. shows that China is also very successful with its trade relations with the US. The trade balance is quite high and positive.

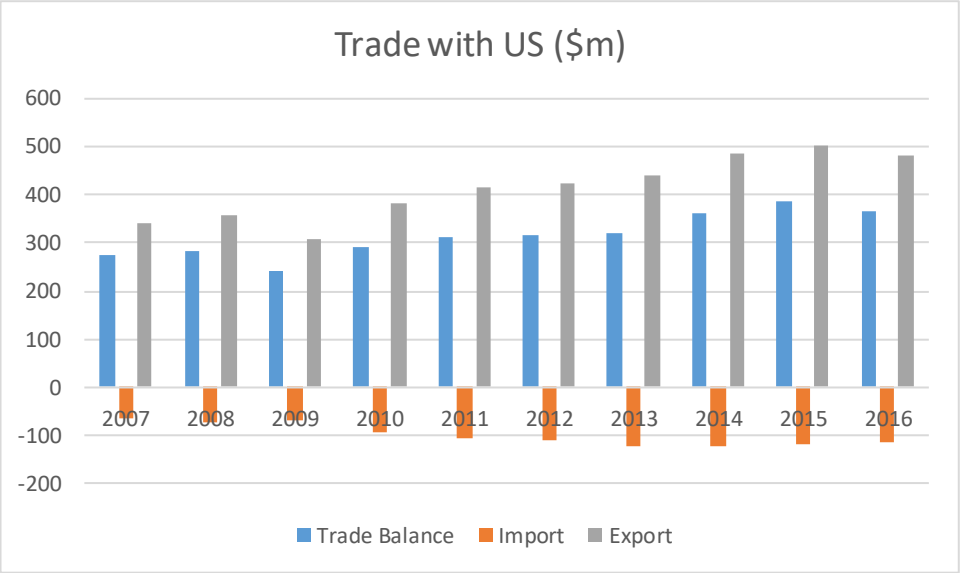


Figure 3.10. Import, Export and Trade Balance of China with the US. Source: World Bank

Based on the data represented in Figure 3.11. we can say that China's situation with its external debt and reserves is quite impressive. External debts are very small in comparison with its total reserves.

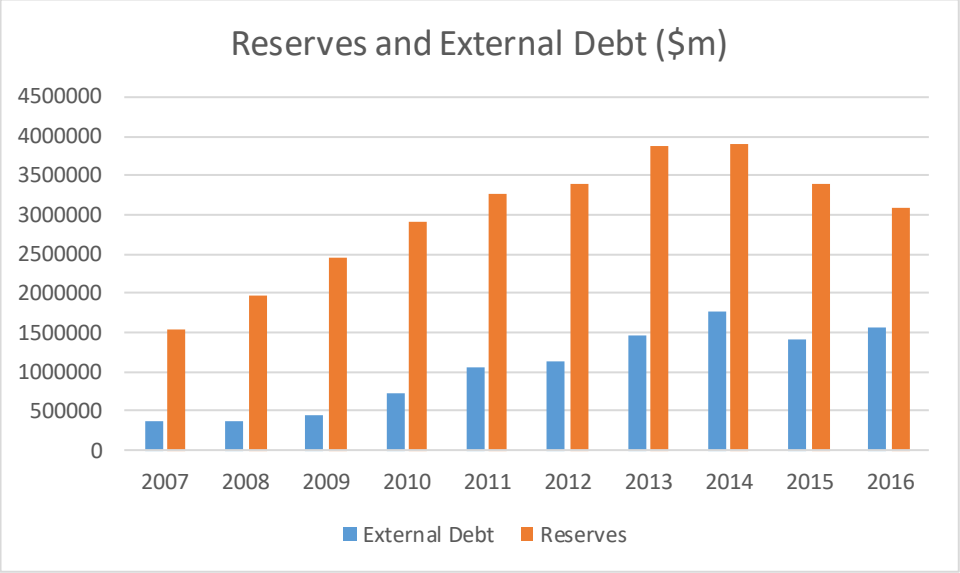


Figure 3.11. External Debt and Total Reserves of China. Source: World Bank

Brazil is one of the top 10 economies of the world by nominal GDP. It is represented by BVSP index in our analyses.

Brazil has had a negative trade balance with the U.S. during 9 of the 10 years between 2007-2016. Related data can be found in Figure 3.12.

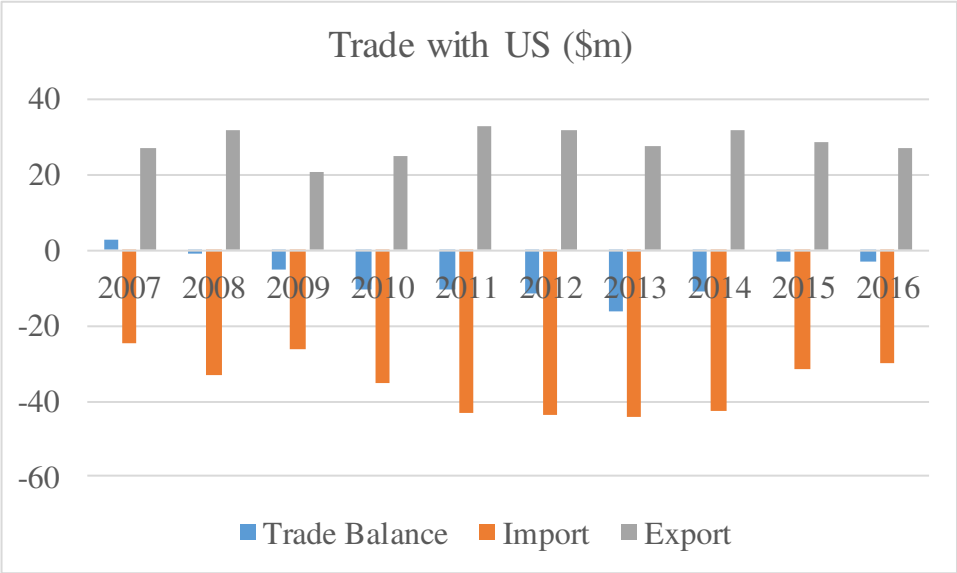


Figure 3.12. Import, Export and Trade Balance of Brazil with the US. Source: World Bank

External Debts of Brazil has been higher than its reserves, but the difference is not huge as it can be seen from the Figure 3.13. The situation of Brazil in this regard is better than U.K., Australia and even Japan.

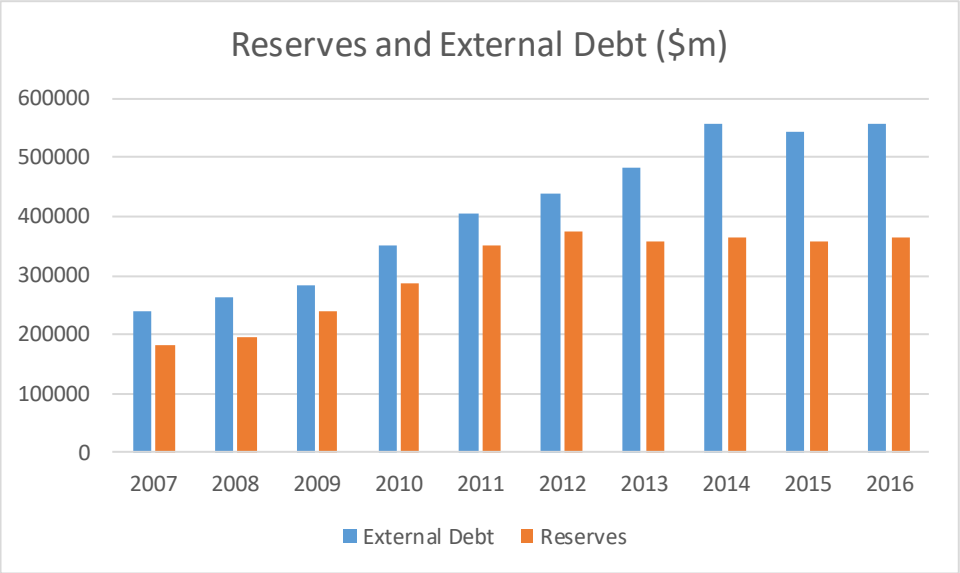


Figure 3.13. External Debt and Total Reserves of Brazil. Source: World Bank

3.2. Country comparisons

Only data for 2016 is used for comparison of the economies. Below figures represent data related to all countries.

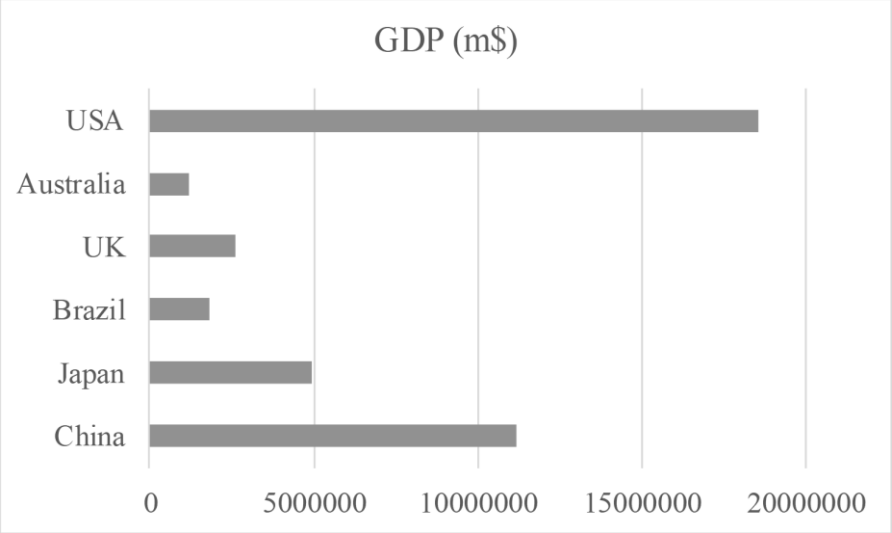


Figure 3.14. GDP of the analysed countries. Source: World Bank

China is the largest economy by nominal GDP among analysed countries except the US, while Australia is the smallest. Figure 3.14. shows GDP data.

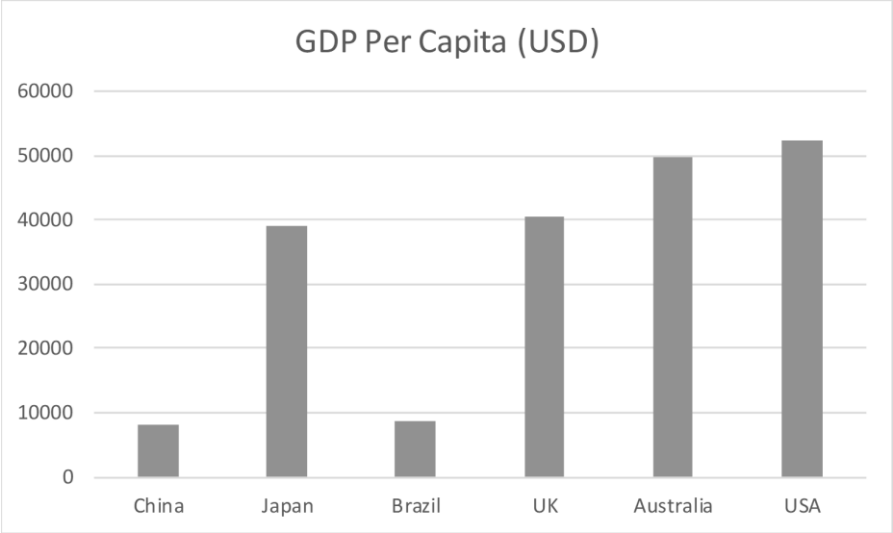


Figure 3.15. GDP Per Capita of the analysed countries. Source: World Bank

As can be seen in Figure 3.15. China and Brazil have lower GDP Per Capita than other countries and this indicator alone lets us consider them as developing economies rather than developed.

If we look at the Trade Balance with the US to GDP, China and Japan have very high positive trade balance with the US to GDP ratio, while Brazil and Australia have a trade deficit. UK's trade balance with the U.S. is close to zero.

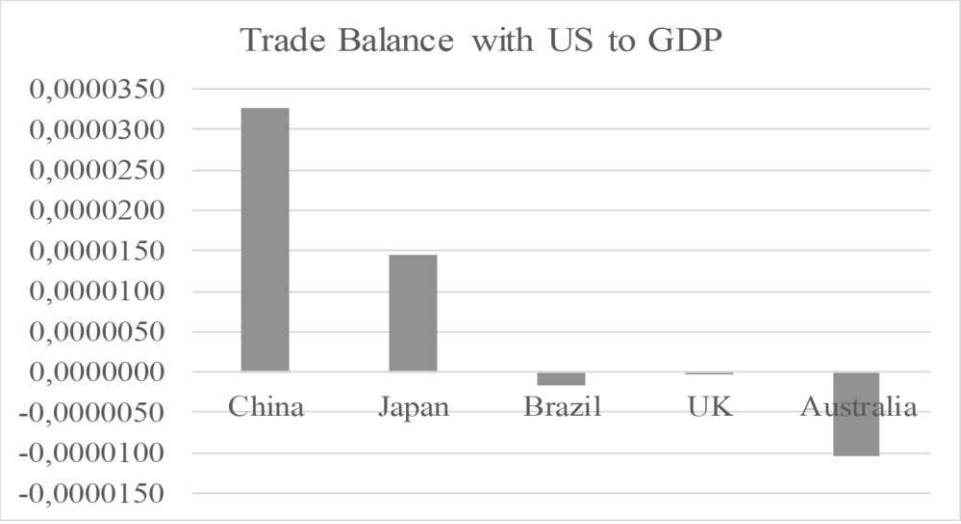


Figure 3.16. Trade Balance with the US to GDP ratio of analysed countries.

Source: World Bank

External Debt to GDP figures show that, United Kingdom has the worst external debt to GDP ratio while China's position is quite immersive.

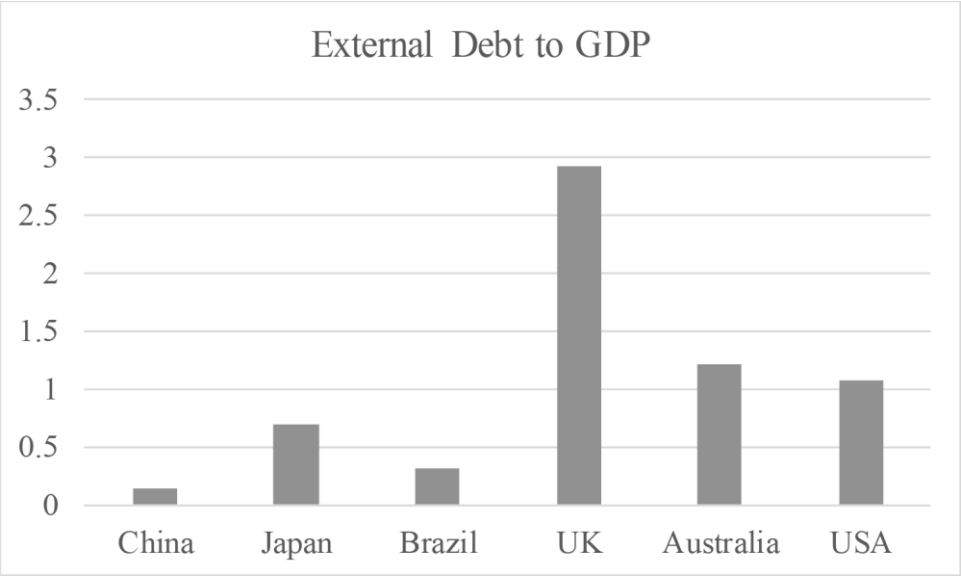


Figure 3.17. External Debt to GDP ratio of analysed countries. Source: World Bank, Australian Bureau of Statistics, U.K. Office for National Statistics

In terms of external Debt to Reserves, the situation is very similar to external debt to GDP ratio. The US, UK, and Australia have serious problems with their debt to reserves ratio while other economies' ratios are very low.

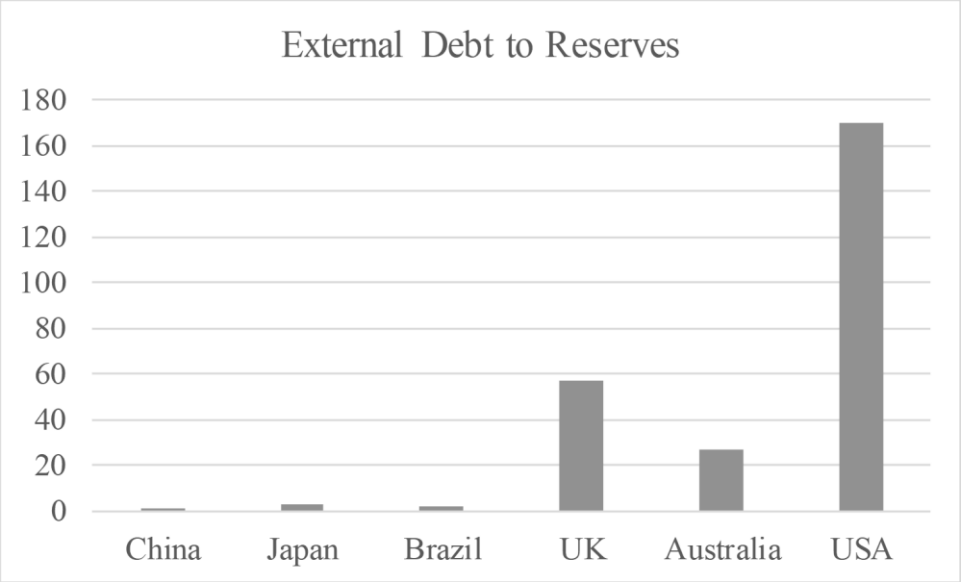


Figure 3.18. External Debt to Reserves ratios of analysed countries. Source: World Bank, Australian Bureau of Statistics, U.K. Office for National Statistics

CHAPTER 4

COMOVEMENTS OF THE STOCK RETURN RATES

This chapter is dedicated to the analyses of the co-movements between daily return rates of stock indices. Correlation matrix, VAR model, and Pair-wise Granger Causality tests are employed to understand the relations between analysed indices.

4.1. Data review for co-movement analyses

4.1.1. General information and data sources

Daily return rates for 6 stock market indices from 6 countries' stock markets have been calculated and used in the analyses of co-movements between stock markets.

Data covers from 01.01.2007 to 01.01.2017. The list of indices and stock markets they are traded in is shown in Table 4.1.

Table 4.1. Stock indices and markets used in co-movement analyses

Index	Country	Market
SP500	USA	NYSE
ASX200	Australia	ASE
N225	Japan	TSE
FTSE100	UK	LSE
SSE	China	SSE
BVSP	Brazil	B3

Return rates calculated with the close prices of each day using following formula:

$$r_t = \ln(\frac{P_t}{P_{t-1}}) \qquad (4.1)$$

Where r_t is return rate for any day. P_t represents the price of the stock index for the end of the day and P_{t-1} shows the price for the end of the previous day.

Sources for the daily price data of each stock index is shown in Table 4.2. below.

Table 4.2. Data sources of daily index prices

Index	Source
SP500	Yahoo!
ASX200	Investing.com
N225	Yahoo!
FTSE100	Investing.com
SSE	Yahoo!
BVSP	Yahoo!

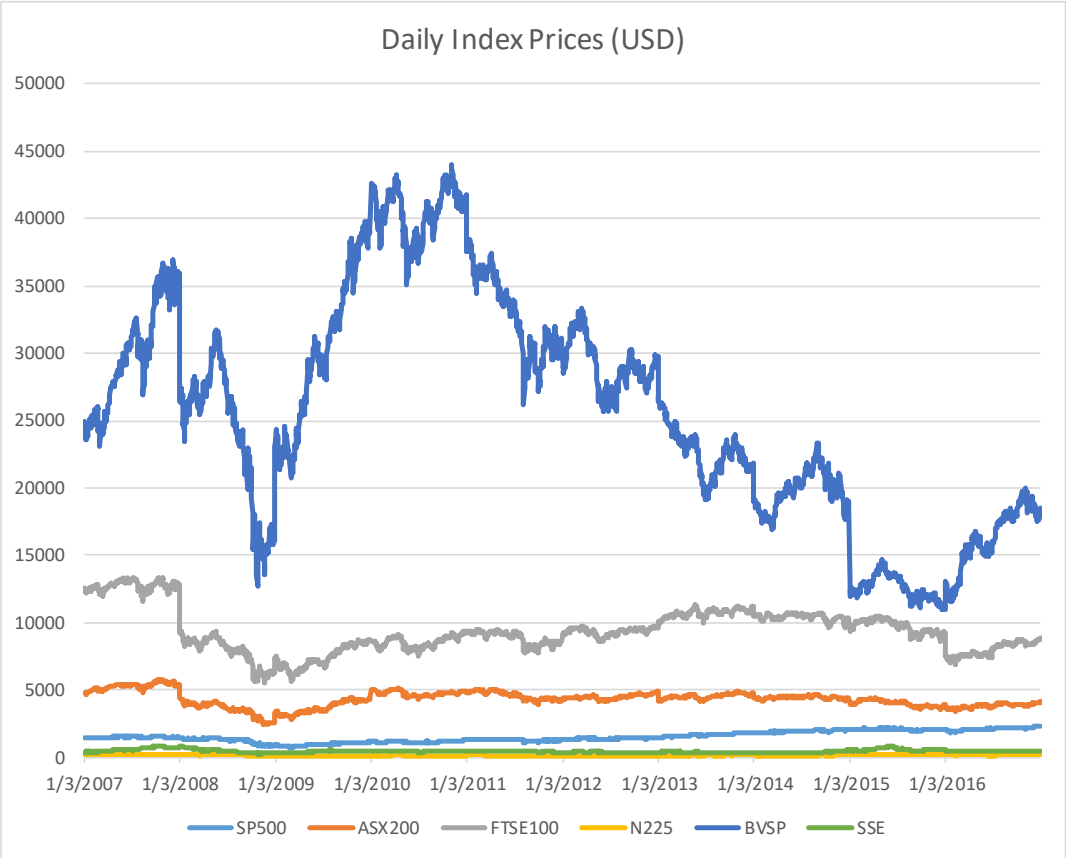


Figure 4.1. Daily prices of analysed stock indices for 10 years between 2007-2016

Figure 4.2. shows bar graphs for daily return rates of all analysed indices. General trends seen in all graphs represented let us say that all analysed stock indices get more volatile during similar periods. For example, during 2008 crisis all indices face significantly high positive and negative return rates while after the crisis all of them

become less volatile. The similarity between SSE and other indices is less pronounced in general.

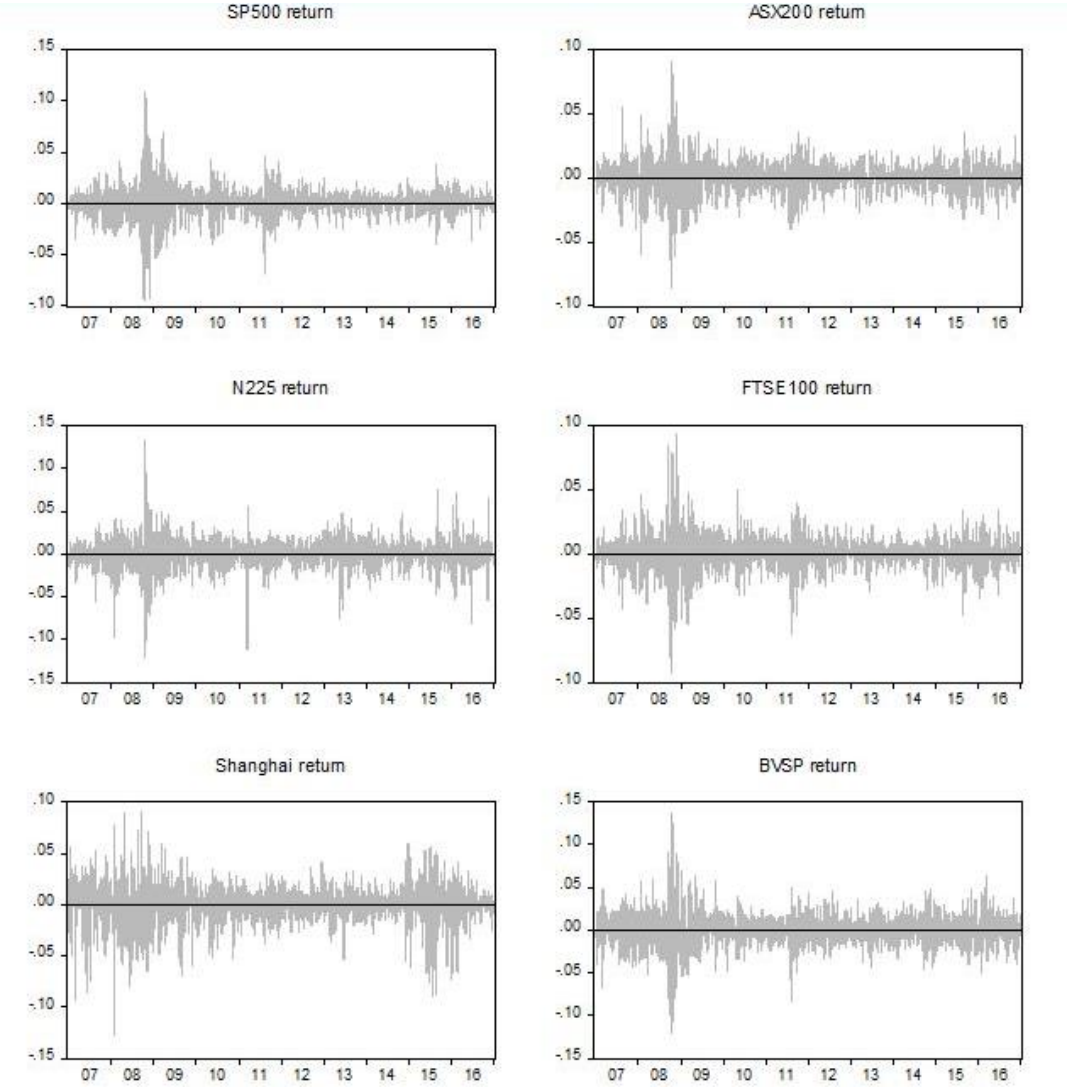


Figure 4.2. Bar graphs of daily return rates of analysed stock indices between 2007-2016. Source: Yahoo! Finance, Investing.com

4.1.2. Descriptive statistics and tests

Table 4.3. contains descriptive statistics for daily return rates of all the 6 stock indices.

Based on the values represented in Table 4.3. we can calculate Jarque-Bera test statistic to test whether any of the data is normally distributed or not.

Table 4.3. Descriptive Statistics of daily index return rates

Statistics / Index	SP500	ASX200	N225	FTSE100	SSE	BVSP
Mean	1,8E-04	-3,0E-07	3,3E-05	4,9E-05	4,4E-05	1,1E-04
Median	6,2E-04	3,9E-04	6,2E-04	4,2E-04	8,8E-04	4,5E-04
Maximum	1,1E-01	5,6E-02	1,3E-01	9,4E-02	9,0E-02	1,4E-01
Minimum	-9,5E-02	-8,7E-02	-1,2E-01	-9,3E-02	-9,3E-02	-1,2E-01
Standard Dev.	1,3E-02	1,2E-02	1,7E-02	1,3E-02	1,8E-02	1,8E-02
Skewness	-3,3E-01	-3,9E-01	-4,9E-01	-1,5E-01	-6,0E-01	1,9E-02
Kurtosis	1,3E+01	7,4E+00	1,0E+01	1,0E+01	6,7E+00	8,6E+00

Based on the values represented in Table 4.3. we can calculate Jarque-Bera test statistic to test whether any of the data is normally distributed or not.

It is clear from the table 4.4. that none of the daily index return rates is normally distributed.

Table 4.4. Jarque-Bera test for daily stock return rates

Normality test	SP500	ASX200	N225	FTSE100	SSE	BVSP
Jarqua Bera	1,04E+04	2,12E+03	5,60E+03	5,39E+03	1,55E+03	3,26E+03
Probability	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000

We can reject the null hypothesis of normal distribution at 1% level in every single case. This situation is quite expected for financial market data and it is common for return rates not to be normally distributed. More graphs related to daily return rates can be found in Appendix A.

4.2. Methodology for co-movement analyses

To check for co-movements between daily return rates of U.S. and other stock markets correlations and Vector Auto-Regressive (VAR) model is used.

Correlation between daily return rates computed to comment on the relation between each stock market and the U.S.

VAR model is first brought to the empirical economics by Sims (1980) and it is used to analyse linear interdependencies between several variables. The independent

variables used to explain each dependent variable are its own lags and lags of other variables. The general form of the VAR model used is as following:

$$r_{kt} = \alpha + \sum_{l=1}^{5} \gamma_l r_{l,t-1} + \sum_{l=1}^{5} \theta_l r_{l,t-2} + \varepsilon_t \qquad (4.2)$$

Here, r_{kt} is the return rate of the dependent stock index at time t, while r_{lt} is the return rate of explanatory stock indices. Same model has been run for all indices.

Pairwise Granger Causality which is first proposed by Granger (1969) test is employed to see which stock indices' return rates are being affected by S&P 500 and vice versa.

Correlation matrix for 6 stock indices is computed.

4.3. Co-movement analyses

Table 4.5. below shows correlations between 6 stock indices. Significance analysis is also conducted for correlations and all correlation values are significant.

Table 4.5. Correlation between daily return rates of indices

Correlations	SP500	N225	FTSE100	SSE	ASX200	BVSP
SP500	1,0000	0,1289	0,5965	0,0803	0,5756	0,6693
N225	0,1289	1,0000	0,3417	0,2813	0,1215	0,1780
FTSE100	0,5965	0,3417	1,0000	0,1703	0,4698	0,5418
SHANGHAI	0,0803	0,2813	0,1703	1,0000	0,0443	0,1639
ASX200	0,5756	0,1215	0,4698	0,0443	1,0000	0,4859
BVSP	0,6693	0,1780	0,5418	0,1639	0,4859	1,0000

The daily return rate of U.S. representative index S&P 500 has a strong positive correlation with return rates of FTSE100, ASX200, and BVSP. But correlations between S&P 500 and Asian stock indices (N225 and SSE) are very low but still positive.

Other than that, pairs of FTSE100 and BVSP, ASX200 and BVSP, FTSE100 and ASX200 also have notably high positive correlations.

Vector Autoregressive Model with 2 lags is derived and results for S&P 500 return rates as the dependent variable is represented in Table 4.6. The results for all indices can be found in Appendix F.

Table 4.6. VAR model regression results for S&P 500

Variable	Coefficient	Std. Dev.	t-statistic
SP500(-1)	-0.1847	0.0322	-5.7456
SP500(-2)	-0.1326	0.0332	-3.9893
N225(-1)	-0.0044	0.0211	-0.2067
N225(-2)	-0.0082	0.0177	-0.4648
FTSE100(-1)	0.0011	0.0314	0.0337
FTSE100(-2)	-0.0381	0.0302	-1.2603
SSE(-1)	-0.0037	0.0153	-0.2444
SSE(-2)	-0.0058	0.0154	-0.3768
BVSP(-1)	-0.0373	0.0205	-1.8219
BVSP(-2)	0.0164	0.0205	0.8013
ASX200(-1)	0.1976	0.0296	6.6836
ASX200(-2)	0.1201	0.0312	3.8524
C	0.0002	0.0003	0.9383

We can see that impacts of all analysed stock indices on S&P 500 is insignificant except for ASX200 for both lags and BVSP for 1st lag. Looking at the whole table in Appendix F, we see that S&P 500 hundred return rates affect all indices except BVSP. The effects of ASX200 lags are both positive.

Pairwise Granger Causality test has been run between S&P 500 and other indices. Null hypotheses, their respective F-Statistic values, and probabilities are represented in Table 4.7.

Table 4.7. Pairwise Granger Causality test between S&P 500 and other stock indices

Null Hypothesis:	F-Statistic	P Value
N225 returns does not Granger Cause SP500 returns	0.3835	0.6815
SP500 returns does not Granger Cause N225 returns	589.095	0,0000***
FTSE100 returns does not Granger Cause SP500 returns	1.3322	0.2641
SP500 returns does not Granger Cause FTSE100 returns	181.819	0,0000***
SSE returns does not Granger Cause SP500 returns	0.2093	0.8112
SP500 returns does not Granger Cause SSE returns	41.1254	0,0000***
ASX200 returns does not Granger Cause SP500 returns	25.2613	0,0000***
SP500 returns does not Granger Cause ASX200 returns	16.1280	0,0000***
BVSP returns does not Granger Cause SP500 returns	0.8916	0.4101
SP500 returns does not Granger Cause BVSP returns	6.2113	0,0020***

Again, ASX200 seems to be the only index that affects S&P 500 in terms of daily return rates. While daily return rates of S&P 500 affect return rates of all analysed stock indices.

4.4. Summary of the results of the co-movement analysis

From the Table 4.5. which shows correlations between the stock indices of different countries, we can see that the daily return rate of U.S. representative index S&P 500 has a strong positive correlation with return rates of FTSE100, ASX200, and BVSP. But correlations between S&P 500 and Asian stock indices (N225 and SSE) are very low but still positive.

Other than that, pairs of FTSE100 and BVSP, ASX200 and BVSP, FTSE100 and ASX200 also have notably high positive correlations.

Checking the Vector Autoregressive Model results in Table 4.6. we can see that impacts of all analysed stock indices on S&P 500 is insignificant except for ASX200 for both lags and BVSP for 1st lag. Instead, S&P 500 return rates significantly affect all the selected stock indices except BVSP.

Pair-wise Granger Causality test results show that daily return rates of S&P 500 are more likely to cause other indices rather than they cause S&P 500, which is quite expected as it represents the largest stock market of the world. Only ASX200 seem to have two-sided relation with S&P 500, meaning they both cause each other. These results are also strongly supported by VAR model results. As mentioned before the

impacts of the lagged values of S&P500 return rates on other stock indices except BVSP are significant. And among all stock indices, ASX200 is the only one that has a significant effect on S&P 500 return rates in both lags.

CHAPTER 5

IMPACTS OF U.S. MACROECONOMIC ANNOUNCEMENTS ON DAILY TRADE VOLUMES

As different investors might evaluate the same information differently, incoming information can create positive trade volume in the market. In this chapter, possible impacts of scheduled U.S. macroeconomic news announcements on daily trade volumes of several local and external stock indices are analysed.

5.1. Data review of trade volume analyses

5.1.1. General information and data sources

Daily volume data for four stock market indices from four countries' stock markets have been used in the analyses. Data covers from 01.01.2007 to 01.01.2017. The list of indices and stock markets they are traded in is shown in Table 5.1.

Table 5.1. Stock indices and markets

Index	Country	Market
SP500	USA	NYSE
ASX200	Australia	ASE
N225	Japan	TSE
SSE	China	SSE

Most of the data is downloaded from Yahoo! Finance historical database. Only 1 of the indices chosen are not available in Yahoo! Finance database and it has been downloaded from Investing.com website. A list of sources can be found in Table 5.2.

Table 5.2. Data sources

Index	Source
SP500	Yahoo!
ASX200	Investing.com
N225	Yahoo!
SSE	Yahoo!

Macroeconomic announcement dates for quarterly GDP Growth, monthly CPI, and monthly Unemployment has been gathered for 10 years from 01.01.2007 to 01.01.2017.

Scheduled dates for quarterly GDP growth can be found at U.S. Bureau of Economic Analysis database. Three announcements (advanced, preliminary, final) is made for each quarter. Most of these announcements are made during last week of each month at 8:30 U.S. time in the morning.

Announcement dates of monthly CPI and Unemployment can be accessed at Bureau of Labor Statistics. Unemployment report is published at the beginning of each month and CPI report in the middle of each month. Both are announced at 8:30 U.S. time in the morning. Publish dates of IMF World Economic Outlook is another data set used.

5.1.2. Descriptive statistics and tests

Table 5.3. below shows descriptive statistics for daily volumes of all indices.

Table 5.3. Descriptive statistics of daily trade volumes

Statistics / Index	SP500	ASX200	N225	SSE
Mean	4,04E+09	7,76E+08	1,50E+05	1,46E+05
Median	3,80E+09	7,19E+08	1,41E+05	1,09E+05
Maximum	1,15E+10	5,37E+09	5,95E+05	8,57E+05
Minimum	1,03E+09	2,01E+07	5,13E+04	3,04E+04
Standard Dev.	1,19E+09	2,98E+08	4,77E+04	1,21E+05
Skewness	1,32863	2,21735	2,42884	2,60910
Kurtosis	6,18051	26,44850	13,84501	10,58785

Based on the values calculated we can get Jarque-Bera test statistics to check for normality. In table 5.4. Jarque-Bera test values are shown for all analyzed indices and based on the results none of the data is normally distributed.

Table 5.4. Jarque-Bera Test for daily trade volumes

Normality test	**SP500**	**ASX200**	**N225**	**SSE**
Jarqua Bera	1802,12	61221,1	14391,78	8597,12
Probability	0,00000	0,00000	0,00000	0,00000

Augmented Dickey-Fuller test has been run to check whether any of the daily stock volumes data has a unit root.

Table 5.5. Augmented Dickey-Fuller test for daily trade volumes

Unit root test	**SP500**	**ASX200**	**N225**	**SSE**
t-Statistic	-8,0380	-5,1147	-9,0023	-2,9422
Probability	0,0000	0,0000	0,0000	0,0408

The null hypothesis of "Trade volume has a unit root" can be rejected for all indices at 1% level except Shanghai Composite Index which can be rejected at 5% level. For t-statistic values and probabilities Table 5.5. can be checked. Results of the test mean that these data sets are stationary and can be used in ARCH/GARCH models.

Below, Figure 5.1. represents histograms for daily trade volume datasets of all four indices.

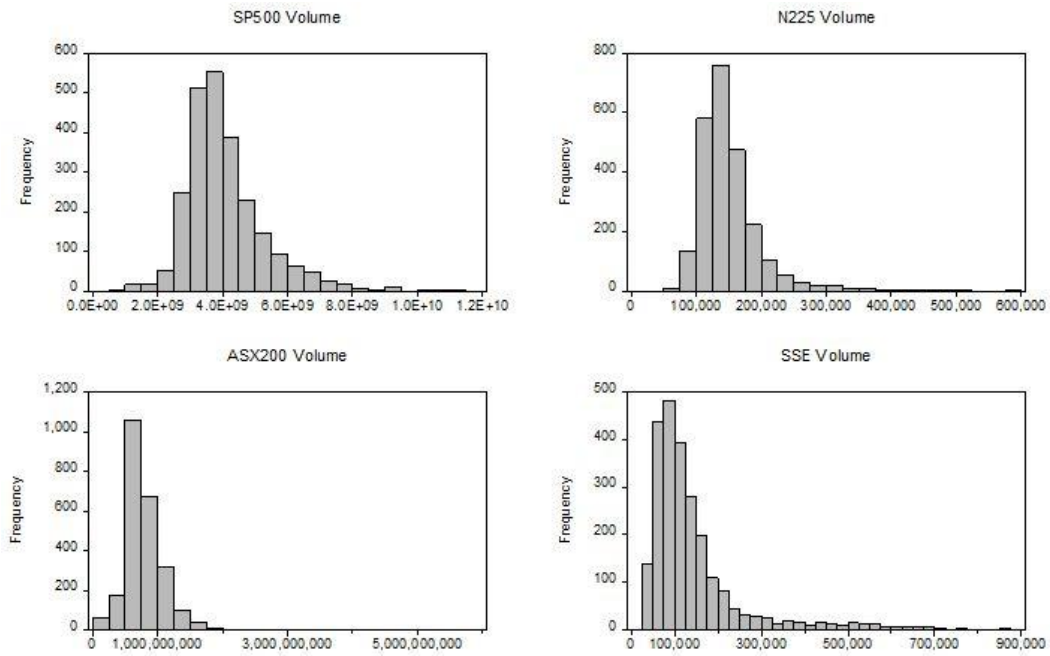


Figure 5.1. Histograms of daily trade volumes of S&P 500, N225, ASX200 and SSE

We can see from histograms that, distributions of all four daily volume data are right skewed. Data represented in descriptive statistics table (Table 5.3.) also support this as means of the data sets are greater than their medians in all cases.

More graphs about the daily trade volume data can be found in Appendix B.

5.2. Methodology for trade volume analyses

To test the impacts of U.S. macroeconomic announcements on daily stock market trading volumes and rate of change in volumes GARCH (1,1) model is employed. GARCH is a generalization of the ARCH model introduced by Bollerslev (1986) and GARCH (1,1) model suggests that the predictor of the next period's variance is the current variance and square of the most recent residual. Bollerslev (1986) also shows that the stationarity of GARCH models can be analysed through the sum of the coefficients of GARCH and ARCH terms. The sum of the coefficients must be less than 1. Other than that, all of the coefficients should be no lower than 0.

To check for eligibility for ARCH/GARCH models Augmented Dickey-Fuller unit root test is employed.

Announcements dates of the three macroeconomic indicators (GDP Growth, CPI, and Unemployment) and publish dates of IMF WEO report are used as dummy variables. Meaning, for the days with an announcement, the value of the independent variable is 1, for other days it is 0.

To avoid the impacts of possible 1st order autocorrelation trade volume (change in trade volume in the other case) of the previous day is also included as an independent variable.

The general form of the model to test for the impacts on daily stock volume is as follows:

$$V_t = \alpha + \mu V_{t-1} + \sum_{j=1}^{3} \beta_j D_{jt} + \beta_4 D_{imf,t} + \varepsilon_t \qquad (5.1)$$

$$\sigma_t^2 = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 \sigma_{t-1}^2 \qquad (5.2)$$

where (5.1) is the mean equation and (5.2) is variance equation. In (5.1) V_t is the trade volume at time t. D_{jt} refers to our three macroeconomic indicators and $D_{imf,t}$ is the announcement dates of IMF WEO forecasts.

The rate of change in daily trading volume is calculated as below:

$$\Delta V_t = \frac{V_t - V_{t-1}}{V_{t-1}}$$

The GARCH (1,1) model for testing the impacts of announcements on the rate of change in daily volume is as follows:

$$\Delta V_t = \alpha + \mu \Delta V_{t-1} + \sum_{j=1}^{3} \beta_j D_{jt} + \beta_4 D_{imf,t} + \varepsilon_t \quad (5.3)$$

$$\sigma_t^2 = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 \sigma_{t-1}^2 \qquad (5.4)$$

where (5.3) is the mean equation and (5.4) is the variance equation.

Residuals in the model are not assumed to be normal in any of the models and to get the best possible result same model with three types of residuals (normal, Generalized Error, student-t) has run. Then, Bayesian Information Criterion (BIC) has been used to compare the three models and choose best fitting one.

Residuals of the best-fitting model are analyzed and checked for normality, serial autocorrelation and for any remaining ARCH effects.

For the cases when coefficients of the terms of do not sum up to 1 or some of them are negative, EGARCH (2,1) model with asymmetric order 1 is employed. EGARCH model is first proposed by Nelson (1991) and uses natural logarithms of the variance terms. Also, the asymmetric version of the model suggests that the impacts of negative residual information would be higher on next periods variance. Nelson (1991) also suggests that stationarity of the model is similar to autoregressive moving average models, thus, the absolute value of the coefficient of logarithmic GARCH term in the equations must be lower than 1. An example of the general form of variance equation of the model is as below:

$$\ln(\sigma_t^2) = \gamma_0 + \gamma_1 \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \gamma_2 \frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \gamma_3 \frac{|\varepsilon_{t-2}|}{\sqrt{\sigma_{t-2}^2}} + \gamma_4 \ln(\sigma_{t-1}^2) \qquad (5.6)$$

Equation (5.6) is used both for volume and rate of volume change analyses.

It is hypothesized that investors would evaluate the public information they get differently and would have different decisions regarding buying or selling stocks. As a result, the positive change in trading volume would be created.

5.3. Analyses of the impacts of the U.S. macroeconomic announcements of daily trade volumes

Augmented Dickey-Fuller test results represented in Table 5.5. shows that none of the daily trade volume and daily changes in trade volume datasets are non-stationary. The null hypothesis of "data has a unit root" can be rejected in all cases. Thus, ARCH models can be employed to analyze these datasets. Models used in the analyses are discussed in Chapter 5.2.

Bayesian Information Criterion is used for lag selection. Residuals are assumed to have Student's t distribution for lag selection. Daily volume and rate of daily volume change datasets of S&P 500 are used as representative index employing models discussed in Chapter 5.2.

Table 5.6. below shows BIC values for models with different lags where daily trading volume is the dependent variable.

Table 5.6. Lag selection for daily trade volume regressions

Model	ARCH (1)	GARCH (1,1)	GARCH (2,2)	GARCH (3,3)	GARCH (4,4)
BIC	43.38	43.35	43.34	43.35	43.35

Table 5.7., on the other hand, represents BIC values of models with different lags for change in trade volume analyses.

Table 5.7. Lag selection for change in daily trade volume regressions

Model	ARCH (1)	GARCH (1,1)	GARCH (2,2)	GARCH (3,3)	GARCH (4,4)
BIC	-0.811	-0.813	-0.810	-0.806	-0.801

Both tables show that increasing lag will not benefit the analyses significantly, instead can sometimes lead to worse results. It will also have a negative impact on computation speed. Considering these, GARCH (1,1) models are employed in all analyses of this Chapter.

All regression models have been repeated three times assuming three different types of residual distribution – normal, generalized error, and Student's t. Student's t distribution appeared to offer the best results among three.

As representative examples, Table 5.8. and Table 5.9. show the BIC values for three distribution types from the regressions analyzing S&P 500 trade volume and change in trade volume datasets.

Table 5.8. Distribution selection for daily volume regressions

Distribution	Normal	GED	Student's t
BIC	43.49	43.44	43.35

Table 5.9. Distribution selection for change in daily volume regressions

Distribution	Normal	GED	Student's t
BIC	-0.55	-0.77	-0.81

As it can be seen from the tables, Student's t distribution offers better models in both cases.

For results of GARCH (1,1) models for regressions regarding daily trade volume with residuals having Student's t distribution, Table 5.10. can be checked.

Table 5.11. shows GARCH (1,1) results for the regressions testing the impacts of macroeconomic announcements on the change in daily trade volume.

In both tables, coefficients from the regressions and their P-values from t-tests for significance are represented along with Ljung–Box autocorrelation test and ARCH LM heteroscedasticity test values.

Impact of CPI announcement on S&P 500 trade volume is significant and positive. Impacts of announcements on trade volumes of other indices are either negative or insignificant.

Table 5.10. Impacts of announcement dates on daily trade volumes of S&P 500, ASX200, N225 and SSE

	S&P 500		**ASX 200**	
Mean Equation	Coefficient	P Value	Coefficient	P Value
Intercept	7.01E+08	0,0000***	2.09E+08	0,0000***
V_{-1}	0.8072	0,0000***	0.7243	0,0000***
CPI Announcement	1.23E+08	0,0058***	-4.20E+07	0,0171**
GDPG Announcement	4.94E+07	0.2775	-1.50E+08	0,0000***
Unemployment Announcement	-5.82E+07	0.2497	-7.80E+07	0,0000***
IMF WEO Publishment	2.00E+08	0.1009	1.22E+07	0.7335
Variance Equation	Coefficient	P Value	Coefficient	P Value
Intercept	7.20E+16	0,0000***	2.67E+16	0,0000***
${e_{-1}}^2$	0.3397	0,0000***	0.4580	0,0000***
σ^2_{-1}	0.5965	0,0000***	0.1148	0,0230**
Sum of coefficients	0.9362		0.5728	
Autocorrelation test	AC	P Value	AC	P Value
1st order	-0.1850	0.0000	-0.1230	0.0000
2nd order	0.0230	0.0000	-0.0010	0.0000
3rd order	0.0050	0.0000	0.0730	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value
ARCH LM	2.4274	0.0637	0.8063	0.4902

	N225		**SSE**	
Mean Equation	Coefficient	P Value	Coefficient	P Value
Intercept	37936	0,0000***	5900.794	0,0000***
V_{-1}	0.7268	0,0000***	0.9274	0,0000***
CPI Announcement	-3030985	0.1747	-1683.879	0.3644
GDPG Announcement	-1444706	0.4965	851.877	0.7113
Unemployment Announcement	-7780022	0,0006***	-625.516	0.6108
IMF WEO Publishment	3273307	0.6013	-2844.682	0.4955
Variance Equation	Coefficient	P Value	Coefficient	P Value
Intercept	2.29E+08	0,0000***	9.94E+06	0,0003***
${e_{-1}}^2$	0.2035	0,0000***	0.1302	0,0000***
σ^2_{-1}	0.5505	0,0000***	0.8750	0,0000***
Sum of coefficients	0.7540		1.0052	
Autocorrelation test	AC	P Value	AC	P Value
1st order	-0.1280	0.0000	-0.2110	0.0000
2nd order	0.0500	0.0000	-0.0610	0.0000
3rd order	0.0150	0.0000	-0.0270	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value
ARCH LM	0.1045	0.7465	2.3203	0.1278

Table 5.11. Impacts of announcement dates on the change in daily trade volume

S&P 500, ASX200, N225 and SSE

	S&P 500		**ASX 200**	
Mean Equation	Coefficient	P Value	Coefficient	P Value
Intercept	0.0052	0,0625*	0.0257	0,0000***
ΔV_{-1}	-0.3059	0,0000***	-0.1651	0,0000***
CPI Announcement	0.0470	0,0001***	-0.0815	0,0005***
GDPG Announcement	0.0049	0.6829	-0.2114	0,0000***
Unemployment Announcement	-0.0374	0,0052***	-0.1356	0,0000***
IMF WEO Publishment	0.0475	0.1143	0.0183	0.7216
Variance Equation	Coefficient	P Value	Coefficient	P Value
Intercept	0.0199	0,0000***	0.0322	0,0009***
${e_{-1}}^2$	0.4204	0,0000***	0.1266	0,0010***
σ^2_{-1}	0.1368	0,0079***	0.7619	0,0000***
Sum of coefficients	0.5572		0.8885	
Autocorrelation test	AC	P Value	AC	P Value
1st order	-0.1040	0.0000	-0.0830	0.0000
2nd order	-0.1350	0.0000	-0.0410	0.0000
3rd order	-0.0690	0.0000	0.0030	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value
ARCH LM	0.3902	0.7601	0.0029	0.9998

	N225		**SSE**	
Mean Equation	Coefficient	P Value	Coefficient	P Value
Intercept	0.0088	0,0139**	-0.0022	0.5827
ΔV_{-1}	-0.2873	0,0000***	-0.1879	0,0000***
CPI Announcement	-0.0080	0.5877	-0.0113	0.4952
GDPG Announcement	-0.0061	0.6989	-0.0057	0.7293
Unemployment Announcement	-0.0696	0,0000***	0.0081	0.6293
IMF WEO Publishment	0.0367	0.3742	-0.0212	0.6412
Variance Equation	Coefficient	P Value	Coefficient	P Value
Intercept	0.0206	0,0104**	0.0835	0,0000***
${e_{-1}}^2$	0.0540	0,0368**	0.0003	0.9275
σ^2_{-1}	0.4178	0,0529*	-0.8513	0,0069***
Sum of coefficients	0.4718		-0.8510	
Autocorrelation test	AC	P Value	AC	P Value
1st order	-0.0600	0.0003	-0.0290	0.1590
2nd order	-0.1540	0.0000	-0.1370	0.0000
3rd order	-0.0900	0.0000	-0.0400	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value
ARCH LM	0.5323	0.4657	2.8837	0.0345

Results are quite like trade volume analyses. CPI announcements seem to be the only one to affect daily trade volume of S&P 500.

ARCH LM test results represented in Tables 5.10. and 5.11. show that, the null hypothesis of the existence of heteroscedasticity can be rejected at 10% in most of the cases. Only, residuals from trade volume regression of S&P 500 can be rejected at 5% level, and residuals from the change in trade volume regression of SSE can be rejected only at 1% level.

Based on Ljung-Box Test Q statistics values, it can be concluded that serial autocorrelation of residuals is either significantly close to zero or very low. Thus, we can assume that there is no serial autocorrelation.

Models for S&P 500, ASX 200 and N225 exhibit stationary variances, as coefficients of σ_{t-1}^2 and e_{t-1}^2 terms sum up to less than 1. Also, all coefficients in variance equations are positive.

However, in the models regarding SSE, several problems can be seen. In the model testing impacts on trade volume sum of the coefficients in variance, equation exceed 1. And in the model testing impacts on change in trade volume, coefficients of σ_{t-1}^2 terms are negative.

For getting rid of the problems regarding models for SSE, EGARCH model is used, and to avoid autocorrelation and heteroscedasticity problems different lag is selected. In this case, EGARCH (2,1) model with asymmetric order 1 is employed and additional terms added to the mean equations. The results of this analyse can be seen in table 5.12. Results represented indicate no conditional heteroscedasticity based on ARCH LM test.

As can be seen from the table, correcting the model did not change results for SSE. All coefficients are still insignificant.

Table 5.12. Impacts of announcement dates on the change in daily trade volumes of SSE

SSE	**Volume**		**Change in Volume**	
Mean Equation	Coefficient	P Value	Coefficient	P Value
Intercept	3761.68	0,0000***	0.001	0.8278
V_{-1} or ΔV_{-1}	0.7411	0,0000***	-0.2138	0,0000***
V_{-2} or ΔV_{-2}	0.2109	0,0000***	-0.1205	0,0000***
CPI Announcement	-2385.56	0.1512	-0.0148	0.3837
GDPG Announcement	-109.562	0.9410	-0.0035	0.8237
Unemployment Announcement	1637.51	0.2858	0.0089	0.5820
IMF WEO Publishment	335.843	0.9282	-0.025847	0.5753
Variance Equation	Coefficient	P Value	Coefficient	P Value
Intercept	0.2338	0,0001***	-1.53E-01	0,0029***
$\lvert e_{-1}\rvert/\sigma_{-1}^{-0.5}$	0.2093	0,0000***	0.0999	0,0595*
$\lvert e_{-2}\rvert/\sigma_{-2}^{-0.5}$	-0.1511	0,0013***	-0.0197	0.7106
$(e_{-1})/\sigma_{-1}^{-0.5}$	0.1717	0,0000***	-0.0606	0,0099***
$\ln(\sigma_{-1}^{2})$	0.9854	0,0000***	0.9672	0,0000***
Autocorrelation test	AC	P Value	AC	P Value
1st order	-0.0490	0.0150	-0.0370	0.0650
2nd order	-0.1390	0.0000	-0.1280	0.0000
3rd order	-0.0500	0.0000	-0.0420	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value
ARCH LM	0.9969	0.3182	2.0676	0.1506

5.4. Results and findings from the trade volume analyses

5.4.1. Summary of the results

Monthly CPI announcements have significant positive impacts on both trade volume and change in trade volume of S&P 500. Both coefficients are positive meaning trade volume of S&P 500 is higher on the dates of CPI announcements. The difference with previous day's trade volume is also larger than normal days.

The coefficient of the dummy variable for monthly unemployment announcements on the rate of change in daily trade volume is statistically significant but negative. So, the initial hypothesis that announcement dates should increase the daily trade volume or result in larger changes compared to previous dates in the local stock market does not hold.

IMF World Economic Outlook publish dates and monthly announcement dates for quarterly GDP Growth does not have a significant impact.

Monthly CPI announcements dates, monthly announcement dates of quarterly GDP Growth and monthly unemployment announcement dates in the U.S. have statistically significant impacts on both trade volume and change in trade volume of ASX 200 index. Coefficients both for trade volume and change in trade is negative.

It can be interpreted that, during the macroeconomic news announcements in the U.S., Australian stock market experience lower trade volumes with negative changes when compared to the day before the announcement. IMF WEO announcements do not seem to create any positive volume.

Unemployment announcement dates in the U.S. have statistically significant negative impacts on trade volume and change in trade of Japanese stock index, N225. Coefficients for CPI and GDP Growth announcement dates are not significant.

None of the variables seem to have statistically significant impacts on trade volumes or changes in trade volumes of Shanghai Stock Exchange index.

5.4.2. Findings

One of the most important findings of this chapter is that the impacts of U.S. macroeconomic announcements are negative or insignificant on trade volumes of the external markets while positive on the local market only for CPI announcement. We can see that macroeconomic announcement dates in the U.S. do not create positive change in trade volume of Australian and Japanese stock market indices, instead, they cause lower trade volumes. As mentioned before, all 3 indicators affect daily trade volume of ASX200 negatively. This finding can be explained with the help of the assumptions and findings of a previous study by Kim and Verrecchia (1991). Their study proposes that investors reach their optimal portfolios before the news release according to their pre-announcement knowledge. Announced news affects the investors' thoughts and they enter to a new round of trading. As traders have different precisions and different interpretations about the announcement, they

react to the announcement differently and it increases the trading volume. The formula below represents the impacts of news announcements on the change in volume, where s_i is the individual precision of investors and s is the average precision. If we have $s_i = s$, then change in volume will be equal to 0. This formula is discussed in Literature Review part of the thesis as well.

$$Volume = \left(\frac{1}{2}\int r_i|s_i - s|di\right)|P_2 - P_1|$$

It means that announcements can create positive change in the trade volume of the stock indices if and only if the individuals participating in the stock market have different opinions about the same announcements. If all investors have similar thoughts, then there will be no change in trade. Thus, we can say that players of the Japanese and Australian stock markets do not have significant differences in the precision and interpretation of incoming information coming from U.S. economy. Also, we can conclude that when monthly CPI rate is announced in the U.S., investors in the U.S. stock market interpret the news differently, so that the daily trade volume increase.

Another suggestion of the authors is that change in volume is a noisier indicator of the incoming information than the price. And this can create biased results in the analyses.

Kim and Verrecchia (1991) conclude that the expected trade volume is a decreasing function of the quantity of available information before an announcement and increasing function of the accuracy of the release. Based on this information, we can say that the quantity of pre-announcement information can also be a reason behind the negative and insignificant impacts of announcement dates on daily trade volumes of analysed stock indices.

China is a country with large financial reserves and low public debt. These might make external factors difficult to impacts Chinese stock market. Thus, investors are less likely to respond to the external news. These factors can be a possible reason for the situation. Another finding from the analyses done is that none of the stock indices react to World Economic Outlook publications from IMF.

Studies analysing the impacts of macroeconomic announcements on trade volumes of stock markets are not as common as analyses regarding return rates and volatilities. A study by Jain (1988) analyse the impacts of the announcements of 5 macroeconomic indicators on hourly trade volumes of S&P 500 index as a market proxy. The study reveals that none of the indicators have a significant effect on trade volume of the proxy index. The author also concludes that the reason behind this situation is significantly similar interpretations of news by individuals.

On the other hand, available literature suggests that trade volumes of bond markets react to macroeconomic announcements. A study by Balduzzi, Elton, and Green (2001) can be a good example of the studies with this conclusion.

CHAPTER 6

SURPRISE IMPACTS OF U.S. MACROECONOMIC ANNOUNCEMENTS ON INTRADAY INDEX RETURN RATES AND RETURN RATE VOLATILITIES

In the previous chapter, the impacts of U.S. macroeconomic announcement dates on daily trade volumes are analysed. This chapter is dedicated to the analyses of the impacts of U.S. macroeconomic announcements on intraday return rates and volatilities of several stock market indices. Surprise (unexpected) parts of the announced macroeconomic values are assumed to be the source of the impact.

Surprises of the investors are defined as the deviations of the announced values of the macroeconomic indicators from their expected values. This brings the problem of obtaining an aggregate measure of the expectations of the investors. To solve this problem firstly we consider that the investors use the professionals' forecasts based on surveys obtained from individual investors who form rational expectations about the future. Then the professionals' forecasts of macroeconomic indicators are rational and optimal and hence, with a circular reasoning, the expectations coming from these forecasts are rational.

The professional forecasts of a macroeconomic indicator at a certain time might not be uniform. However, there are studies which claim that the dispersion of the forecasts reduces closer to the forecast target date as agents update their expectations in accordance with real-time information (Lahiri and Sheng, 2008). Using the rational and non-dispersed professional forecasts we can claim that the investors' rationally expected values of the macroeconomic indicators are the professionals' forecasts.

Secondly, the investors might have adaptive expectations: they might expect that the future values of the macroeconomic indicators will be the same as present values.

Using the above arguments, we model the effects of macroeconomic news in the selected stock markets both with adaptive expectations and rational expectations in the following parts of this chapter.

After the specification of the expectations, we elaborate on surprises, which are the deviations of the announced values of macroeconomic indicators from their expectations. First, the impacts of all surprises are studied without their sign distinctions as zero, negative or positive under the name surprises without differentiation (between positive and negative). Then surprises are classified as the negative surprises which are the ones with higher expected values than their announced values and positive surprises which are the ones with lower expected values than their announced values. After this classification, the impacts of each type of surprises are examined as being surprises with differentiation (between positive and negative).

The macroeconomic indicators used are GDP growth rate, unemployment rate, and inflation rate. In this sense, positive surprises in GDP growth rates can be accepted as good news, but the positive surprises of unemployment rates can be considered as bad news. When it comes to inflation rates associated with CPI rates the interpretations of positive or negative surprises might be much more complex.

The forthcoming analyses take the magnitudes of the surprizes into account by squaring the surprize variables. The higher the size of the squared surprize would mean the lower the precision of the forecast and this can indicate that investors get more exposed to a highly uncertain environment. The Figure 6.1. below display the ways surprises are considered:

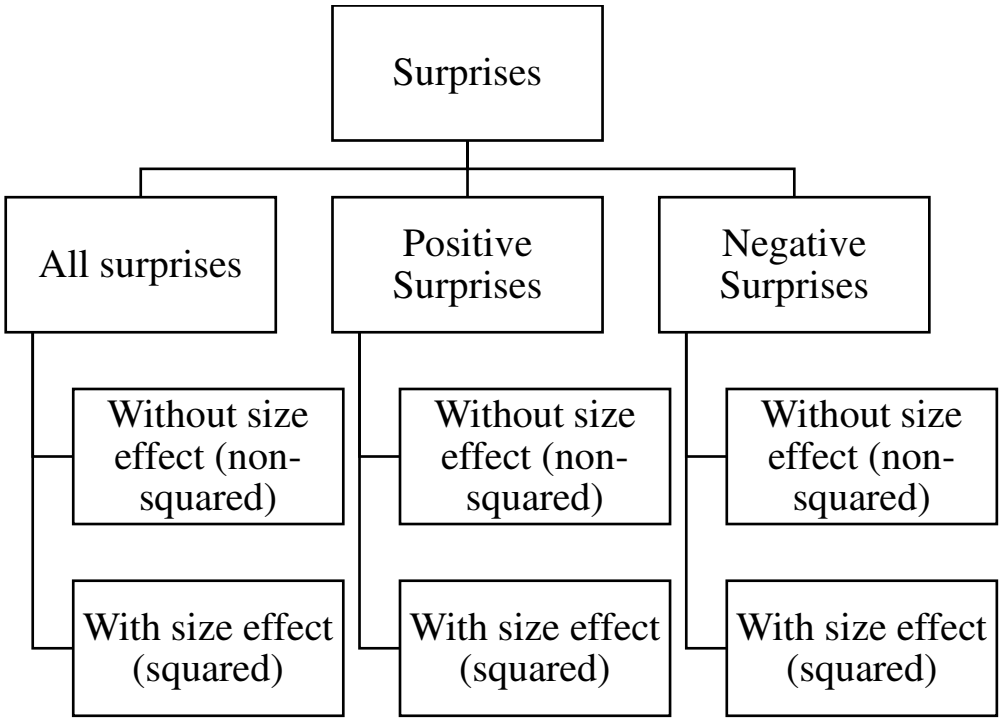


Figure 6.1. Classification of the ways surprises are considered

In summary, in this chapter, the expectations of the investors are classified as rational and adaptive expectations. However, the focus is on the rational expectations since all the selected indices are studied in this context. Only S&P index is subjected to the analyses under adaptive expectations in addition to the rational expectations. The effects of each type of surprises are investigated: all surprises without differentiation and the ones with differentiation between negative and positive. The impacts of the squared values of each type of the surprize are also studied.

6.1. Data review of intraday index return rate and volatility analyses

6.1.1. General information and data sources

5-minute intra-day logarithmic return rate data for 6 stock market indices from 6 countries' stock markets have been used in the analyses. Data covers the period from 01.01.2007 to 01.01.2017. The list of indices and stock markets they are traded in is shown in Table 6.1.

Return rates are calculated with the close prices of each 5-minute period same as mentioned in formula (4.1).

Where r_t is the return rate for any 5 minutes. P_t is the price of the stock index for the end of 5-mithe nutes period and P_{t-1} is the price for the end of previous 5 minutes.

Table 6.1. Stock indices and markets used in intraday index return rate and volatility analyses

Index	Country	Market
SP500	USA	NYSE
ASX200	Australia	ASE
N225	Japan	TSE
FTSE100	UK	LSE
SSE	China	SSE
BVSP	Brazil	B3

Finam.ru database is used to download intraday data for all indices analyzed.

Macroeconomic announcements for quarterly GDP Growth, monthly CPI, and monthly Unemployment has been gathered for 10 years from 01.01.2007 to 01.01.2017. Also, expectations for the announcements for the same period is used to calculate the unexpected part of the announcements.

GDP Growth data is available at U.S. Bureau of Economic Analysis. three announcements (advanced, preliminary, final) is made for each quarter. Most of these announcements are made during last week of each month at 8:30 U.S. time in the morning. For expected values of quarterly GDP Growth, Economic Forecasting Survey provided by Wall Street Journal is used. It is a survey system that collects forecasts from 60 different economists and provides an average of their predicted values publicly. We assume that all 60 of the economists have rational thinking so that their forecasts can be used as expected values under rational expectations.

For monthly CPI and Unemployment announcements, U.S. Bureau of Labor Statistics is used. Unemployment report is published at the beginning of each month and CPI report in the middle of each month. Both are announced at 8:30 U.S. time

in the morning. Expected values for CPI and Unemployment is gathered from International Monetary Fund, World Economic Outlook database which is provided twice a year including expectations for following years. These forecasts are mostly based on an expected future event in the economies. Thus, they can be used as a measure of rationally expected values of macroeconomic indicators. We assume that all rational investors in the market either use the same methods of forecasting with IMF analysts or simply take IMF data as given. A summary of sources used for macroeconomic indicators and their expected values can be seen in table 6.2. below.

Table 6.2. Data sources of macroeconomic indicators used in intraday index return rate and volatility analyses

Indicator	**Source**
GDP Growth	U.S. BEA
Expected GDP Growth	WSJ Survey
CPI	U.S. BLS
Expected CPI	IMF WEO
Unemployment	U.S. BLS
Expected Unemployment	IMF WEO

Several figures related to surprise part of macroeconomic variables are available in Appendix E.

6.1.2. Descriptive statistics and tests

Table 6.3. below shows descriptive statistics for 5-minute return rates of all analysed indices.

Table 6.3. Descriptive Statistics of 5-minute index return rates

Statistics / Index	**SP500**	**ASX200**	**N225**	**FTSE100**	**SSE**	**BVSP**
Mean	2,2E-06	-9,2E-07	7,3E-07	5,6E-07	-5,3E-06	1,6E-06
Median	5,9E-06	0,0E+00	0,0E+00	0,0E+00	0,0E+00	7,9E-06
Maximum	4,4E-02	3,4E-02	5,4E-02	5,2E-02	8,9E-02	5,4E-02
Minimum	-5,3E-02	-4,2E-02	-8,5E-02	-9,0E-02	-7,0E-02	-6,2E-02
Standard Dev.	1,4E-03	1,1E-03	1,9E-03	1,2E-03	2,4E-03	1,8E-03
Skewness	-3,8E-01	-9,7E-01	-1,2E+00	-1,9E+00	3,6E-01	-2,0E-01
Kurtosis	1,0E+02	1,1E+02	1,1E+02	2,8E+02	9,6E+01	9,2E+01

Based on the values calculated we can get Jarque-Bera test statistics to check for normality. In table 6.4. Jarque-Bera test values are shown for the return rates of all analyzed indices and based on the results none of the data is normally distributed. We reject the null hypothesis of data is normally distributed for all indices.

Table 6.4. Jarque-Bera Test of 5-minute index return rates

Normality test	**SP500**	**ASX200**	**N225**	**FTSE100**	**SSE**	**BVSP**
Jarqua Bera	8,35E+07	7,49E+07	6,99E+07	7,94E+08	4,19E+07	6,84E+07
Probability	0,00000	0,00000	0,00000	0,00000	0,00000	0,00000

To check for the existence of unit-root Augmented Dickey-Fuller test is used. As it can be seen from the Table 6.5. we reject the existence of unit root for all the index return rates at 1% level.

Table 6.5. Augmented Dickey-Fuller test of 5-minute index return rates

Unit root test	**SP500**	**ASX200**	**N225**	**FTSE100**	**SSE**	**BVSP**
t-Statistic	-317,7537	-274,3313	-206,6195	-360,1610	-125,3437	-310,0008
Probability	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001

Below Figure 6.1. shows histograms for intraday return rate datasets of all 6 indices.

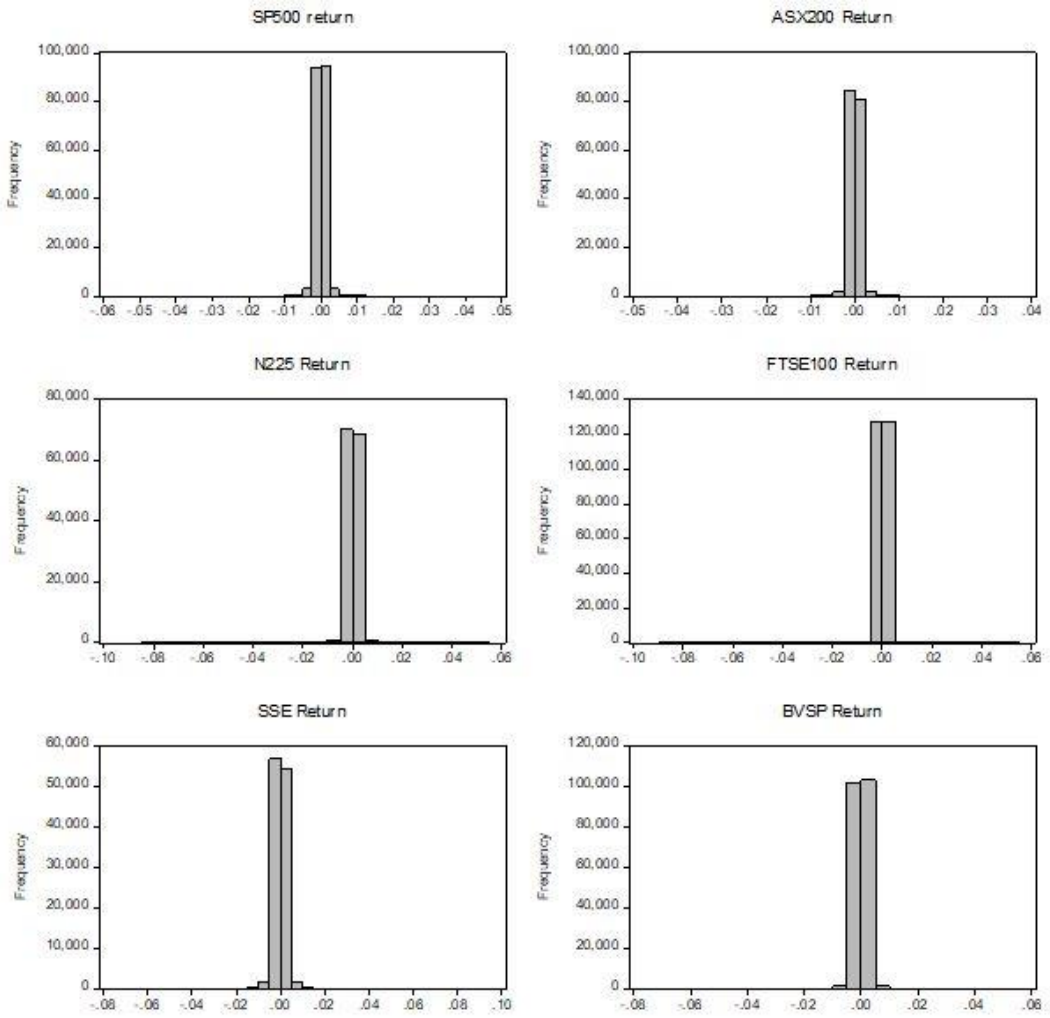


Figure 6.2. Histograms of intraday stock index return rates

Histograms, along with descriptive statistics show that return rates are generally around 0 with small deviations. More graphs related to the 5-minute return rate data can be found in Appendix C.

6.2. The methodology of intraday index rate of returns and volatilities analyses

To analyse the surprise impacts of the U.S. macroeconomic announcements on stock market return rates and their volatilities, EGARCH (1,1) model is employed. To check for eligibility for return rate data for ARCH/GARCH models Augmented Dickey-Fuller unit root test is used.

As an explanatory variable, surprise parts of the macroeconomic announcements are used. The calculation of surprise has been done in two ways: 1) Assuming investors with rational expectations; 2) Assuming investors with adaptive expectations.

In the part with rational investors, all the previously mentioned stock indices are analysed, while analyses of the other part are limited to DJI and S&P 500.

The surprise is defined as follows:

$S_{rational,jt} = MI_{jt} - E(MI_{jt})$ (6.1) for the case with rational expectations.

$S_{adaptive,jt} = MI_{jt} - MI_{j,t-1}$ (6.2) for the case with adaptive expectations.

Here, MI_{jt} is the announced value of macroeconomic indicator j, at time t. For (6.1) expected values for indicators are as mentioned in Chapter 6.1. Latest available expected value is used for calculations.

It is assumed that impacts of the surprise can best be realized during the first 5-10 minutes period after the announcement is made. If the stock market of a country does not work during the time announcement is made, then the impacts are expected to be realized during first 10 minutes after the stock market is open the next day.

Time differences between the U.S. and other countries are considered.

Four types of the EGARCH (1,1) model is used for the analyses:

a) A model with all surprises of macroeconomic indicators as one variable
b) A model with all surprises of macroeconomic indicators as one variable in squared form
c) A model differentiating between positive and negative surprises as two separate variables
d) A model differentiating between positive and negative surprises as two separate variables in the squared form

These four types are applicable both to models testing impacts on return rates and models testing impacts on volatilities.

The EGARCH (1,1) models used to analyse the impacts of the announcements on stock market return rates are as follows:

a) Surprise impacts on the return rates of the stock market indices without differentiating between positive and negative surprises

$$r_t = \alpha + \sum_{j=1}^{3} \beta_j S_{jt} + \varepsilon_t \qquad (6.3)$$

$$\ln(\sigma_t^2) = \gamma_0 + \gamma_1 \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \gamma_2 \frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \gamma_3 \ln(\sigma_{t-1}^2) \qquad (6.4)$$

where (6.3) is mean equation and (6.4) is variance equation.

b) Surprise impacts on the return rates of the stock market indices without differentiating between positive and negative surprises

$$r_t = \alpha + \sum_{j=1}^{3} \beta_j S_{jt}^2 + \varepsilon_t \qquad (6.5)$$

$$\ln(\sigma_t^2) = \gamma_0 + \gamma_1 \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \gamma_2 \frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \gamma_3 \ln(\sigma_{t-1}^2) \qquad (6.6)$$

c) Surprise impacts on the return rates of the stock market indices with differentiating between positive and negative surprises

$$r_t = \alpha + \sum_{j=1}^{3} \beta_j S_{positive,jt} + \sum_{j=1}^{3} \gamma_j S_{negative,jt} + \varepsilon_t \qquad (6.7)$$

$$\ln(\sigma_t^2) = \gamma_0 + \gamma_1 \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \gamma_2 \frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \gamma_3 \ln(\sigma_{t-1}^2) \qquad (6.8)$$

d) Surprise impacts on the return rates of the stock market indices without differentiating between positive and negative surprises

$$r_t = \alpha + \sum_{j=1}^{3} \beta_j S_{positive,jt}^2 + \sum_{j=1}^{3} \gamma_j S_{negative,jt}^2 + \varepsilon_t \qquad (6.9)$$

$$\ln(\sigma_t^2) = \gamma_0 + \gamma_1 \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \gamma_2 \frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \gamma_3 \ln(\sigma_{t-1}^2) \qquad (6.10)$$

Here, (6.7) and (6.8) are relatively mean and variance equations for type (c), (6.9) and (6.10) are for type (d).

Mean and variance equations of the EGARCH (1,1) models for testing the impacts of macroeconomic announcements on the stock market volatility are as follows:

a) Surprise impacts on the return rate volatilities of the stock market indices without differentiating between positive and negative surprises

$$r_t = \alpha + \varepsilon_t \qquad (6.11)$$

$$\ln(\sigma_t^2) = \gamma_0 + \gamma_1 \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \gamma_2 \frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \gamma_3 \ln(\sigma_{t-1}^2) + \sum_{j=1}^{3} \beta_j S_{jt} \qquad (6.12)$$

b) Squared surprise impacts on the return rate volatilities of the stock market indices without differentiating between positive and negative surprises

$$r_t = \alpha + \varepsilon_t \qquad (6.13)$$

$$\ln(\sigma_t^2) = \gamma_0 + \gamma_1 \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \gamma_2 \frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \gamma_3 \ln(\sigma_{t-1}^2) + \sum_{j=1}^{3} \beta_j S_{jt}^2 \qquad (6.14)$$

c) Surprise impacts on the return rate volatilities of the stock market indices with differentiating between positive and negative surprises

$$r_t = \alpha + \varepsilon_t \qquad (6.15)$$

$$\ln(\sigma_t^2) = \gamma_0 + \gamma_1 \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \gamma_2 \frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \gamma_3 \ln(\sigma_{t-1}^2) + \sum_{j=1}^{3} \beta_j S_{positive,jt} + \sum_{j=1}^{3} \gamma_j S_{negative,jt} \qquad (6.16)$$

d) Squared surprise impacts on the return rate volatilities of the stock market indices with differentiating between positive and negative surprises

$$r_t = \alpha + \varepsilon_t \qquad (6.17)$$

$$\ln(\sigma_t^2) = \gamma_0 + \gamma_1 \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \gamma_2 \frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \gamma_3 \ln(\sigma_{t-1}^2) + \sum_{j=1}^{3} \beta_j S_{positive,jt}^2 + \sum_{j=1}^{3} \gamma_j S_{negative,jt}^2 \qquad (6.18)$$

All models above are the same both for the assumption of rational investors and for the assumption of investors with adaptive expectations.

Residuals in the model are not assumed to be normal in any of the models and to get the best possible result same model with three types of residuals (normal, Generalized Error, student-t) has run for all cases. Then, Bayesian Information Criterion (BIC) has been used to compare the three models and choose best fitting one.

Residuals of the best-fitting model are analyzed and checked for normality, serial autocorrelation and for any remaining ARCH effects.

For the cases when EGARCH (1,1) leads to heteroscedasticity or autocorrelation problems, EGARCH (2,1) models with asymmetric order 1 are employed. An example of the general form of variance equations of the models are as below:

$$\ln(\sigma_t^2) = \gamma_0 + \gamma_1 \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \gamma_2 \frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \gamma_3 \frac{|\varepsilon_{t-2}|}{\sqrt{\sigma_{t-2}^2}} + \gamma_4 \ln(\sigma_{t-1}^2) \qquad (6.19)$$

Explanatory variables (surprises) are added to the mean and variance equations the same way represented in EGARCH (1,1) models.

It is hypothesized that, if investors of a market think that U.S. macroeconomic indicators will have an impact on their market, then they will increase or decrease their demand based on their interpretation of incoming surprise information. As investors can get information very fast – as soon as the announcement is made, they should respond in a few minutes after the announcement is made.

Also, differences between models with adaptive and rational expectations will help to identify investor behaviour, the way they think. Whether investors appreciate expected values announced by large organizations and professional economists, or they just take most recent official announcement as the expected value or both.

6.3. Analyses of intraday index return rates and volatilities

Results of Augmented Dickey-Fuller test represented in Table 6.5. shows that, 5-minute return rate datasets of all indices are stationary. The null hypothesis of the existence of unit root can be rejected in all cases. Models used in the analyses are represented in Chapter 6.2.

Bayesian Information Criterion is used for lag selection. Residuals are assumed to have Student's t distribution for lag selection. 5-minute return rate data of S&P 500 is used as representative index employing the models in equations (6.3) as mean and (6.4) as variance equation discussed in Chapter 6.2.

Table 6.6. below shows BIC values for models with different lags.

Table 6.6. Lag selection for 5-minute return rate regressions

Model	ARCH (1)	EGARCH (1,1)	EGARCH (2,2)	EGARCH (3,3)	EGARCH (4,4)
BIC	-11.43	-11.62	-11.62	-11.63	-11.64

It appeared that increasing lag after EGARCH (1,1) will not benefit the model significantly. Considering the negative impacts of increasing lag on computing speed, it is better to stick with EGARCH (1,1) model.

For S&P 500, N225, FTSE 100 and SSE indices, EGARCH (1,1) with asymmetric order 1 is used. For ASX 200 and BVSP indices, EGARCH (2,1) is employed to avoid heteroscedasticity and serial correlation problems.

All regression models for all indices have been repeated three times assuming three different types of residual distribution – normal, generalized error, and Student's t. Student's t distribution appeared to offer the best results among three. As a representative example, Table 6.7. show the BIC values for three distribution types from the regression analyzing S&P 500 5-minute return rates using EGARCH (1,1) model as represented in equation (6.3) and (6.4).

Table 6.7. Distribution selection for 5-minute return rate regressions

Distribution	Normal	GED	Student's t
BIC	-11.10	-11.56	-11.62

This chapter analyses the impacts of the surprise parts of the U.S. macroeconomic announcements on return rates and volatilities of stock indices and many aspects of these impacts are analysed. As mentioned before, we test the impacts both with and without differentiating positive and negative surprises. This lets us identify whether both positive and negative surprises have similar impacts or there are differences.

Also, we analyse the impacts of the squared surprises on both return rates and volatilities to see if the relation between surprises and variables of stock indices are linear or the impacts are quadratic. It will show us whether the sign or the size of the surprise is more important. Another aspect we analyse, as mentioned before, is the analyses of the impacts of the surprises under adaptive expectations. We analyse and compare results of the impacts under adaptive and rational expectations to see whether both types of investors exist in the market or not. Also, this will reveal if both react to similar information in the same way.

Below you can see a brief classification of the tables showing the results of the regression analyses.

1) Impacts of U.S. macroeconomic announcements without differentiating between positive and negative surprises under rational expectations

6.8. Surprise impacts on the rates of returns of the stock market indices

6.9. Squared surprise impacts on the rates of returns of the stock market indices

6.10. Surprise impacts on the volatilities of the rates of returns of the stock market indices

6.11. Squared surprise impacts on the volatilities of the rates of returns of the stock market indices

2) Impacts of U.S. macroeconomic announcements with differentiating between positive and negative surprises under rational expectations

6.12. Surprise impacts on the rates of returns of the stock market indices

6.13. Squared surprise impacts on the rates of returns of the stock market indices

6.14. Surprise impacts on the volatilities of the rates of returns of the stock market indices

6.15. Squared surprise impacts on the volatilities of the rates of returns of the stock market indices

3) Impacts of U.S. macroeconomic announcements under adaptive expectations

6.16. Surprise and squared surprise impacts on the rates of returns of the stock market index S&P 500

6.17. Surprise and squared surprise impacts on the volatilities of the rates of returns of the stock market index S&P 500

6.3.1. Models with the assumption of investors with rational expectations

In this part of the analyses, investors are assumed to have rational expectations, meaning values announced by global organizations and journals are takes as expected macroeconomic indicator values.

Tables below represent results of regression analyses without differentiating between positive and negative surprises.

Tables 6.8. and 6.9. show that, CPI surprises have significant positive impacts on S&P 500 return rates, while the square of the CPI surprises has no significant impacts. GDP Growth also has significant positive impacts on return rates of S&P 500. Unemployment surprises also create positive return rates and the impacts are quadratic.

Table 6.8. Surprise impacts on the rates of returns of the stock market indices

	S&P 500		**N225**		**FTSE 100**		**SSE**		**ASX 200**		**BVSP**	
Mean Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	9.65E-06	0.0000***	1.85E-06	0.3553	3.40E-06	0.0017***	1.22E-05	0.0002***	0.0000	0.0169**	7.15E-06	0.0005***
CPI Surprise	0.0137	0.0005***	0.0183	0.0126**	-0.00326	0.3446	-0.00773	0.0006***	-0.00347	0.4987	0.00261	0.8302
GDPG Surprise	0.0216	0.0000***	0.0468	0.0000***	0.0135	0.0003***	-0.00136	0.5801	-0.0374	0.0000***	0.0105	0.4065
Unemployment Surprise	0.00567	0.5453	0.0597	0.0003***	-0.0706	0.0000***	-0.00516	0.2134	-0.00638	0.3823	-0.00239	0.9187
Variance Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	-0.1003	0.0000***	-0.0493	0.0000***	-0.3807	0.0000***	-0.0903	0.0000***	-0.5073	0.0000***	-0.4638	0.0000***
$\lvert e_{-1}\rvert/\sigma_{-1}^{-0.5}$	0.0953	0.0000***	0.0612	0.0000***	0.1984	0.0000***	0.0880	0.0000***	0.5225	0.0000***	0.3240	0.0000***
$\lvert e_{-2}\rvert/\sigma_{-2}^{-0.5}$									-0.2811	0.0000***	-0.1091	0.0000***
$(e_{-1})/\sigma_{-1}^{-0.5}$	-0.0284	0.0000***	-0.0198	0.0000***	-0.0287	0.0000***	-0.0197	0.0000***	-0.0096	0.0000***	-0.0163	0.0000***
$\ln(\sigma^2_{-1})$	0.9975	0.0000***	0.9988	0.0000***	0.9828	0.0000***	0.9977	0.0000***	0.9755	0.0000***	0.9757	0.0000***
Autocorrelation test	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value
1st order	0.0050	0.041	0.0300	0.0000	0.0160	0.0000	0.0160	0.0000	0.0640	0.0000	0.0610	0.0000
2nd order	-0.0070	0.001	-0.0040	0.0000	-0.0090	0.0000	0.0000	0.0000	0.0030	0.0000	-0.0050	0.0000
3rd order	0.0040	0.0010	0.0050	0.0000	0.0040	0.0000	-0.0120	0.0000	-0.0030	0.0000	-0.0040	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value
ARCH LM	0.4700	0.4930	0.9825	0.3216	0.6774	0.4105	1.2617	0.2613	0.0258	0.8724	0.0900	0.7642

Table 6.9. Squared surprise impacts on the rates of returns of the stock market indices

	S&P 500		**N225**		**FTSE 100**		**SSE**		**ASX 200**		**BVSP**	
Mean Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	0.0000	0.0000***	0.0000	0.3849	0.0000	0.0015***	0.0000	0.0003***	0.0000	0.0183**	7.12E-06	0.0005***
$(CPI\ Surprise)^2$	-0.1330	0.5483	5.4200	0.0000***	-0.2570	0.1977	-0.2680	0.0383	0.7860	0.0018***	0.2380	0.7497
$(GDPG\ Surprise)^2$	-0.0707	0.7793	-2.1300	0.0004***	-0.9100	0.0004***	0.0791	0.6071	2.8700	0.0000***	1.7600	0.0451**
$(Unemployment\ Surprise)^2$	3.0100	0.029**	11.1500	0.0000***	6.6500	0.0000***	0.4480	0.4608	6.2700	0.0000***	4.0600	0.3533
Variance Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	-0.1003	0.0000***	-0.0492	0.0000***	-0.3805	0.0000***	-0.0903	0.0000***	-0.5082	0.0000***	-0.4639	0.0000***
$\lvert e_{-1}\rvert/\sigma_{-1}^{-0.5}$	0.0954	0.0000***	0.0611	0.0000***	0.1983	0.0000***	0.0880	0.0000***	0.5225	0.0000***	0.3239	0.0000***
$\lvert e_{-2}\rvert/\sigma_{-2}^{-0.5}$									-0.2810	0.0000***	-0.1090	0.0000***
$(e_{-1})/\sigma_{-1}^{-0.5}$	-0.0284	0.0000***	-0.0198	0.0000***	-0.0287	0.0000***	-0.0197	0.0000***	-0.0094	0.0000***	-0.0162	0.0000***
$\ln(\sigma^2_{-1})$	0.9974	0.0000***	0.9988	0.0000***	0.9828	0.0000***	0.9977	0.0000***	0.9755	0.0000***	0.9757	0.0000***
Autocorrelation test	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value
1st order	0.0050	0.0410	0.0290	0.0000	0.0160	0.0000	0.0160	0.0000	0.0640	0.0000	0.0610	0.0000
2nd order	-0.0070	0.0010	-0.0040	0.0000	-0.0090	0.0000	0.0000	0.0000	0.0030	0.0000	-0.0050	0.0000
3rd order	0.0040	0.0010	0.0050	0.0000	0.0040	0.0000	-0.0120	0.0000	-0.0030	0.0000	-0.0040	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value
ARCH LM	0.4709	0.4926	0.9878	0.3203	0.6808	0.4093	1.2675	0.2602	0.0267	0.8701	0.0908	0.7631

It can be seen from Tables 6.8. and 6.9. that, impacts of CPI surprise and squared CPI surprise on N225 return rate is positive. GDP Growth surprises have positive impacts, but impacts of squared surprises are negative. Coefficients for unemployment surprises, their squares are positive.

Tables 6.8. and 6.9. show that, CPI surprises have no statistically significant impacts on FTSE 100 return rates. GDP Growth surprises have positive impacts, but impacts of squared surprises are negative. We can see from Tables 6.10. and 6.11. that, all three indicators affect the volatility of return rates.

Tables 6.8. and 6.9. show that, only the impacts of CPI surprises on SSE return rates is statistically significant. The volatility of SSE return rates is significantly affected by the square of CPI announcements which can be seen from Tables 6.10. and 6.11.

Tables 6.9. and 6.9. show that, square of CPI surprise is a significant explanatory variable for ASX 200 return rates with a positive coefficient. Both GDP Growth surprises (negatively) and squared GDP Growth surprises (positively) significantly affect the return rates. Square of Unemployment surprises has a positive impact on return rates. We can see from Tables 6.10. and 6.11. that squares of all three indicators have statistically significant positive impacts on return rate volatility.

Only the square of GDP Growth surprise is a significant positive explanatory variable for BVSP return rates which can be seen in Table 6.9. When it comes to volatility, none of the variables have significant positive impacts, as represented in Tables 6.10. and 6.11.

Table 6.10. Surprise impacts on the volatilities of the rates of returns of the stock market indices

	S&P 500		**N225**		**FTSE 100**		**SSE**		**ASX 200**		**BVSP**	
Mean Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	0.0000	0.0000***	0.0000	0.3578	0.0000	0.0016***	0.0000	0.0003***	0.0000	0.2970	7.15E-06	0.0005***
Variance Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	-0.1002	0.0000***	-0.0497	0.0000***	-0.3801	0.0000***	-0.0908	0.0000***	-0.5085	0.0000***	-0.4625	0.0000***
$\lvert e_{-1}\rvert/\sigma_{-1}^{-0.5}$	0.0954	0.0000***	0.0611	0.0000***	0.1982	0.0000***	0.0881	0.0000***	0.5223	0.0000***	0.3240	0.0000***
$\lvert e_{-2}\rvert/\sigma_{-2}^{-0.5}$									-0.2809	0.0000***	-0.1093	0.0000***
$(e_{-1})/\sigma_{-1}^{-0.5}$	-0.0284	0.0000***	-0.0198	0.0000***	-0.0287	0.0000***	-0.0197	0.0000***	-0.0103	0.0000***	-0.0163	0.0000***
$\ln(\sigma_{-1}^2)$	0.9975	0.0000***	0.9988	0.0000***	0.9828	0.0000***	0.9977	0.0000***	0.9754	0.0000***	0.9757	0.0000***
CPI Surprise	2.3453	0.3440	-6.6854	0.0028***	10.2771	0.0038***	-0.0558	0.6716	0.9910	0.7881	-15.3194	0.0094***
GDPG Surprise	1.8497	0.5657	-0.7041	0.8190	0.0757	0.9864	0.2480	0.1356	-5.5428	0.1548	8.3213	0.2291
Unemployment Surprise	-5.5201	0.2860	10.7690	0.0094***	-14.1453	0.0417**	0.5384	0.0356**	-0.5462	0.9425	-13.6624	0.3026
Autocorrelation test	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value
1st order	0.0050	0.0370	0.0300	0.0000	0.0160	0.0000	0.0160	0.0000	0.0640	0.0000	0.0610	0.0000
2nd order	-0.0070	0.0010	-0.0040	0.0000	-0.0090	0.0000	0.0000	0.0000	0.0030	0.0000	-0.0050	0.0000
3rd order	0.0040	0.0010	0.0050	0.0000	0.0040	0.0000	-0.0120	0.0000	-0.0030	0.0000	-0.0040	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value
ARCH LM	0.4752	0.4906	0.9931	0.3190	0.7066	0.4006	1.2698	0.2598	0.0264	0.8710	0.0893	0.7651

Table 6.11. Squared surprise impacts on the volatilities of the rates of returns of the stock market indices

	S&P 500		**N225**		**FTSE 100**		**SSE**		**ASX 200**		**BVSP**	
Mean Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	0.0000	0.0000***	0.0000	0.3590	0.0000	0.0016***	0.0000	0.0002***	0.0000	0.3029	7.15E-06	0.0005***
Variance Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	-0.1018	0.0000***	-0.0502	0.0000***	-0.3779	0.0000***	-0.0909	0.0000***	-0.5155	0.0000***	-0.4600	0.0000***
$\lvert e_{-1}\rvert/\sigma_{-1}^{-0.5}$	0.0953	0.0000***	0.0611	0.0000***	0.1962	0.0000***	0.0880	0.0000***	0.5215	0.0000***	0.3239	0.0000***
$\lvert e_{-2}\rvert/\sigma_{-2}^{-0.5}$									-0.2800	0.0000***	-0.1097	0.0000***
$(e_{-1})/\sigma_{-1}^{-0.5}$	-0.0285	0.0000***	-0.0200	0.0000***	-0.0286	0.0000***	-0.0196	0.0000***	-0.0106	0.0000***	-0.0164	0.0000***
$\ln(\sigma_{-1}^2)$	0.9974	0.0000***	0.9987	0.0000***	0.9829	0.0000***	0.9977	0.0000***	0.9750	0.0000***	0.9759	0.0000***
$(CPI\ Surprise)^2$	316.100	0.0183**	340.060	0.0019***	1330.02	0.0000***	12.4500	0.0576*	854.860	0.0000***	-1475.21	0.0000***
$(GDPG\ Surprise)^2$	609.380	0.0014***	298.670	0.0909*	1355.25	0.0000***	9.2500	0.2989	913.450	0.0001***	-535.960	0.2802
$(Unemployment\ Surprise)^2$	1969.27	0.0002***	777.300	0.0599*	7524.50	0.0000***	28.1200	0.3933	6657.88	0.0000***	1436.33	0.5390
Autocorrelation test	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value
1st order	0.0050	0.0370	0.0300	0.0000	0.0160	0.0000	0.0160	0.0000	0.0630	0.0000	0.0610	0.0000
2nd order	-0.0070	0.0010	-0.0040	0.0000	-0.0090	0.0000	0.0000	0.0000	0.0030	0.0000	-0.0050	0.0000
3rd order	0.0040	0.0010	0.0050	0.0000	0.0040	0.0000	-0.0120	0.0000	-0.0030	0.0000	-0.0040	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value
ARCH LM	0.4802	0.4883	0.9770	0.3229	0.7087	0.3999	1.2544	0.2627	0.0252	0.8738	0.0888	0.7657

Tables below represent results of regression analyses on return rates and volatilities of 6 indices this time assuming different reactions to positive and negative macroeconomic announcement surprises.

Differentiating between positive and negative surprises, we can see from Tables 6.12., 6.13. that, impacts of negative CPI surprises on S&P 500 return rates is positive while squared negative surprises have a negative effect. Positive surprises, on the other hand, show significant positive quadratic impacts on return rates.

For N225 return rates, the impacts of large negative CPI surprises are negative. But for negative surprises with smaller absolute value, it is vice versa. Impacts of positive surprises are positive. As the absolute value of negative GDP Growth surprises gets larger, the return rates of N225 decrease. Positive GDP Growth surprises have a positive quadratic effect on N225 return rates.

Coefficient showing the impacts of positive unemployment surprises and squared positive surprises are significant and positive on N225 returns. Only negative CPI and positive unemployment surprises have significant impacts on return rate volatility and this can be seen in Tables 6.14. and 6.15.

Table 6.12. Surprise impacts on the rates of returns of the stock market indices

	S&P 500		**N225**		**FTSE 100**		**SSE**		**ASX 200**		**BVSP**	
Mean Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	0.0000	0.0000***	0.0000	0.3856	0.0000	0.0016***	0.0000	0.0002***	0.0000	0.2676	0.0000	0.0005***
Negative CPI Surprise	0.0325	0.0000***	-0.1299	0.0000***	-0.0007	0.8951	-0.0025	0.4956	-0.0159	0.0082***	0.0002	0.9910
Positive CPI Surprise	0.0085	0.1308	0.0373	0.0005***	-0.0053	0.2488	-0.0103	0.0003***	0.0482	0.0000***	0.0050	0.7510
Negative GDPG Surprise	0.0196	0.0001***	0.0562	0.0000***	0.0211	0.0000***	-0.0014	0.6449	-0.0407	0.0000***	-0.0027	0.8609
Positive GDPG Surprise	0.0263	0.0011***	0.0163	0.2140	0.0068	0.2947	-0.0013	0.7706	-0.0152	0.0802*	0.0324	0.1381
Negative Unemployment Surprise	-0.0089	0.3826	0.0089	0.6761	-0.0774	0.0000***	-0.0057	0.2422	-0.0322	0.0003***	-0.0048	0.8463
Positive Unemployment Surprise	0.0471	0.0503*	0.3414	0.0000***	-0.0069	0.7250	-0.0034	0.6708	0.3593	0.0000***	0.0100	0.8813
Variance Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	-0.1002	0.0000***	-0.0492	0.0000***	-0.3807	0.0000***	-0.0903	0.0000***	-0.5076	0.0000***	-0.4639	0.0000***
$\lvert e_{-1}\rvert/\sigma_{-1}^{-0.5}$	0.0953	0.0000***	0.0611	0.0000***	0.1983	0.0000***	0.0881	0.0000***	0.5217	0.0000***	0.3240	0.0000***
$\lvert e_{-2}\rvert/\sigma_{-2}^{-0.5}$									-0.2806	0.0000***	-0.1091	0.0000***
$(e_{-1})/\sigma_{-1}^{-0.5}$	-0.0284	0.0000***	-0.0197	0.0000***	-0.0287	0.0000***	-0.0197	0.0000***	-0.0101	0.0000***	-0.0162	0.0000***
$\ln(\sigma^2_{-1})$	0.9975	0.0000***	0.9988	0.0000***	0.9828	0.0000***	0.9977	0.0000***	0.9755	0.0000***	0.9757	0.0000***
Autocorrelation test	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value
1st order	0.0050	0.0430	0.0290	0.0000	0.0160	0.0000	0.0160	0.0000	0.0630	0.0000	0.0610	0.0000
2nd order	-0.0070	0.0010	-0.0040	0.0000	-0.0090	0.0000	0.0000	0.0000	0.0030	0.0000	-0.0050	0.0000
3rd order	0.0040	0.0010	0.0050	0.0000	0.0040	0.0000	-0.0120	0.0000	-0.0030	0.0000	-0.0040	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value
ARCH LM	0.4663	0.4947	0.9852	0.3209	0.6806	0.4094	1.2668	0.2604	0.0272	0.8690	0.0901	0.7641

Table 6.13. Squared surprise impacts on the rates of returns of the stock market indices

	S&P 500		**N225**		**FTSE 100**		**SSE**		**ASX 200**		**BVSP**	
Mean Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	0.0000	0.0000***	0.0000	0.0325**	0.0000	0.0015***	0.0000	0.0002***	0.0000	0.0191**	0.0000	0.0006***
$(Negative\ CPI\ Surprise)^2$	-2.0800	0.0000***	6.3400	0.0000***	-0.1340	0.6074	0.1070	0.5480	0.4510	0.1393	-0.1230	0.9024
$(Positive\ CPI\ Surprise)^2$	0.6910	0.0663*	5.0000	0.0000***	-0.3840	0.2138	-0.6240	0.0009***	8.6100	0.0000***	0.8040	0.4579
$(Negative\ GDPG\ Surprise)^2$	-1.3100	0.0001***	-2.3900	0.017**	-2.1400	0.0000***	0.0997	0.5750	2.9700	0.0000***	0.9960	0.3002
$(Positive\ GDPG\ Surprise)^2$	0.6120	0.2291	1.7700	0.0645*	0.5260	0.1610	-0.0096	0.9750	-2.2200	0.0008***	5.5600	0.001***
$(Negative\ UnemploymentSurprise)^2$	3.0400	0.0844*	0.2080	0.9627	13.1700	0.0000***	0.7500	0.3232	5.5300	0.0006***	3.8100	0.4084
$(Positive\ UnemploymentSurprise)^2$	3.0300	0.1722	29.6600	0.0000***	-1.0800	0.4791	-0.3890	0.6973	7.2500	0.0000***	5.6400	0.6851
Variance Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	-0.1003	0.0000***	-0.1236	0.0000***	-0.3807	0.0000***	-0.0903	0.0000***	-0.5075	0.0000***	-0.4644	0.0000***
$\lvert e_{-1}\rvert/\sigma_{-1}^{-0.5}$	0.0954	0.0000***	0.1823	0.0000***	0.1983	0.0000***	0.0880	0.0000***	0.5219	0.0000***	0.3240	0.0000***
$\lvert e_{-2}\rvert/\sigma_{-2}^{-0.5}$									-0.2805	0.0000***	-0.1090	0.0000***
$(e_{-1})/\sigma_{-1}^{-0.5}$	-0.0284	0.0000***	-0.0374	0.0000***	-0.0287	0.0000***	-0.0197	0.0000***	-0.0093	0.0000***	-0.0162	0.0000***
$\ln(\sigma_{-1}^2)$	0.9975	0.0000***	0.9969	0.0000***	0.9828	0.0000***	0.9977	0.0000***	0.9755	0.0000***	0.9756	0.0000***
Autocorrelation test	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value
1st order	0.0050	0.0440	0.0200	0.0000	0.0160	0.0000	0.0160	0.0000	0.0630	0.0000	0.0610	0.0000
2nd order	-0.0070	0.0010	-0.0040	0.0000	-0.0090	0.0000	0.0000	0.0000	0.0030	0.0000	-0.0050	0.0000
3rd order	0.0040	0.0010	0.0030	0.0000	0.0040	0.0000	-0.0120	0.0000	-0.0030	0.0000	-0.0040	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value
ARCH LM	0.4675	0.4941	0.8835	0.3472	0.6811	0.4092	1.2615	0.2614	0.0258	0.8724	0.0899	0.7643

Table 6.14. Surprise impacts on the volatilities of the rates of returns of the stock market indices

	S&P 500		**N225**		**FTSE 100**		**SSE**		**ASX 200**		**BVSP**	
Mean Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	0.0000	0.0000***	0.0000	0.3588	0.0000	0.0018***	0.0000	0.0003***	0.0000	0.3191	0.0000	0.0005***
Variance Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	-0.1029	0.0000***	-0.0503	0.0000***	-0.3718	0.0000***	-0.0911	0.0000***	-0.5242	0.0000***	-0.4570	0.0000***
$\lvert e_{-1}\rvert/\sigma_{-1}^{-0.5}$	0.0956	0.0000***	0.0610	0.0000***	0.1937	0.0000***	0.0881	0.0000***	0.5205	0.0000***	0.3239	0.0000***
$\lvert e_{-2}\rvert/\sigma_{-2}^{-0.5}$									-0.2782	0.0000***	-0.1101	0.0000***
$(e_{-1})/\sigma_{-1}^{-0.5}$	-0.0286	0.0000***	-0.0200	0.0000***	-0.0287	0.0000***	-0.0196	0.0000***	-0.0108	0.0000***	-0.0165	0.0000***
$\ln(\sigma_{-1}^2)$	0.9973	0.0000***	0.9987	0.0000***	0.9832	0.0000***	0.9976	0.0000***	0.9745	0.0000***	0.9761	0.0000***
Negative CPI Surprise	-8.3239	0.0406**	-16.6595	0.0000***	-26.9361	0.0000***	-35.1000	0.089**	-17.0254	0.0003***	10.4887	0.2281
Positive CPI Surprise	10.5925	0.001***	0.0378	0.9899	33.9377	0.0000***	18.2600	0.2940	39.0672	0.0000***	-40.1885	0.0000***
Negative GDPG Surprise	-15.1256	0.0017***	-6.4962	0.1446	-38.3511	0.0000***	11.3900	0.6381	-20.6736	0.0001***	12.7994	0.1307
Positive GDPG Surprise	15.7905	0.0008***	4.2542	0.3251	38.8820	0.0000***	38.7300	0.0946**	21.4201	0.0009***	-3.1733	0.7798
Negative Unemployment Surprise	-42.8815	0.0000***	5.0978	0.4332	-128.00	0.0000***	60.0800	0.0926**	-88.1289	0.0000***	-8.5567	0.5441
Positive Unemployment Surprise	23.1791	0.0013***	14.6772	0.0073***	99.8131	0.0000***	47.4000	0.2083	82.1040	0.0000***	-34.8740	0.3344
Autocorrelation test	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value
1st order	0.0050	0.0360	0.0290	0.0000	0.0160	0.0000	0.0160	0.0000	0.0630	0.0000	0.0610	0.0000
2nd order	-0.0070	0.0010	-0.0040	0.0000	-0.0090	0.0000	0.0000	0.0000	0.0030	0.0000	-0.0050	0.0000
3rd order	0.0040	0.0010	0.0050	0.0000	0.0040	0.0000	-0.0120	0.0000	-0.0030	0.0000	-0.0040	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value
ARCH LM	0.4963	0.4811	0.9831	0.3214	0.7615	0.3829	1.2583	0.2620	0.0231	0.8793	0.0880	0.7668

Tables 6.12. and 6.13. show that, as the absolute value of negative GDP Growth surprises gets larger, the return rates of FTSE 100 decrease. Only negative Unemployment surprises have significant impacts on FTSE 100 return rates.

The volatility of SSE return rates increases by the impacts of positive GDP Growth and negative unemployment surprises which is represented in Tables 6.14. and 6.15.

Impacts of GDP Growth surprises on BVSP returns is mostly because of positive GDP Growth surprises. These results can be found in Tables 6.12. and 6.13.

Table 6.15. Squared surprise impacts on the volatilities of the rates of returns of the stock market indices

	S&P 500		**N225**		**FTSE 100**		**SSE**		**ASX 200**		**BVSP**	
Mean Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	0.0000	0.0000***	0.0000	0.3614	0.0000	0.0016***	0.0000	0.0002***	0.0000	0.0194**	0.0000	0.0005
Variance Equation	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	-0.1017	0.0000***	-0.0502	0.0000***	-0.3765	0.0000***	-0.0913	0.0000***	-0.5193	0.0000***	-0.4575	0.0000***
$\lvert e_{-1}\rvert/\sigma_{-1}^{-0.5}$	0.0954	0.0000***	0.0610	0.0000***	0.1958	0.0000***	0.0880	0.0000***	0.5213	0.0000***	0.3240	0.0000***
$\lvert e_{-2}\rvert/\sigma_{-2}^{-0.5}$									-0.2790	0.0000***	-0.1101	0.0000***
$(e_{-1})/\sigma_{-1}^{-0.5}$	-0.0285	0.0000***	-0.0199	0.0000***	-0.0286	0.0000***	-0.0196	0.0000***	-0.0097	0.0000***	-0.0165	0.0000***
$\ln(\sigma_{-1}^2)$	0.9974	0.0000***	0.9987	0.0000***	0.9830	0.0000***	0.9976	0.0000***	0.9748	0.0000***	0.9761	0.0000***
$(Negative\ CPI\ Surprise)^2$	169.22	0.3777	640.7800	0.0000***	954.8300	0.0009***	10.76	0.2263	501.11	0.0218**	-181.26	0.7048
$(Positive\ CPI\ Surprise)^2$	507.29	0.007***	11.5500	0.9437	1760.30	0.0000***	14.84	0.1231	2110.86	0.0000***	-3231.96	0.0000***
$(Negative\ GDPG\ Surprise)^2$	896.83	0.0044***	216.7700	0.4370	1553.90	0.0001***	-9.33	0.5294	1004.13	0.001***	-846.97	0.1314
$(Positive\ GDPG\ Surprise)^2$	495.32	0.0369**	340.5900	0.1340	1229.23	0.0006***	22.54	0.041**	773.72	0.0377	1483.14	0.1716
$(Negative\ UnemploymentSurprise)^2$	5991.00	0.0000***	-1088.5100	0.2974	17656.52	0.0000***	-55.34	0.3374	16006.38	0.0000***	2670.24	0.2784
$(Positive\ UnemploymentSurprise)^2$	1357.07	0.0186**	1063.2300	0.0173**	5689.53	0.0000***	62.30	0.1204	5472.15	0.0000***	-6073.45	0.4178
Autocorrelation test	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value	AC	P Value
1st order	0.0050	0.0360	0.0300	0.0000	0.0160	0.0000	0.0160	0.0000	0.0630	0.0000	0.0610	0.0000
2nd order	-0.0070	0.0010	-0.0040	0.0000	-0.0090	0.0000	0.0000	0.0000	0.0030	0.0000	-0.0050	0.0000
3rd order	0.0040	0.0010	0.0050	0.0000	0.0040	0.0000	-0.0120	0.0000	-0.0030	0.0000	-0.0040	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value	F Value	P Value
ARCH LM	0.4853	0.4860	0.9877	0.3203	0.7447	0.3881	1.2590	0.2618	0.0215	0.8834	0.0872	0.7678

ARCH LM test results represented in the table show that the null hypothesis of the existence of heteroscedasticity can be rejected at 10% in all the cases. Also, looking at Ljung-Box Test Q statistics values, serial correlation of residuals is either significantly close to zero or very low. Thus, we can assume that there is no serial autocorrelation.

All models exhibit stationary variances as the coefficients of $\ln(\sigma_{t-1}^2)$ terms in variance equations are always below 1.

6.3.2. Models with the assumption of investors with adaptive expectations

This part of the analyses calculates surprise assuming investors with adaptive expectations and only deals with S&P 500 return rates and return rate volatility without differentiating between positive and negative surprises. Tables 6.16. and 6.17. below show the results of regression analyses.

Table 6.16. Surprise and squared surprise impacts on the rates of returns of the stock market index S&P 500

Mean Equation	Coefficient	P Value	*Mean Equation*	Coefficient	P Value
Intercept	9.78E-06	0.0000***	Intercept	9.67E-06	0.0000***
CPI Surprise	0.0128	0.0000***	$(CPI\ Surprise)^2$	-0.2650	0.0004***
GDPG Surprise	0.0080	0.0000***	$(GDPG\ Surprise)^2$	0.0250	0.4756
Unemployment Surprise	0.0005	0.3744	$(Unemployment\ Surprise)^2$	0.0327	0.0000***
Variance Equation	Coefficient	P Value	Variance Equation	Coefficient	P Value
Intercept	-0.1000	0.0000***	*Intercept*	-0.1003	0.0000***
$\lvert e_{-1}\rvert/\sigma_{-1}^{-0.5}$	0.0952	0.0000***	$\lvert e_{-1}\rvert/\sigma_{-1}^{-0.5}$	0.0954	0.0000***
$(e_{-1})/\sigma_{-1}^{-0.5}$	-0.0283	0.0000***	$(e_{-1})/\sigma_{-1}^{-0.5}$	-0.0284	0.0000***
$\ln(\sigma_{-1}^2)$	0.9975	0.0000***	$\ln(\sigma_{-1}^2)$	0.9974	0.0000***
Autocorrelation test	AC	P Value	*Autocorrelation test*	AC	P Value
1st order	0.0050	0.0380	1st order	0.0050	0.0380
2nd order	-0.0070	0.0010	2nd order	-0.0070	0.0010
3rd order	0.0040	0.0010	3rd order	0.0040	0.0010
Heteroscedasticity test	F Value	P Value	*Heteroscedasticity test*	F Value	P Value
ARCH LM	0.4724	0.4919	ARCH LM	0.4722	0.4920

Table 6.16. shows that, both CPI surprises (positively) and the square of CPI surprises (negatively) are significant explanatory variables for S&P 500 return rates.

Table 6.17. Regression results for surprise and squared surprise impacts on S&P 500 return rate volatility assuming adaptive expectations

Mean Equation	Coefficient	P Value	*Mean Equation*	Coefficient	P Value
Intercept	9.60E-06	0.0000***	Intercept	9.64E-06	0.0000***
Variance Equation	Coefficient	P Value	Variance Equation	Coefficient	P Value
Intercept	-0.1013	0.0000***	*Intercept*	-0.1033	0.0000***
$\lvert e_{-1}\rvert/\sigma_{-1}^{-0.5}$	0.0950	0.0000***	$\lvert e_{-1}\rvert/\sigma_{-1}^{-0.5}$	0.0959	0.0000***
$(e_{-1})/\sigma_{-1}^{-0.5}$	-0.0287	0.0000***	$(e_{-1})/\sigma_{-1}^{-0.5}$	-0.0286	0.0000***
$\ln(\sigma_{-1}^2)$	0.9974	0.0000***	$\ln(\sigma_{-1}^2)$	0.9973	0.0000***
CPI Surprise	98.3796	0.0000***	$(CPI\ Surprise)^2$	133.1400	0.0000***
GDPG Surprise	35.8000	0.0000***	$(GDPG\ Surprise)^2$	53.4300	0.0098***
Unemployment Surprise	44.7565	0.0000***	$(Unemployment\ Surprise)^2$	23.1000	0.0000***
Autocorrelation test	AC	P Value	*Autocorrelation test*	AC	P Value
1st order	0.0050	0.0380	1st order	0.0050	0.0380
2nd order	-0.0070	0.0010	2nd order	-0.0070	0.0010
3rd order	0.0040	0.0010	3rd order	0.0040	0.0010
Heteroscedasticity test	F Value	P Value	*Heteroscedasticity test*	F Value	P Value
ARCH LM	0.3045	0.5810	ARCH LM	0.4830	0.4871

GDP Growth surprise has positive significant impacts on return rates of S&P 500. Square of Unemployment is also a positive significant variable for return rates.

All three indicators have significant positive impacts on return rate volatility of S&P 500 as can be seen in Table 6.17. The impacts of the squares of all three indicators are also positive and significant.

ARCH LM test results represented in the table show that the null hypothesis of the existence of heteroscedasticity can be rejected at 10% in all the cases.

Based on Ljung-Box Test Q statistics values, it can be concluded that serial autocorrelation of residuals is either significantly close to zero or very low. Thus, we can assume that there is no serial autocorrelation.

All models exhibit stationary variances as the coefficients of $\ln(\sigma_{t-1}^2)$ terms in variance equations are always below 1.

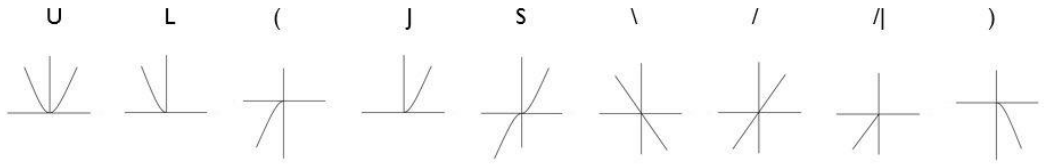
6.4. Results and findings from intraday index return rates and volatility analyses

6.4.1. Summary of results

6.4.1.1. Results from the models assuming rational expectations

Table 6.18. shows general form of impacts of each macroeconomic variable on the intraday rate of return and volatility of each stock index. The graphs illustrated are not numerically exact, but shows general tendency of the style of impacts. Each type of graph is nominated by a symbol and the table below represents those symbols.

Table 6.18. Type of the impacts of each macroeconomic variable on each stock index



Return Rate	S&P 500	ASX 200	N225	FTSE 100	SSE	BVSP
CPI	S	U	U		)	
GDPG	/	\	S	(		J
Unemp	L	U	U	L		
Volatility						
CPI	U	U	L	U	U	
GDPG	U	U		U	J	
Unemp	U	U	J	U	/|	

CPI surprises have significant positive impacts on S&P 500 return rates, while the square of the CPI surprises has no significant impacts. Differentiating between positive and negative surprises, we can see that, impacts of negative surprises is positive while squared negative surprises have a negative effect. Meaning, the larger the absolute value of negative surprise is, the more it will affect return rates negatively. Positive surprises, on the other hand, show significant positive quadratic impacts on return rates. The Consumer Price Index having significant impacts on US stock market is also supported by Kim, McKenzie, Faff (2004). But they do not focus on the information content of news announcements. Instead, they use

announcement dates as positive and negative dummy variables and identify impacts on daily return rates and volatilities.

GDP Growth also has significant positive impacts on return rates. The style of impacts remains the same when looked negative and positive surprises separately.

Unemployment surprises also create positive return rates and the impacts are quadratic. This effect is mostly due to negative surprises.

Birz and Lott (2008) also show that GDP growth and unemployment announcements have significant impacts on stock return rates.

Surprises of the all three analysed indicators have positive quadratic impacts of return rate volatility of S&P 500. Both for positive and negative surprises of all three indicators, as the square of the surprise, gets larger, the volatility increases.

Impacts of CPI surprise and squared CPI surprise on N225 return rate is positive. Concluding results with separate analyses of positive and negative surprises, it appears that, the impacts of large negative surprises is negative, meaning the larger the absolute value of negative surprise, the higher the return rates. But for negative surprises with smaller absolute value, it is vice versa. Impacts of positive surprises are positive.

GDP Growth surprises have positive impacts, but impacts of squared surprises are negative. As the absolute value of negative GDP Growth surprises gets larger, the return rates decrease. Positive surprises have a positive quadratic effect on N225 return rates.

Coefficients for unemployment surprises, their squares, positive surprises and squared positive surprises are significant and positive. Meaning, negative surprises with larger absolute values and positive surprises increase the return rates as they get larger.

Only negative CPI and positive unemployment surprises have significant impacts on return rate volatility. Volatility increase as the surprise gets larger.

CPI surprises have no statistically significant impacts on FTSE 100 return rates.

GDP Growth surprises have positive impacts, but impacts of squared surprises are negative. As the absolute value of negative GDP Growth surprises gets larger, the return rates decrease. Positive surprises have no significant impacts on return rates.

Only negative Unemployment surprises have significant impacts on FTSE 100 return rates. As the surprise gets larger the return rates increase.

All three indicators affect the volatility of return rates. As the surprise gets larger the volatility increase, except for negative CPI surprises and positive Unemployment surprises with very small absolute values.

Findings by Becker, Finnerty, and Friedman (1995) suggested that reactions of UK stock market to US macroeconomic news are quite similar to reactions of US stock market. This idea is also supported by our analyses in terms of the impacts on return rate volatility and the effects of GDP growth and unemployment surprises on return rates.

Only the impacts of CPI surprises on SSE return rates is statistically significant. Coefficients of both CPI surprise and squared CPI surprise are negative. Looking at separate analyses of positive and negative surprises, we can see that the impacts are only related to positive CPI surprises, meaning when CPI in the US is higher than expected, return rates of SSE get lower or negative.

The volatility of SSE return rates is significantly affected by the square of CPI announcements. Volatility also increases by the impacts of positive GDP Growth and negative unemployment surprises.

Square of CPI surprise is a significant explanatory variable for ASX 200 return rates with a positive coefficient. Concluding all related analyses, we can say that, as the surprise gets larger, return rates of ASX 200 increase.

Both GDP Growth surprises (negatively) and squared GDP Growth surprises (positively) significantly affect the return rates. Analysing the impacts of positive and negative return rates separately, GDP Growth surprises are in negative relation

to ASX 200 return rates. Return rates get lower as negative surprises get close to zero and as positive surprises get larger.

Square of Unemployment surprises has a positive impact on return rates. All related analyses support the same idea. Return rates get higher as the surprises get larger in squared value.

Squares of all three indicators have statistically significant positive impacts on return rate volatility.

Only the square of GDP Growth surprise is a significant positive explanatory variable for BVSP return rates. And it is mostly due to the effect of positive GDP Growth surprises.

When it comes to volatility, none of the variables have significant positive impacts.

6.4.1.2. Results from the models under adaptive expectations

This part of the analyses only covers S&P 500 return rates and return rate volatility.

Both CPI surprises (positively) and the square of CPI surprises (negatively) are significant explanatory variables for S&P 500 return rates. Positive CPI surprise impacts are in line with the results achieved using the assumption of investors with rational expectation.

GDP Growth surprise has positive significant impacts on return rates of S&P 500, which is also supported by the result from previous part.

Square of Unemployment is also a positive significant variable for return rates. Again, the result coincides with the result from Chapter 5.4.1.

All three indicators have significant positive impacts on return rate volatility of S&P 500. The impacts of the squares of all three indicators are also positive and significant. Results from the analyses assuming investors with rational expectations were also like this one.

6.4.2. Findings

In Chapter 5 we mentioned that impacts of external news coming from the U.S. on China was expected to be low and the results from current analyses also supported this idea. Also, Brazil is a country with low public debt and large financial reserves. So, based on the results from the analyses of Chinese stock index, it was expected that the impacts of external news releases should be less in Brazil when compared to countries with high public debt. Results of the analyses also met our expectations about Brazil. When we look at the results regarding countries with high external debt and low financial reserves, we can see that the impacts of the surprises are significant most of the time. As mentioned before, these results were quite expected. Because, when countries have low debts and high international reserves, investors investing in their financial markets will have trust in the economy of those countries. When investors do not consider external news important enough to affect the market, then they will not make significant investments to create extraordinarily high or low returns. But we do not yet have enough facts to prove this claim. Further analyses to find the possible reasons behind differences in sensitivities of stock indices is available in Chapter 7.

Nowak et al. (2011) suggest that the impacts of surprises are in emerging markets are more significant on volatility rather than prices. This idea is also supported by our analyses but not only for emerging markets (China and Brazil) but for all countries analysed. Only analyses showed that impacts on the volatility of return rates have a higher number of significant variables than impacts on return rates for the local stock market of United States and for the UK and Australia stock markets which are all developed countries. These analyses can be taken further by doing a similar study on a higher number of countries to see whether this fact is true for all markets or only for our selection of countries.

Other than the results above, based on our analyses we can say that the size of the surprise is more important most of the time, rather than the sign of the surprise. This result comes from the fact that, most of the time the impacts on return rate volatilities and sometimes the impacts on return rates are quadratic. To our best knowledge, studies available analyze the impact of the surprise parts of the macroeconomic

announcements assuming the impacts will be linear. But our analyses of non-linearity revealed that absolute value of the surprise is more important than its real value. Meaning, as the surprise get larger, the return rates or return rate volatilities get higher.

The result discussed above brings us to some important conclusions. As discussed before, investors do not always interpret a news announcement in the same way. Same news can be accepted as good news for the stock market by some investors, while some might consider it as bad news. Results from our analyses show us the dominating thoughts about the news and we see that in some cases no matter an information is above or below the previously expected value, investors accept this as good news for the market. But sometimes, investors are able to decide between good and bad news.

In the United States, investors are clear when deciding whether an information is good or bad news for the market. They think that higher than expected CPI and higher than expected GDP Growth are both good news for the market, while they consider higher than expected unemployment rate to be bad news.

However, in Australian and Japanese stock markets the announced values of the U.S. CPI and unemployment rates, no matter if they are higher or lower than their previously expected values, are always considered as good news. The impacts of them on the return rates of ASX200 and N225 indices are quadratic. As investors always take the incoming news related to CPI and unemployment rates of US as good news, they increase their demand to get benefited from higher returns in all cases and this situation increases the prices and of course, return rates in the markets.

As mentioned before, findings by Becker, Finnerty, and Friedman (1995) suggested that reactions of UK stock market to US macroeconomic news are quite similar to reactions of the local stock market of the United States. This idea is also supported by our analyses in terms of the impacts on return rate volatility and the effects of GDP growth and unemployment surprises on return rates. Only the impact of the CPI rate on return rates is not significant for the UK while it is significant for the US. These results mean that, when GDP growth in the US is higher than expected,

then investors in UK stock market consider this as good news for their market. Also, when the unemployment rate is lower than expected in the US, investors take it as a good indicator for UK market.

The results of the analyses assuming adaptive expectations are quite like the ones assuming rational expectations. From this result, we can say that some investors are making their expectations based on rational thinking while others expect most recent official data to be repeated. Meaning, the rational and adaptive expectation types are not just a theory, but there are really some investors who build their expectations based on rational thinking and some others who assume that the previous values of macroeconomic indicators are better indicators of their future values.

Also, results related to the analyses of the adaptive expectations reveal that both types of investors have a similar interpretation of similar types of information. These results are only applicable to the U.S. stock market as we did not make similar analyses for the other countries. Further analyses in this area can be done to see whether both types of investors exist in other stock markets or not.

CHAPTER 7

REASONS BEHIND DIFFERENCES IN STOCK INDEX SENSITIVITIES

We realized that among our selected stock indices some are less sensitive to macroeconomic news coming from the US. This part of the thesis tries to indentify whether these variables have statistically significant impacts on stock market volatility. Other possible reasons for return rate volatility are also analysed. As mentioned before, to our best knowledge, this thesis is the first one to analyse the reasons for differences in stock index sensitivities.

To test for the possible reasons behind differences in stock index sensitivities we take the monthly averages of intraday EGARCH volatilities from the models estimated in Chapter 6.

Data used in this part forms a panel data for five countries and four economic indicators as explanatory variables. To make our analyses 3 panel data models are estimated. These are pooled OLS, Random effect and Fixed effect models. Random effects vary across individuals, while random effects are constant. Pooled OLS, on the other hand, does not take any of these effect into account. All 3 models are estimated to get more reliable results.

7.1. Data review of stock market sensitivity analyses

Data used for countries except the US forms a panel data for five countries and four economic indicators as explanatory variables for 10 years between 2007 and 2016.

EGARCH implied variances from the models with variance equation represented in Equation (5.14) are used as a proxy of stock market sensitivity. Figure 7.1. below show bar graphs of implied intraday variances.

Average monthly variances are calculated and used as dependent variable. In Table 7.1. descriptive statistics for pooled average variances can be found.

Table 7.1. Descriptive Statistics of averages variances

Average Variance	
Mean	1,4996E-05
Median	2,5375E-06
Minimum	4,6085E-07
Maximum	0,00031413
Std. Deviation	5,1437E-05
Kurtosis	26,1336465
Skewness	5,00213808

As explanatory variables, four macroeconomic ratios of all 5 countries are used. These are an external debt to GDP ratio, international reserves to GDP ratio, total trade with the US to GDP ratio, and trade balance with the US to GDP ratio. All four indicators of five countries and their GDPs are represented and compared in Chapter 2.

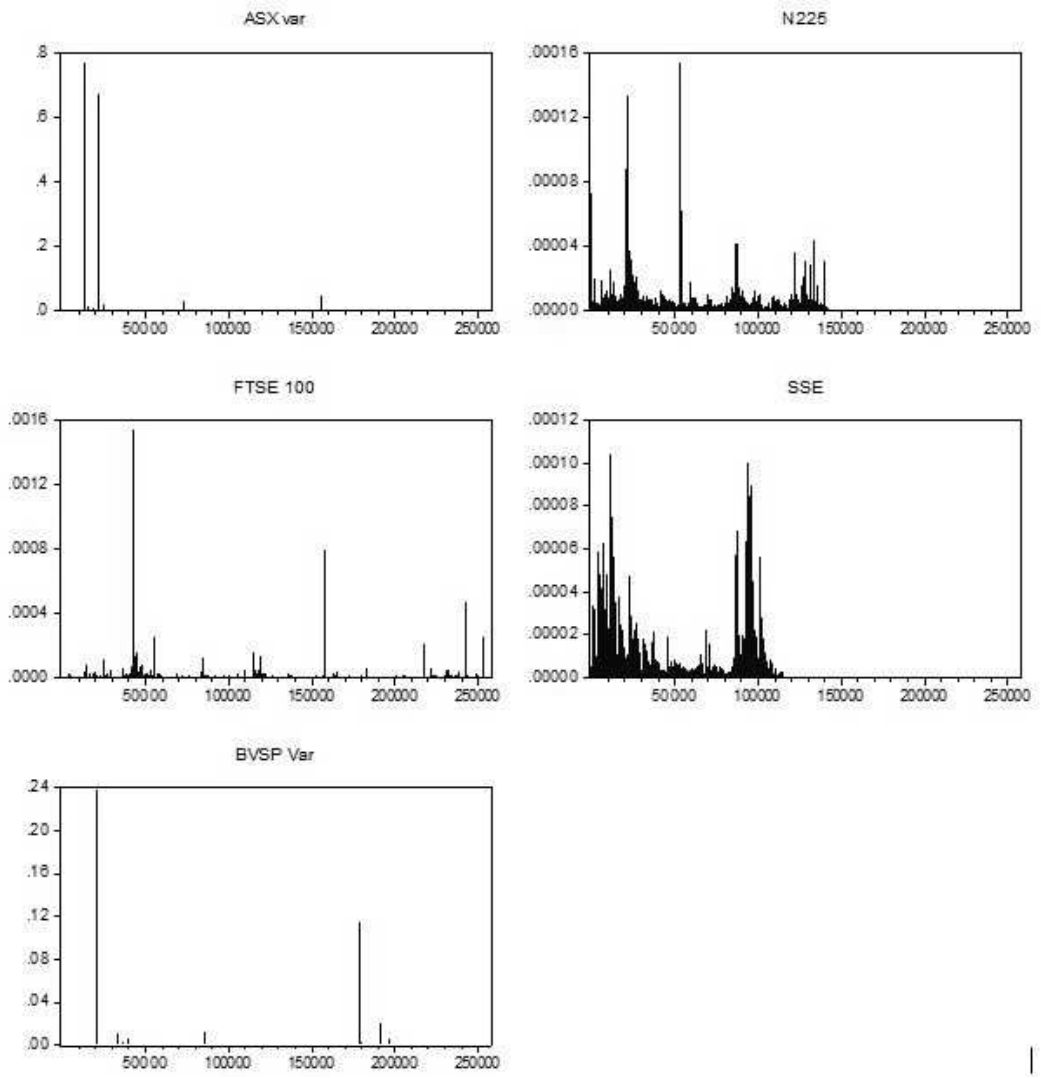


Figure 7.1. Bar graphs of implied intraday variances of ASX200, N225, FTSE 100, SSE and BVSP

Figure 7.1. shows that, return rates of Asian stock indices (SSE and N225) seem to have more volatile variances, while variances of the return rates of other stock indices are relatively stable.

The reasons of US stock market volatility are analyzed using a similar approach to the one used for other countries. GARCH (1,1) variances are calculated for daily S&P 500 return rates and used as the dependent variable as an indicator of stock market sensitivity.

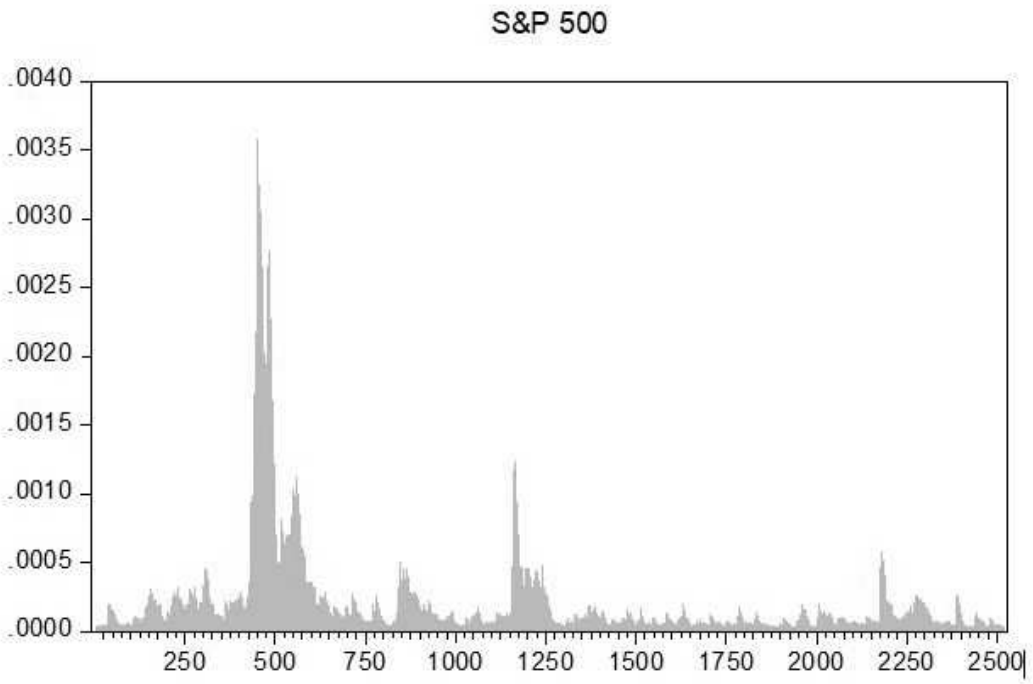


Figure 7.2. Bar graph of implied daily variances of S&P 500 between 2007-2016

During 2008, S&P 500 seems to have significantly higher return rate volatility when compared to other years.

Descriptive statistics of average monthly variances calculated from daily variances is represented in Table 7.2.

Table 7.2. Descriptive Statistics of S&P 500 monthly average variance

Avgerage Variance	
Mean	0,0002
Median	0,0001
Minimum	0,0000
Maximum	0,0024
Std. Deviation	0,0003
Kurtosis	29,655
Skewness	5,0568

Explanatory variables are four macroeconomic indicators of US which we think might affect stock market volatility. These are GDP, trade balance, external debt, and international reserves. Descriptive statistics of these indicators can be found in Table 7.3. below.

Table 7.3. Descriptive Statistics of US indicators (in million USD)

United States	GDP	Trade Balance	External Debt	Reserves	Total Trade
Mean	16094287,7	-44460,2	14619773,3	119442,3	384781
Median	15836590,5	-42479,5	15289540,3	127983,7	406076,5
Minimum	14418739,0	-66842,0	8707561,1	65063,4	277813
Maximum	18569100,0	-25372,0	19976827,0	153075,4	440916
Standard Deviation	1450607,9	8818,9	3495931,9	29904,2	45353,6
Kurtosis	-1,2867	0,0930	-1,2272	-0,9773	-0,4982
Skewness	0,3938	-0,6912	-0,3078	-0,7450	-0,8249

7.2. The methodology of stock market sensitivity analyses

Panel data analyses using various models are employed to determine whether the chosen macroeconomic variables affect stock market volatility or not.

The first model used is pooled OLS described as below:

$$\sigma^2_{average,t} = \alpha + \sum_{i=1}^{4} \beta_i R_{it} + \varepsilon_t, \qquad where\ \varepsilon_t \sim N(0, \sigma^2_\varepsilon), \qquad (7.1)$$

In (7.1) $\sigma^2_{average,t}$ is monthly average of intraday EGARCH variances at time *t*. R_{it} is the four macroeconomic ratios – external debt to GDP, international reserves to GDP, total trade with the US to GDP, and the trade balance with the US to GDP. ε_t is the error term and it is assumed to be normally distributed. White cross-section standard errors and covariance and Cross-section SUR (Davidson et al., 1993) weights are used for the model.

The second model used for analyses includes the same explanatory variables as in (7.1) but this time using cross-section Random Effect model. Again, White cross-section standard errors and covariance is used in the analyses.

The third model is also the same as the first two models, this time using cross-section Fixed Effect Model. White cross-section standard errors and covariance and Cross-section SUR weights are used for the model.

We expect the extent of relations with the US to have an impact on implied stock market volatility. Because the variances of the stock indices of all countries are estimated using a model which includes surprise news from the US

Also, based on the information from Chapter 5 and Chapter 6, it is expected that higher reserves and lower external debt might lead to a more stable stock market.

As mentioned before, monthly averages of daily GARCH variances are used as a proxy for the sensitivity of S&P 500 return rates for US anaylses. Standard GARCH (1,1) model is employed and it is as represented below:

$$r_t = \alpha + \beta r_{t-1} + \varepsilon_t \quad (7.2)$$

$$\sigma_t^2 = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 \sigma_{t-1}^2 \quad (7.3)$$

where (7.2) is mean equation and (7.3) is variance equation. r_t represents daily return rates of S&P 500 while σ_t^2 is its variance at time t. ε_t is the error term and is assumed to have Student's t distribution. r_{t-1} is added to the equation to avoid first order serial correlation. ARCH LM heteroscedasticity test is employed to test for remaining ARCH effects in the model and

To test the impacts of several factors on the volatility of S&P 500 return rates macroeconomic variables of United States are used as explanatory variables as discussed in Chapter 7.1. The general form of OLS model used is as follows:

$$\sigma_{average,t}^2 = \alpha + \sum_{i=1}^{5} \beta_i MI_{it} + \varepsilon_t, \qquad where\ \varepsilon_t \sim N(0, \sigma_\varepsilon^2), \qquad (7.4)$$

Here, $\sigma_{average,t}^2$ is monthly average of daily GARCH variances at time *t*. MI_{it} represents 5 macroeconomic indicators which are GDP, external debt, international reserves, total trade and trade balance. And ε_t is the error term and is assumed to be normally distributed. Newey-West standard errors & covariance is employed to avoid autocorrelation and heteroscedasticity problems.

7.3. Stock market sensitivity analyses

7.3.1. Analyses of the countries except for the U.S.

Table 7.4. below shows results of all three panel data regressions to test impacts of several macroeconomic ratios on average stock market volatility.

Table 7.4. Panel data analyses for countries except US

Average Variance	**Pooled OLS**		**Random Effect**		**Fixed Effect**	
	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	4.97E-06	0.2385	-5.09E-08	0.9975	0.0000	0.8218
External Debt to GDP	-6.25E-06	0,0243**	-1.61E-05	0,0182**	0.0000	0.1404
International Reserves to GDP	-0.0001	0,0024***	-0.0001	0,0454**	-0.0001	0,0203**
Total Trade with US to GDP	0.5172	0,0897*	1.4914	0,0155**	1.4108	0,0521*
Trade Balance with US to GDP	-0.1822	0.5529	-1.2230	0,0587*	-1.4188	0,0959*

Effect of external debt to GDP ratio on average variance is significant but surprisingly negative. International Reserves to GDP ratio and Trade Balance with the U.S. to GDP ratio also have a negative significant impact, while Total Trade with the U.S. to GDP ratio increase volatility.

International reserves and trade balance with the US also has significant negative impacts on volatility. Total trade with the US, on the other hand, affects the volatility positively.

7.3.2. Analyses of the U.S.

As mentioned before, GARCH model is used to achieve daily S&P 500 variances. The results of the model can be found in Table 7.5. Results of Ljung-Box Test for autocorrelation and ARCH LM heteroscedasticity tests are also represented in the table.

Based on Ljung-Box Test Q statistics values, it can be concluded that there is no serial autocorrelation.

Also, the null hypothesis of homoscedastic residuals cannot be rejected by the ARCH LM test results.

The coefficient of the external debt to GDP ratio's impacts on return rate volatility did not meet the expectations. It has a significant negative impact which is surprising. The impact is insignificant when using Fixed Effect model.

Table 7.5. Results of GARCH (1,1) regression for S&P 500 daily return rates

S&P 500 returns		
Mean Equation	Coefficient	P Value
Intercept	0.0009	0,0000***
r_{-1}	-0.0680	0,0003***
Variance Equation	Coefficient	P Value
Intercept	2.19E-06	0,0001***
${e_{-1}}^2$	0.1310	0,0000***
σ^2_{-1}	0.8632	0,0000***
Sum of coefficients		
Autocorrelation test	AC	P Value
1st order	-0.0030	0.8820
2nd order	-0.0040	0.9700
3rd order	-0.0140	0.9030
Heteroscedasticity test	F Value	P Value
ARCH LM	2.4989	0.1141

Results of OLS model testing the impacts of macroeconomic variables on S&P 500 average return rate volatility is shows in Table 7.6.

Table 7.6. Results of regression for S&P 500 average return rate volatility

Average Variance	Coefficient	P Value
Intercept	0.0050	0,0565*
GDP	-4.38E-10	0,0894*
External Debt	1.96E-10	0.1161
International Reserves	-1.22E-08	0,0767*
Total Trade	2.07E-09	0.2024
Trade Balance	3.66E-11	0.9954

Table 7.6. shows that, as international reserves and GDP of the U.S. get higher, its stock market becomes less volatile.

Results show that total external debt, total trade, and trade balance of United States does not have statistically significant impacts on S&P 500 average monthly volatility. Instead, GDP and international reserves both negatively affect the variances of S&P 500.

7.4. Findings from stock market sensitivity analyses

It can be concluded that, as international reserves of a country get higher, its stock market becomes less sensitive. It might be due to the higher confidence of investors in the economy. Total trade with the US to GDP ratio of a country can be an indicator of the strong economic relations with the US, thus, having large trade volumes with the US might lead to a more sensitive stock market to external factors. Positive trade balance with the US on the other hand, lets the stock market have lower volatility.

As mentioned before, to our best knowledge, this study is the first one in the literature to analyze the reasons behind differences in volatilities.

Results from the analyses of S&P 500 average volatilities show that, as the economy of the U.S. gets larger and as the international reserves of US get higher, the stock market becomes less volatile. These results are quite expected as both cases are positive signs for the economy. Investors take both information as positive news for the market as well, and do not make decisions which might lead to increased volatility.

CHAPTER 8

LONG RUN IMPACTS OF U.S. MACROECONOMIC VARIABLES ON STOCK MARKETS

Results from Chapter 6 show that U.S. macroeconomic announcements have impacts on return rates and volatilities of stock indices from external markets. The significance and the direction (sign) of the impacts differ from market to market. Those analyses were related to high-frequency data and we can expect that, in very short periods of time such as 5 minutes, investors can misinterpret the news and can lead to unreasonable changes in return rates and volatilities. This chapter analyses the impacts of the U.S. economy on monthly return rates of the stock market indices to see whether the intraday impacts are reasonable or not. Monthly return rates can be considered as long run return rates of an index. If the impacts of a macroeconomic variable on the monthly return rates of an index is similar to the impacts on the intraday return rates, we can say that the investors were successful in interpreting the news coming from the U.S.

8.1. Data review for long run impacts of U.S. economy on stock markets

8.1.1. General information and data sources

Monthly logarithmic return rate data for 6 stock market indices from 6 countries' stock markets have been used in the analyses.

Monthly price data covers the period from 01.01.2007 to 01.01.2017. The indices used to analyse and stock markets they are traded in is the same as shown in Table 6.1.

Return rates are calculated with the close price of each month using the formula (4.1)

Data sources for monthly prices of indices are the same as shown in Table 4.2.

GDP Growth data is available at U.S. Bureau of Economic Analysis. Three announcements (advanced, preliminary, final) is made for each quarter.

For monthly CPI and Unemployment rates data from U.S. Bureau of Labor Statistics is used.

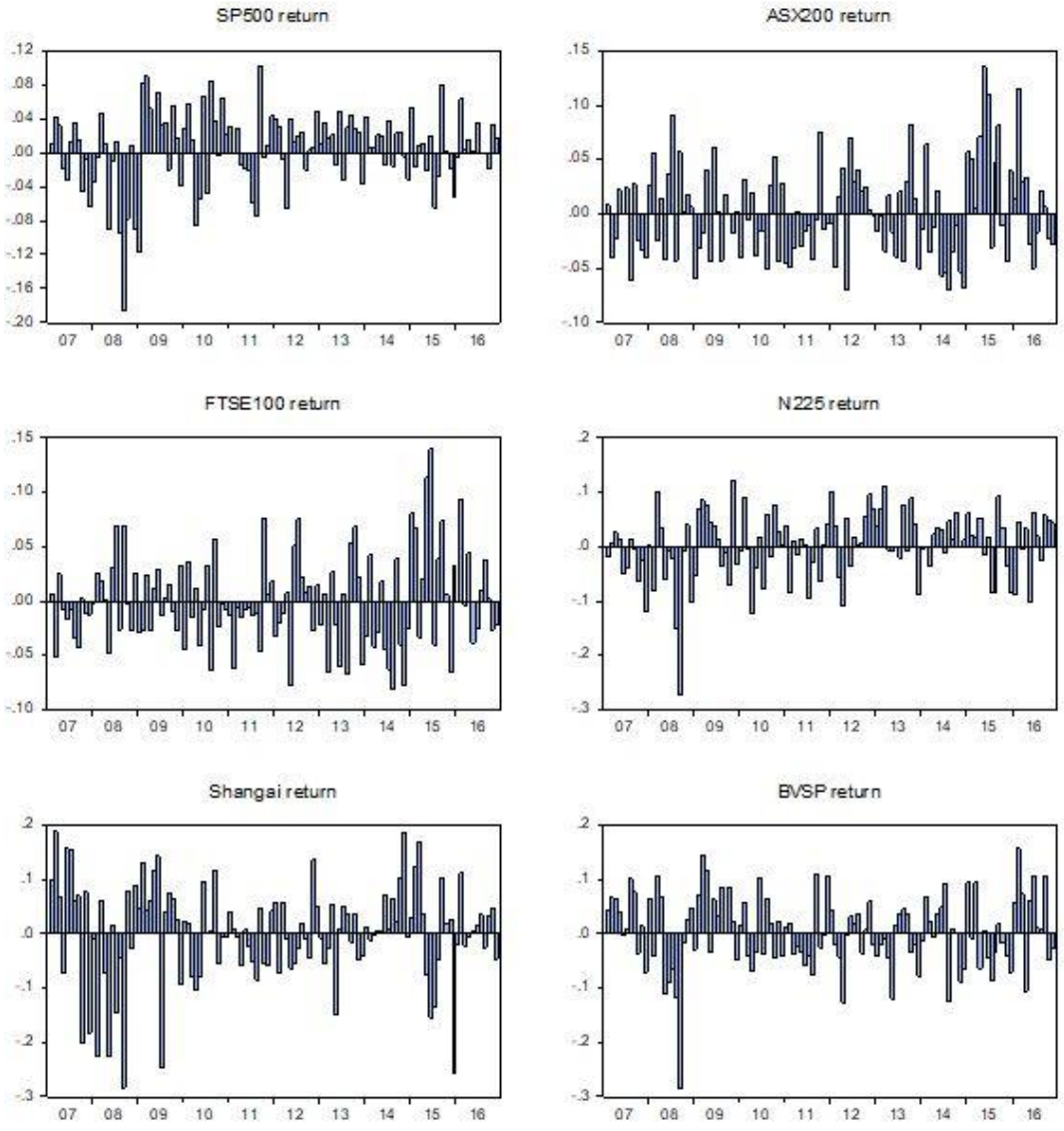


Figure 8.1. Bar graphs of monthly return rates of all stock indices

8.1.2. Descriptive statistics and Tests

For descriptive statistics information of monthly return rates of 8 indices the Table 8.1. below can be checked.

Table 8.1. Descriptive statistics of monthly return rates of indices. Source: Yahoo! Finance, Investing.com

Statistics / Index	SP500	ASX200	N225	FTSE100	SSE	BVSP
Mean	3,9E-03	5,5E-04	7,0E-04	-1,0E-03	6,3E-04	2,7E-03
Median	1,0E-02	-3,2E-03	5,0E-03	-5,3E-03	6,9E-03	3,4E-03
Maximum	1,0E-01	1,4E-01	1,2E-01	1,4E-01	1,9E-01	1,6E-01
Minimum	-1,9E-01	-7,1E-02	-2,7E-01	-8,1E-02	-2,8E-01	-2,8E-01
Standard Dev.	4,5E-02	4,2E-02	6,2E-02	4,1E-02	9,1E-02	6,7E-02
Skewness	-9,1E-01	6,7E-01	-9,2E-01	5,9E-01	-7,2E-01	-5,2E-01
Kurtosis	5,0E+00	3,2E+00	5,2E+00	3,5E+00	4,0E+00	4,7E+00

To test normality Jarque-Bera test is employed. Table 8.2 shows that We can accept null hypothesis of normality at 1% level for monthly return rates of ASX200 and FTSE100. While the null hypothesis can be rejected for all other stock indices at 1% level. Monthly return rates of stock indices seem more likely to be normally distributed.

Table 8.2. Jarque-Bera test for monthly return rates of indices

Normality test	SP500	ASX200	N225	FTSE100	SSE	BVSP
Jarqua Bera	3,70E+01	8,90E+00	3,98E+01	8,11E+00	1,54E+01	1,91E+01
Probability	0,00000	0,01168	0,00000	0,01733	0,00045	0,00007

Table 8.3. shows unit root tests for the monthly return rates and none of the indices exhibit unit root.

Table 8.3. Unit root test of monthly return rates

Unit root test	SP500	ASX200	N225	FTSE100	SSE	BVSP
t-Statistic	-8.9887	-9.5780	-9.0890	-10.7454	-9.9858	-8.9030
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

8.2. The methodology of long run impacts of U.S. economy on stock markets

In this part of the thesis Ordinary Least Squares model is employed to check for the impacts of currently available official information about U.S. macroeconomic indicators on monthly return rates of 6 stock indices from 6 different countries.

The general form of the OLS model is as follows:

$$r_{tl} = \alpha + \sum_{j=1}^{3} \beta_j MI_{jt} + \varepsilon_t \qquad (8.1)$$

where r_t is monthly return rate of the lth stock index, MI_{jt} is the value of macroeconomic indicator j (GDP growth, CPI, Unemployment) at month t.

In this part of the thesis, the impacts of macroeconomic indicators on the size of price change is also tested. Such that, the absolute value of return rate is used as dependent variable. So, the general form of the model is as below:

$$|r_{tl}| = \alpha + \sum_{j=1}^{3} \beta_j MI_{jt} + \varepsilon_t \qquad (8.2)$$

For both (8.1) and (8.2) Breusch-Godfrey Serial Correlation LM Test is used to test for the existence of serial autocorrelation in the error terms. In case of the existence of a serial correlation of residuals for any index, the model has been run again with Newey–West variance-covariance matrix.

Also, Breusch-Pagan-Godfrey test is employed to test for heteroscedasticity of errors. When it exists, the model has been corrected with the White heteroskedasticity-consistent variance-covariance matrix.

It is hypothesized that, if a stock market responds to the announcement surprises of U.S. macroeconomic indicators (as seen in Chapter 6.), then these indicators should have real impacts on return rates of those markets in the long run. Otherwise, the short-run surprise impacts are just a misinterpretation of U.S. impacts on the markets by investors. On the other hand, if a market does not respond to announcement surprises, but is significantly affected by U.S. economy, it means investors of that market cannot fully appreciate and understate the impacts of U.S. macroeconomic indicators.

8.3. Analyses of long run impacts of U.S. economy on stock markets

Regression results for the model specified in equation (8.1) which analyses macroeconomic impacts on monthly return rates are represented in Table 8.3. below.

Table 8.4. on the other hand, shows results for the model in equation (8.2) which analyses macroeconomic impacts on absolute values of monthly return rates.

Breusch-Godfrey and Durbin-Watson test statistics for serial correlation and Breusch-Pagan-Godfrey test statistic for heteroscedasticity of errors are also available in both Table 8.4. and Table 8.5. along with regression results.

Table 8.4. Regression results for macroeconomic impacts on monthly return rates

Monthly Return	**S&P 500**		**ASX 200**		**N225**	
	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	-0.5421	0.7510	2.7852	0.1024	-0.2169	0.9283
Monthly CPI	-0.9460	0,0089***	-0.2987	0.2798	-1.0138	0,0107**
Monthly Unemployment	0.3147	0.1386	-0.3119	0.1502	0.2444	0.4260
Quarterly GDPG	0.2176	0.4218	-0.0095	0.9564	0.1961	0.4283
Autocorrelation test	Test value	P Value	Test value	P Value	Test value	P Value
Breusch-Godfrey	0.2013	0.6545	0.8734	0.3520	1.0257	0.3133
Durbin-Watson	1.9129		1.8193		1.8057	
Heteroscedasticity test	F Value	P Value	F Value	P Value	F Value	P Value
Breusch-Pagan-Godfrey	6.8561	0.0003	2.0669	0.1085	2.2661	0.0846

Monthly Return	**FTSE 100**		**SSE**		**BVSP**	
	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	1.9724	0.2374	4.6410	0.1939	3.4647	0.1895
Monthly CPI	-0.2944	0.2779	-1.5170	0,0098***	-1.1718	0,0337**
Monthly Unemployment	-0.2250	0.2893	-0.2091	0.6445	-0.1058	0.7386
Quarterly GDPG	0.0136	0.9365	-0.2721	0.4570	-0.2412	0.3782
Autocorrelation test	Test value	P Value	Test value	P Value	Test value	P Value
Breusch-Godfrey	0.0432	0.8357	0.0313	0.8599	1.5844	0.2107
Durbin-Watson	2.0355		1.9528		1.7595	
Heteroscedasticity test	F Value	P Value	F Value	P Value	F Value	P Value
Breusch-Pagan-Godfrey	2.2331	0.0882	1.9956	0.1186	3.4012	0.0202

From Table 8.4., monthly CPI rate seems to be the most important variable for most indices.

Table 8.5. Regression results for macroeconomic impacts on absolute monthly return rates

Absolute Montly Return	**S&P 500**		**ASX 200**		**N225**	
	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	1.4979	0.1359	5.6243	0,0000***	4.1060	0,0026***
Monthly CPI	0.4349	0.1095	-0.2057	0.1998	0.4603	0.2528
Monthly Unemployment	0.2706	0,0321**	-0.2772	0,0284**	0.0522	0.7707
Quarterly GDPG	-0.4360	0,0021***	0.0604	0.5499	-0.3671	0,0257**
Autocorrelation test	Test value	P Value	Test value	P Value	Test value	P Value
Breusch-Godfrey	0.4887	0.4859	1.0813	0.3006	0.0208	0.8856
Durbin-Watson	1.8644		1.7882		1.9687	
Heteroscedasticity test	F Value	P Value	F Value	P Value	F Value	P Value
Breusch-Pagan-Godfrey	5.6569	0.0012	2.0830	0.1064	3.5076	0.0177

Absolute Montly Return	**FTSE 100**		**SSE**		**BVSP**	
	Coefficient	P Value	Coefficient	P Value	Coefficient	P Value
Intercept	4.9628	0,0000***	11.7756	0,0000***	7.1524	0,0000***
Monthly CPI	-0.2383	0.2190	0.2398	0.5382	0.5005	0.2035
Monthly Unemployment	-0.2202	0.1014	-0.7267	0,0185**	-0.3031	0,0797*
Quarterly GDPG	0.1364	0,0653*	-0.2121	0.3889	-0.3607	0,0787*
Autocorrelation test	Test value	P Value	Test value	P Value	Test value	P Value
Breusch-Godfrey	1.0044	0.3184	0.0041	0.9488	0.0021	0.9635
Durbin-Watson	1.7968		2.0084		2.0018	
Heteroscedasticity test	F Value	P Value	F Value	P Value	F Value	P Value
Breusch-Pagan-Godfrey	2.8207	0.0421	2.1469	0.0982	3.0679	0.0308

Different from results represented in Table 8.4., in Table 8.5. we can see that variables other than CPI also affect monthly return rates of indices in absolute terms. But there is some heteroscedasticity problem in the results related to S&P 500 and BVSP.

In both tables, 8.4. and 8.5., none of the models exhibit serial correlation problem as can be seen from Breusch-Godfrey and Durbin-Watson test results. Field (2009) propose that Durbin Watson test values higher than 3 or lower than 1 are definite causes for concern. But values between 1.5 and 2.5 are thought to be normal as a rule of thumb.

We can see the existence of heteroscedastic errors in models related to S&P 500 and BVSP in both models, while N225 and FTSE 100 only exhibit the problem of heteroscedasticity in the model which analyses the absolute return rates. To avoid this problem, regressions with heteroscedastic errors are repeated employing White heteroskedasticity-consistent standard errors & covariance. Results are repeated for the repeated models and the values represented in Tables 8.4. and 8.5. are results of the corrected models.

Correcting the models, some of the previously insignificant variables turned out to be significant. While it also revealed some significant variables to be insignificant.

8.4. Results and findings from the analyses of long run impacts of U.S. economy on stock markets

8.4.1. Summary of the results

Monthly CPI rates have significant negative impacts on monthly S&P 500 monthly return rates. While the absolute value of return rates is affected by monthly unemployment rate positively and quarterly GDP growth rates negatively. All three indicators being significant is the same as the results represented in Chapter 6.4. but the content of results is quite different.

None of the indicators has significant impacts on monthly ASX200 return rates. The monthly unemployment rate of U.S. has significant negative impacts on the absolute value of return rates. In Chapter 6.4., surprises of all three indicators were significant in explaining 5-min return rates of ASX200, but we cannot see the similar result here.

Monthly CPI rates affect N225 return rates negatively. And quarterly GDP Growth rate affects absolute value of N225 return rates negatively. The results are again not in line with the content of results from the analyses of surprise impacts on 5-minute return rates of N225.

FTSE 100 return rates are affected by none of the macroeconomic indicators, only quarterly GDP Growth rate has a positive effect on the absolute value of return rates.

But 5-minute FTSE 100 return rates and volatilities were affected by surprises of all three indicators to some extent.

Monthly CPI rates affect SSE return rates negatively, while monthly unemployment has negative impacts on the absolute value of return rates. These results are quite close to the ones from the analyses regarding SSE return rates and volatility in Chapter 6.4.

BVSP return rates get affected by monthly CPI rate negatively, and absolute values of return rates are affected both by monthly unemployment rate and quarterly GDP Growth rate negatively. 5-min return rates of BVSP were found to be affected only by positive GDP Growth surprises, while none of the indicators had positive impacts on volatility.

8.4.2. Findings

Considering the results achieved, we can conclude that, investors of Chinese stock market are quite successful in interpreting results coming from the U.S. economy. Results from the analyses of the impacts of macroeconomic variables on the intraday and monthly return rates coincide. Investors of British, Australian and Brazil stock markets are not good at evaluating the external impacts. While investors of BVSP are understating the effect of U.S. economy, investors of ASX200 and FTSE 100 are overstating. Players of Japanese and U.S. stock markets are good at appreciating the impacts of U.S. macroeconomic variables on the stock markets, but they probably fail to evaluate the direction of impacts.

CHAPTER 9

SURPRISE IMPACTS OF U.S. MACROECONOMIC ANNOUNCEMENTS ON U.S. COMPANIES; USING GARCH/EGARCH AND CAPM MODELS TOGETHER

In this chapter, the impacts of scheduled U.S. macroeconomic announcements on intraday return rates of Apple Inc. and Exxon Mobil Corp are analysed. Apple Inc. has the largest market value among the US companies and Exxon Mobil Corp is one of the few non-tech companies frequently seen in the most valuable companies list of the U.S.

9.1. Data review for intraday company return rates and volatility analyses

9.1.1. General information and data sources

Data used in this part of the analyses is intraday 5-minute return rates for Apple Inc. and Exxon Mobil Corporation. Both companies are publicly traded and listed on NYSE.

Intraday price data for both companies is downloaded from Finam.ru database and return rates are calculated with the formula (4.1).

Data for announcements and expected values of macroeconomic indicators is the same as in Chapter 6.1.1. An overview of data sources of macroeconomic indicators and expectations can be seen in Table 6.2.

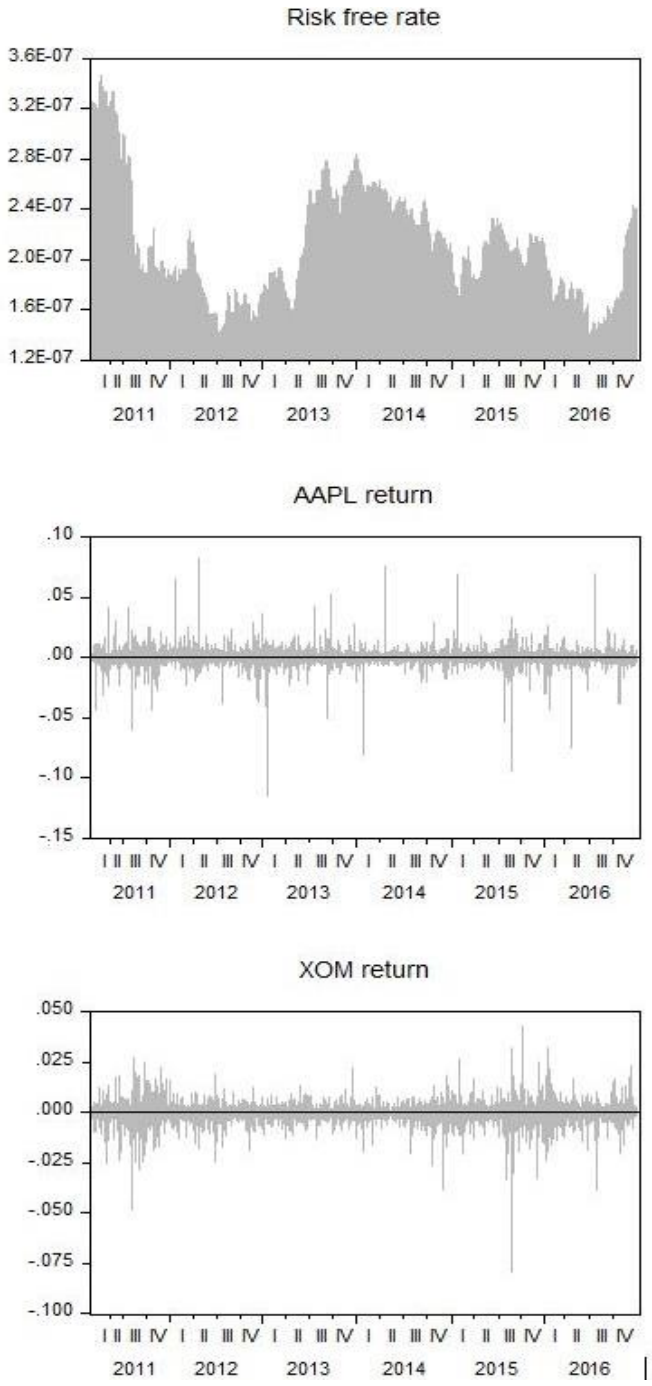


Figure 9.1. Bar graphs of the risk-free rate and return rates of AAPL and XOM.

9.1.2. Descriptive statistics and tests

Descriptive statistics for both Apple Inc and Exxon Mobil Corporation can be found below in Table 9.1.

Table 9.1. Descriptive statistics of AAPL and XOM 5-minute return rates

Statistics / Company	AAPL	XOM
Mean	8,15E-06	1,80E-06
Median	0,00000	0,00000
Maximum	0,083264	0,043276
Minimum	-0,114212	-0,079314
Standard Dev.	0,00188	0,001439
Skewness	-2,313964	-2,467472
Kurtosis	411,1969	160,6328

To test for the normality of data sets we use Jarque-Bera test statistic and below in Table 9.2. we see that none of the data is normally distributed.

Table 9.2. Jarque-Bera tests for AAPL and XOM 5-minute return rates

Normality test	AAPL	XOM
Jarque Bera	7,74E+08	1,15E+08
Probability	0,00000	0,00000

As mentioned previously, it is quite uncommon to find normally distributed return rates in financial markets.

To test for the existence of unit root Augmented Dickey-Fuller test is employed. Table 9.3. can be checked for t-statistic values and probabilities.

Table 9.3. Augmented Dickey-Fuller tests for AAPL and XOM 5-minute return rates

Unit root test	AAPL	XOM
t-Statistic	-244,3783	-244,6737
Probability	0,0001	0,0001

We can reject the null hypothesis at 1% level and say that unit root does not exist in any of the two companies return rate data. It means that both data sets can be used in autoregressive models such as GARCH or EGARCH.

More graphs and tables related to both companies can be found in Appendix D.

9.2. The methodology of intraday company rate of returns and volatility analyses

This part of the thesis is dedicated to analysing the impacts of U.S. macroeconomic announcements on two representative U.S. companies. For this purpose, GARCH (1,1) and Capital Asset Pricing Model (CAPM) are both employed. CAPM is first proposed by Markowitz (1952) and later developed by Treynor (1961, 1962), Sharpe (1964) and others. The model suggests that the return rate on an asset is sensitive to the market risk and the expected theoretical risk-free asset return rate.

In our analyses, CAPM is used as the mean equation of GARCH (1,1) model.

To represent market return rate, S&P 500 index is used. While 10-year U.S. government bonds represent risk-free rate.

Companies are chosen based on their market values. Apple Inc. has had the largest market cap in the United States for several years and Exxon Mobil Corp. is one of the largest companies in the non-tech sphere.

To check for eligibility of return rate data of companies for ARCH/GARCH models Augmented Dickey-Fuller unit root test is used.

As an explanatory variable, surprise parts of the macroeconomic announcements are used. The surprise is defined as in (6.1).

It is assumed that the impacts of the surprise can best be realized during the first 5-10 minutes period after the announcement is made.

Two of the four types of GARCH models discussed in Chapter 6.2. are used. But including CAPM this time.

The models to test the impacts on stock return rates are as following:

a) Surprise impacts on the rates of returns of companies

$$r_t = r_{ft} + \theta\left(r_{mt} - r_{ft}\right) + \sum_{j=1}^{3} \beta_j S_{jt} + \varepsilon_t \qquad (9.1)$$

$$\sigma_t^2 = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 \sigma_{t-1}^2 \qquad (9.2)$$

b) Squared surprise impacts on the rates of returns of the companies

$$r_t = r_{ft} + \theta\left(r_{mt} - r_{ft}\right) + \sum_{j=1}^{3} \beta_j S_{jt}^2 + \varepsilon_t \qquad (9.3)$$

$$\sigma_t^2 = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 \sigma_{t-1}^2 \qquad (9.4)$$

Here, (9.1) and (9.3) are mean equations, while (9.2) and (9.4) are respective variance equations. In the models, r_t is the return rate of a stock at time t, r_{ft} is risk free rate and r_{mt} represents the market rate of return.

Mean and variance equations for testing the impacts of macroeconomic announcements on the stock return rate volatility are as follows:

a) Surprise impacts on the volatilities of the return rates of the companies

$$r_t = r_{ft} + \theta\left(r_{mt} - r_{ft}\right) + \varepsilon_t \qquad (9.5)$$

$$\sigma_t^2 = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 \sigma_{t-1}^2 + \sum_{j=1}^{3} \beta_j S_{jt} \qquad (9.6)$$

b) Squared surprise impacts on the volatilities of the return rates of the companies

$$r_t = r_{ft} + \theta\left(r_{mt} - r_{ft}\right) + \varepsilon_t \qquad (9.7)$$

$$\sigma_t^2 = \gamma_0 + \gamma_1 \varepsilon_{t-1}^2 + \gamma_2 \sigma_{t-1}^2 + \sum_{j=1}^{3} \beta_j S_{jt}^2 \qquad (9.8)$$

Here, (9.5) and (9.7) are mean equations, while (9.6) and (9.8) are respective variance equations. In the models, r_t is the return rate of a stock at time t, r_{ft} is risk free rate and r_{mt} represents market rthe ate of return rate.

Residuals in the model are not assumed to be normal in any of the models and to get the best possible result, the same model with three types of residuals (normal, Generalized Error, student-t) has run for all cases. Then, Bayesian Information Criterion (BIC) values have been used to compare the three models and choose best fitting one.

Residuals of the best-fitting model are analyzed and checked for normality, serial autocorrelation and for any remaining ARCH effects.

For the cases when coefficients of the terms of do not sum up to 1 or some of them are negative, EGARCH (1,1) model with asymmetric order 1 is employed. An example of the general form of variance equation of the model is as below:

$$\ln(\sigma_t^2) = \gamma_0 + \gamma_1 \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \gamma_2 \frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}^2}} + \gamma_3 \ln(\sigma_{t-1}^2) \quad (9.9)$$

Explanatory variables (surprises) are added to the mean and variance equations the same way represented in GARCH (1,1) models.

It is hypothesized that investors will increase or decrease their demand based on their interpretation of incoming surprise information. As investors are able to get information very fast, the will respond in a few minutes after the announcement is made. And this will change the stock price and its volatility.

9.3. Analyses of the impacts of U.S. macroeconomic announcements on intraday company return rates and volatility

As it can be seen from the results of Augmented Dickey-Fuller tests in Table 9.3. intraday return rates of both Apple Inc. and Exxon Mobil Corp. does not have a unit root. It means they are stationary variables and ARCH models can be used to analyse them. Models used for the analyses are specified in Chapter 9.2.

Model shown in formula (9.1) is used as a representative mean equation for lag selection. Residuals are assumed to have student-t distribution.

For the analyses of AAPL return rates, looking at Table 8.4. we can see that increasing lag will not decrease the Bayesian Information Criterion significantly, but instead, it negatively affects the computation speed of the models. That is why GARCH (1,1) is selected as the model to be used.

Table 9.4. Lag selection for AAPL return rates

Model	ARCH (1)	GARCH (1,1)	GARCH (2,2)	GARCH (3,3)	GARCH (4,4)
BIC	-10.94	-11.03	-11.02	-11.03	-11.03

Running the same analyses for XOM return rates, it appears that, the result does not change. And as it can be seen in Table 9.5. GARCH (1,1) offers very close BIC values while having a significant advantage in computation speed.

Table 9.5. Lag selection for XOM return rates

Model	ARCH (1)	GARCH (1,1)	GARCH (2,2)	GARCH (3,3)	GARCH (4,4)
BIC	-11.37	-11.44	-11.44	-11.45	-11.45

As mentioned in Chapter 9.2. all regressions have been run three times assuming three types of residual distributions and then compared based on BIC values.

Below, Table 9.6. and Table 9.7. show the BIC values for three types of residual distributions for the representative model (9.1) as mean and (9.2) as variance equations.

Table 9.6. Distribution selection for AAPL return rates

Distribution	Normal	GED	Student's t
BIC	-10.22	-10.95	-11.03

Table 9.7. Distribution selection for AAPL return rates

Distribution	Normal	GED	Student's t
BIC	-10.97	-11.38	-11.44

Student-t distribution seems to offer slightly lower BIC values; thus, it is better to assume that residuals have student-t distribution for both AAPL and XOM.

Below Table 9.8. shows the results of regressions analysing the impacts of macroeconomic announcement surprises on 5-minute stock return rates.

Table 9.9. shows the results for the model where impacts of the squares of the surprises tested on stock return rates.

Results represented in both tables show that all variables have a significant impact on AAPL and XOM intraday return rates, either linear or squared or both impacts exist in all cases.

Table 9.8. Surprise impacts on the rates of returns of companies

	AAPL		**XOM**	
Mean Equation	Coefficient	P Value	Coefficient	P Value
$r_m - r_f$	0.9302	0,0000***	0.9115	0,0000***
CPI Surprise	-0.0025	0.8080	0.0290	0,0003***
GDPG Surprise	0.0315	0,0029***	-0.0316	0,0024***
Unemployment Surprise	0.0158	0.4428	0.1198	0,0000***
Variance Equation	Coefficient	P Value	Coefficient	P Value
Intercept	7.54E-08	0,0000***	4.99E-08	0,0000***
${e_{-1}}^2$	0.2344	0,0000***	0.1888	0,0000***
σ^2_{-1}	0.7629	0,0000***	0.7774	0,0000***
Sum of coefficients	0.9973		0.9662	
Autocorrelation test	AC	P Value	AC	P Value
1st order	-0.019	0.0000	-0.0310	0.0000
2nd order	-0.005	0.0000	-0.0110	0.0000
3rd order	0.0020	0.0000	-0.0020	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value
ARCH LM	0.0161	0.8991	0.0539	0.8165

In both tables (9.8. and 9.9.) coefficients from the regressions and their P-values from t-tests for significance are represented along with Ljung-Box autocorrelation test and ARCH LM heteroscedasticity test values.

Table 9.9. Squared surprise impacts on the rates of returns of companies

	AAPL		**XOM**	
Mean Equation	Coefficient	P Value	Coefficient	P Value
$r_m - r_f$	0.9308	0,0000***	0.910762	0,0000***
$(CPI\ Surprise)^2$	0.9182	0.1518	-0.6181	0.1136
$(GDPG\ Surprise)^2$	1.7515	0,0432**	-6.2285	0,0000***
$(Unemployment\ Surprise)^2$	17.8561	0,0000***	-17.9458	0,0000***
Variance Equation	Coefficient	P Value	Coefficient	P Value
Intercept	7.55E-08	0,0000***	4.99E-08	0,0000***
${e_{-1}}^2$	0.2344	0,0000***	0.1891	0,0000***
σ^2_{-1}	0.7628	0,0000***	0.7771	0,0000***
Sum of coefficients	0.9972		0.9662	
Autocorrelation test	AC	P Value	AC	P Value
1st order	-0.0190	0.0000	-0.0310	0.0000
2nd order	-0.0050	0.0000	-0.0110	0.0000
3rd order	0.0020	0.0000	-0.0020	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value
ARCH LM	0.0161	0.8992	0.0540	0.8162

Results of the analyses about the impacts of macroeconomic announcement surprises on volatilities of return rates of the two companies are represented below in Table 9.10. The models represented is shown in equations (9.5) and (9.6).

Table 9.11. on the other hand, shows results from the regressions to test the impacts of squared surprise values on stock return rate volatilities of AAPL and XOM using models described in equations (9.7) and (9.8).

In both tables coefficients from the regressions and their P-values from t-tests for significance are represented along with Ljung-Box autocorrelation test and ARCH LM heteroscedasticity test values.

Table 9.10. Surprise impacts on the volatilities of the return rates of companies

	AAPL		**XOM**	
Mean Equation	Coefficient	P Value	Coefficient	P Value
$r_m - r_f$	0.9305	0,0000***	0.9105	0,0000***
Variance Equation	Coefficient	P Value	Coefficient	P Value
Intercept	7.55E-08	0,0000***	5.00E-08	0,0000***
CPI Surprise	1.02E-05	0,0800*	1.74E-06	0.6508
GDPG Surprise	3.49E-06	0.6793	-6.59E-06	0.2370
Unemployment Surprise	-7.89E-05	0,0000***	-2.79E-05	0,0000***
${e_{-1}}^2$	0.2338	0,0000***	0.1886	0,0000***
σ^2_{-1}	0.7628	0,0000***	0.7772	0,0000***
Sum of coefficients	0.9966		0.9658	
Autocorrelation test	AC	P Value	AC	P Value
1st order	-0.0190	0.0000	-0.0310	0.0000
2nd order	-0.0050	0.0000	-0.0110	0.0000
3rd order	0.0020	0.0000	-0.0020	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value
ARCH LM	0.0162	0.8988	0.0528	0.8183

Results represented in Tables 9.11. show that, surprise parts of all variables have a significant impact on company return rate volatilities. The impact is U shaped, meaning, as the absolute value of the surprise increase, return rate volatilities get larger. However, results in the table 9.10. are not reliable as there exist negative coefficients in variance equations. These models are corrected in next part.

Table 9.11. Squared surprise impacts on the volatilities of the return rates of companies

	AAPL		**XOM**	
Mean Equation	Coefficient	P Value	Coefficient	P Value
$r_m - r_f$	0.9313	0,0000***	0.9117	0,0000***
Variance Equation	Coefficient	P Value	Coefficient	P Value
Intercept	7.68E-08	0,0000***	5.04E-08	0,0000***
$(CPI\ Surprise)^2$	0.0359	0,0000***	0.0168	0,0000***
$(GDPG\ Surprise)^2$	0.0762	0,0000***	0.0525	0,0000***
$(Unemployment\ Surprise)^2$	0.2096	0,0000***	0.0644	0,0000***
${e_{-1}}^2$	0.2355	0,0000***	0.1875	0,0000***
σ^2_{-1}	0.7561	0,0000***	0.7738	0,0000***
Sum of coefficients	0.9916		0.9614	
Autocorrelation test	AC	P Value	AC	P Value
1st order	-0.0190	0.0000	-0.0310	0.0000
2nd order	-0.0050	0.0000	-0.0110	0.0000
3rd order	0.0020	0.0000	-0.0020	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value
ARCH LM	0.0141	0.9054	0.0494	0.8241

As it is clear from tables 9.8., 9.9., 9.10. and 9.11, residuals from none of the models exhibit conditional heteroscedasticity. We cannot reject the null hypothesis of no heteroscedasticity in any of the cases.

Based on Ljung-Box Test Q statistics values, it can be concluded that serial autocorrelation of residuals is either significantly close to zero or very low. Thus, we can assume that there is no serial autocorrelation.

In all variance equations, coefficients of σ^2_{t-1} and e^2_{t-1} terms sum up to less than 1, and it means that the variances are stationary.

However, the models represented in Table 9.10. exhibit the problem of variables with negative coefficients in variance equations. To eliminate this problem, same analyses are repeated using EGARCH (1,1) model with asymmetric order 1 as shown in equations (9.9) and (9.10). Residuals are assumed to have Student's t

distribution. Results from this model are represented in Table 8.12. along with heteroscedasticity and autocorrelation tests.

Table 9.12. Regression results for corrected models

	AAPL		**XOM**	
Mean Equation	Coefficient	P Value	Coefficient	P Value
$r_m - r_f$	0.9305	0,0000***	0.9105	0,0000***
Variance Equation	Coefficient	P Value	Coefficient	P Value
Intercept	-1.1221	0,0000***	-1.0875	0,0000***
CPI Surprise	21.3784	0,0017***	13.3994	0,0242**
GDPG Surprise	-7.4650	0.3530	-26.5319	0,0006***
Unemployment Surprise	-170.9720	0,0000***	-136.6692	0,0000***
$\lvert e_{-1}\rvert/\sigma_{-1}^{-0.5}$	0.2735	0,0000***	0.2742	0,0000***
$(e_{-1})/\sigma_{-1}^{-0.5}$	-0.0232	0,0000***	0.0273	0,0000***
$\ln(\sigma_{-1}^2)$	0.9314	0,0000***	0.9370	0,0000***
Autocorrelation test	AC	P Value	AC	P Value
1st order	-0.020	0.000	-0.0310	0.0000
2nd order	-0.005	0.000	-0.0110	0.0000
3rd order	0.002	0.000	-0.0020	0.0000
Heteroscedasticity test	F Value	P Value	F Value	P Value
ARCH LM	0.0089	0.9246	0.0041	0.9489

Based on Ljung-Box Test Q statistics values, it can be concluded that serial autocorrelation of residuals is either significantly close to zero or very low. Thus, we can assume that there is no serial autocorrelation. Also, P values for ARCH LM heteroscedasticity tests are very high. Coefficients of $\ln(\sigma_{t-1}^2)$ terms are smaller than 1 which means the variances are stable.

9.4. Summary of the results from the intraday company return rates and volatility analyses

CPI surprises have no significant impacts on AAPL return rates. GDP Growth surprises have positive impacts on return rates and the impacts of the square of GDP Growth surprises is also positive. Meaning, as the surprises get larger, the return rates increase. But this is not true for very small negative surprises.

Square of unemployment surprises affects AAPL return rates positively. As the surprises get larger, the return rates increase.

CPI and Unemployment surprises and the squared surprises of all three indicators have significant impacts on AAPL return rate volatility.

CPI surprises have a positive significant effect on return rates of XOM. The impacts of GDP Growth surprises are negative while the impacts of the squared GDP Growth surprises are positive. Again, return rates get higher as the surprises get larger. Only very small positive surprises can be vice versa.

Both unemployment surprises and squared unemployment surprises affect XOM return rates positively. Surprises of all three indicators and their squares significantly affect XOM return rate volatility.

The impacts of the surprises on the intraday volatilities of Apple Inc. and Exxon Mobil Corp. are like each other. But the impacts on the return rates are different in some situations. For example, CPI surprises have significant positive impact on XOM return rates while do not have significant impacts on APPL return rates. A possible reason can be differences in the elasticities of the demands to their relative products. Demand to the oil products are not as elastic as mobile phone and PC products. As results increased CPI might increase Exxon Mobil revenues.

CHAPTER 10

CONCLUSION

This thesis analyses the surprise impacts of the announcements of some macroeconomic indicators of the United States (U.S.) on the indices of the selected stock markets of U.S. (S&P 500) together with other countries, namely: Australia (ASX200), Brazil (BVSP), China (SSE), Japan (N225) and United Kingdom (U.K.) (FTSE100). In addition to these indices, the stocks of two companies from U.S., Apple Inc. and Exxon Mobil Corp are considered in this context. The surprise impacts are observed on the trade volumes in these indices, their rates of returns together with the volatilities in these rates of returns.

The first set of results come from Chapter 4 which analyses the co-movements among the indices' return rates and their directions of Granger causalities: S&P 500 return rates are more likely to affect the return rates of other indices and these rates do not get affected by the others except ASX200. These results are taken as the indication of the leading role of U.S. economy on the other selected countries' stock markets and hence the importance of the investigation of the U.S. macroeconomic indicators on these markets.

The findings of Chapter 5, analysing the surprise impacts of U.S. macroeconomic announcements on the indices' daily trade volumes, imply that although the U.S. volume of stock market trading may decline, the same effect is not likely to happen in the volumes the other countries' stock market trades.

Chapter 6 investigates 5-minute stock index return rates and their volatilities estimated with EGARCH models. In most of the analyses, the U.S. macroeconomic announcement surprises are specified according to the rational expectations represented with the professionals' forecasts obtained from aggregated measures of

their surveys. Some parts of the analyses also consider the adaptive expectations and according to our knowledge such type of expectations is not considered except the present study. This chapter's studies show that stock market indices of U.S., Japan, Australia and the United Kingdom get significantly affected from the surprises on U.S. macroeconomic announcements. However, the impacts on the Chinese stock index are very low and, moreover, the impacts on the Brazilian stock index are almost non-existent. Interestingly, a new observation in the macroeconomic announcement literature, as we believe, is that the sizes of surprises are more important than their signs. Also, the surprise impacts on the volatilities of the rates of returns are more significant than the impacts on return rates themselves. This finding for the developed countries of our study is important since the existing literature mainly emphasizes this result for developing countries' markets.

The findings of Chapters 4, 5 and 6 of the thesis led us to investigate the macroeconomic characteristics of the selected countries using some panel data analysis techniques. We analyse the roles of the macroeconomic indicators on the stock market sensitivities. In the context of the studies the important implications emerge. U.S. stock markets get less volatile as U.S. GDP goes up. Although high foreign trade levels with U.S. increase the selected countries' stock market indices' volatilities, positive trade balances with U.S. reduce them. Importantly, high foreign reserve to GDP ratios decrease the return rate volatilities. These help us to understand why some stock markets are so sensitive to the U.S. macroeconomic indicator announcements' surprises while some others are not.

Since the data used in Chapters 4-6 are daily or minutely data, the analyses with them reveal short term impacts of the surprises of the macroeconomic indicators. Chapter 8 studies concentrate on the impacts of the U.S. macroeconomic indicators on the rates of returns of the selected stock indices of the countries and their volatilities with monthly data and therefore the inspections get directed to the long run. In this frame we find that the U.S. stock market indices' monthly rates of returns are sensitive to the macroeconomic indicators. On the other hand, for other countries sensitivities to the U.S. macroeconomic indicators vary with monthly data. In summary, we can claim that the leading economy's macroeconomic variables'

impacts depend on the economic characteristics of the relevant country as well as time periods considered as can be classifies as the long run and the short run.

Instead of aggregated indices Chapter 9 looks at two important individual stocks of U.S. and proves the importance of macroeconomic news for these stocks' return rates and their volatilities with the context of CAPM-GARCH/EGARCH volatility models.

Our analyses suggest that further elaboration of the macroeconomic characteristics of the countries on the stock markets must be considered and the surprise impacts of macroeconomic indicator announcements must be subjected to different specifications.

REFERENCES

Oliver Kim and Robert E. Verrecchia (1991). Trading Volume and Price Reactions to Public Announcements. Journal of Accounting Research, Vol. 29, No. 2 (Autumn, 1991), pp. 302-321.

Chen, Roll, and Ross (1986) Economic forces and the stock market. Journal of Business 59 (3), pp. 383–403.

Suk-Joong Kim, Michael D. McKenzie and Robert W. Faff (2004). Macroeconomic News Announcements and the Role of Expectations: Evidence for Us Bond, Stock and Foreign Exchange Markets. Journal of Multinational Financial Management, Vol. 14, No. 4, 2004, pp. 217-232.

Gene Birz and John R. Lott, Jr. (2008). The Effect of Macroeconomic News on Stock Return rates: New Evidence from Newspaper Coverage. Journal of Banking & Finance 35(11), pp. 2791-2800.

Pierluigi Balduzzi, Edwin J. Elton and T. Clifton Green (2001). Economic News and Bond Prices: Evidence from the U.S. Treasury Market. The Journal of Financial and Quantitative Analyses, Vol. 36, No. 4 (Dec. 2001), pp. 523-543.

Menachem Brenner, Paolo Pasquariello and Marti Subrahmanyam (2009). On the Volatility and Comovement of U.S. Financial Markets around Macroeconomic News Announcements. Journal of Financial and Quantitative Analyses, 2009, vol. 44, issue 06, 1265-1289.

Robert Engle (2002) Dynamic Conditional Correlation, Journal of Business & Economic Statistics, 20:3, pp. 339-350.

Linda S. Goldberg, Christian Grisse (2013). Time Variation in Asset Price Responses to Macro Announcements. NBER Working Paper No. 19523, Issued in October 2013.

Sylwia Nowak, JochenAndritzky, Andreas Jobst and Natalia Tamirisa (2011). Macroeconomic fundamentals, price discovery, and volatility dynamics in emerging bond markets. Journal of Banking & Finance, Volume 35, Issue 10, October 2011, pp. 2584-2597.

Jussi Nikkinen and Petri Sahlstrom (2001). Impact of Scheduled U.S. Macroeconomic News on Stock Market Uncertainty: A Multinational Perspecive. Multinational Finance Journal, 2001, vol. 5, issue 2, pp. 129-148.

Jussi Nikkinen and Petri Sahlstrom (2004). Scheduled domestic and US macroeconomic news and stock valuation in Europe. Journal of Multinational Financial Management, 2004, vol. 14, issue 3, pp. 201-215.

Jussi Nikkinen, Mohammed Omran, Petri Sahlstrom and Janne Aijo (2006). Global stock market reactions to scheduled U.S. macroeconomic news announcements. Global Finance Journal, 2006, vol. 17, issue 1, pp. 92-104.

Torben G. Andersen, Tim Bollerslev, Francis X. Diebold and Clara Vega (2007). Real-time price discovery in global stock, bond and foreign exchange markets. Journal of International Economics 73 (2007), pp. 251-277.

Jan Hanousek and Evžen Kočenda (2011). Foreign News and Spillovers in Emerging European Stock Markets. Review of International Economics, 19(1), pp. 170–188.

ElenaFedorova, Laura Wallenius and Mikael Collan (2017). The Impact of Euro Area Macroeconomic Announcements on CIVETS Stock Markets. Procedia Economics and Finance Volume 15, 2014, pp 27-37.

Kent G. Becker, Joseph E. Finnerty and Joseph Friedman (1995). Economic news and equity market linkages between the U.S. and U.K. Journal of Banking & Finance, 1995, vol. 19, issue 7, pp. 1191-1210.

Robert A. Connolly and F. Albert Wang (2001). International equity market comovements: Economic fundamentals or contagion? Pacific-Basin Finance Journal 11 (2003) pp. 23-43.

Turhan Korkmaz, Emrah Çevik and Erdal Atukeren (2012). Return rate and volatility spillovers among CIVETS stock markets. Emerging Markets Review, 2012, vol. 13, issue 2, pp. 230-252.

Harry Markowitz (1952). Portfolio Selection. The Journal of Finance, Vol. 7, No. 1. (Mar. 1952), pp. 77-91.

French, Craig W. (2003). The Treynor Capital Asset Pricing Model. Journal of Investment Management, Vol. 1, No. 2, pp. 60-72.

William F. Sharpe (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. The Journal of Finance, Vol. 19, No. 3 (Sep. 1964), pp. 425-442.

Tim Bollerslev (1986). Generalized autoregressive conditional heteroskedasticity. Journal of Econometrics, Volume 31, Issue 3, April 1986, pp. 307-327.

Daniel B. Nelson (1991). Conditional Heteroskedasticity in Asset Return rates: A New Approach. Econometrica, 1991, vol. 59, issue 2, pp 347-370.

Christopher A. Sims (1980). Macroeconomics and Reality. Econometrica, Vol. 48, No. 1 (Jan. 1980), pp. 1-48.

C. W. J. Granger (1969). Investigating Causal Relations by Econometric Models and Cross-spectral Methods. Econometrica, Vol. 37, No. 3. (Aug. 1969), pp. 424-438.

Field, A. (2009). Discovering Statistics Using SPSS. 3rd Edition, Sage Publications Ltd., London.

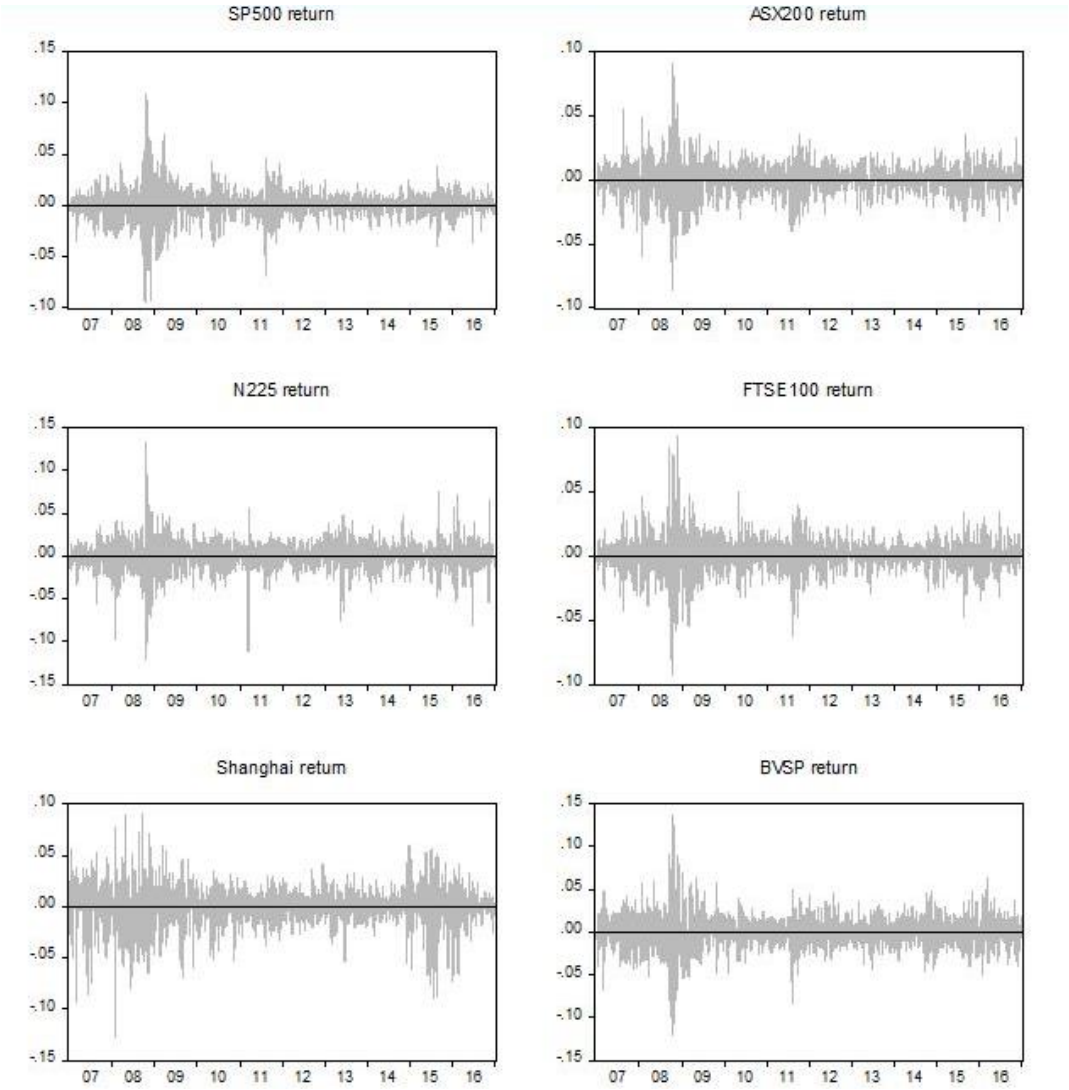
Prem C. Jain (1988). Response of Hourly Stock Prices and Trading Volume to Economic News. The Journal of Business, Vol. 61, No. 2 (Apr., 1988), pp. 219-231.

Davidson, Russell; MacKinnon, James G. (1993). Estimation and inference in econometrics. Oxford University Press.

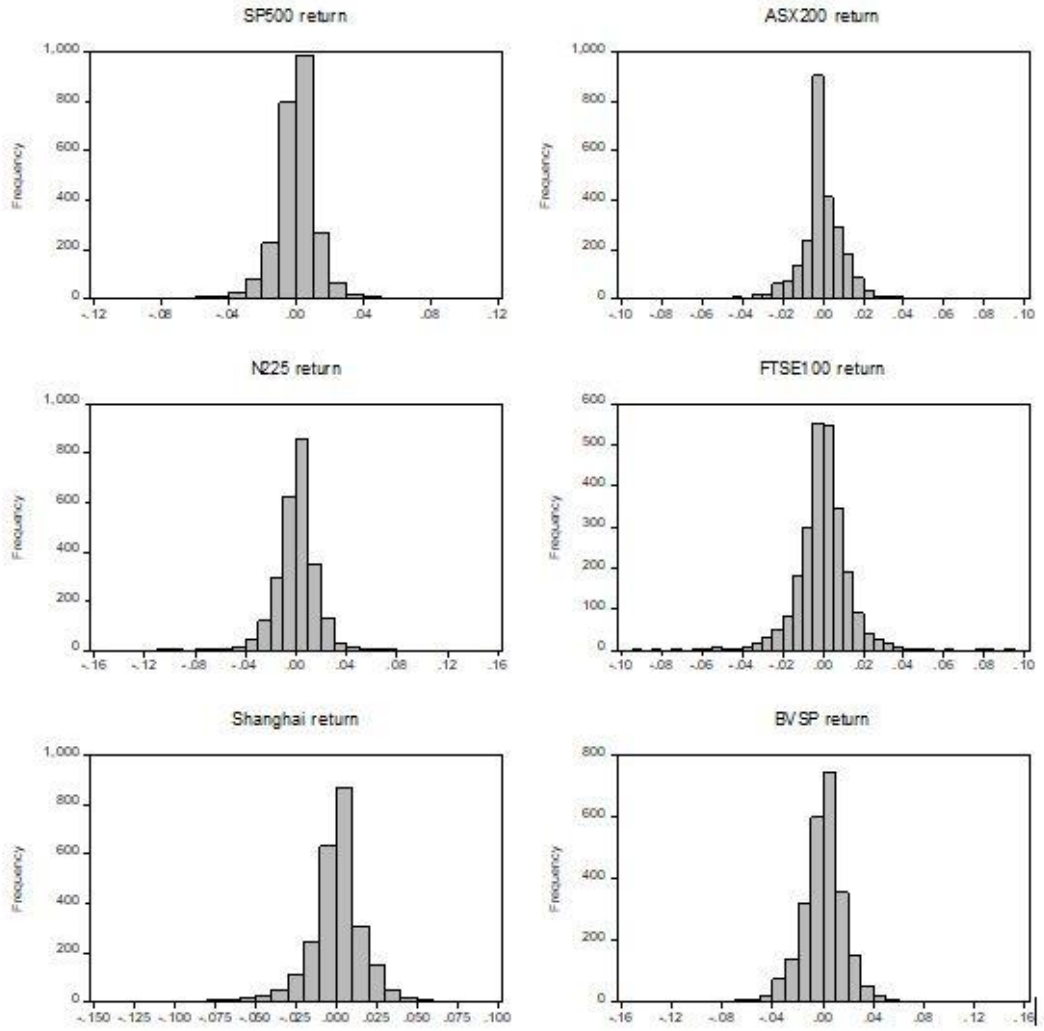
APPENDICES

A. FIGURES RELATED TO DAILY RETURN RATES

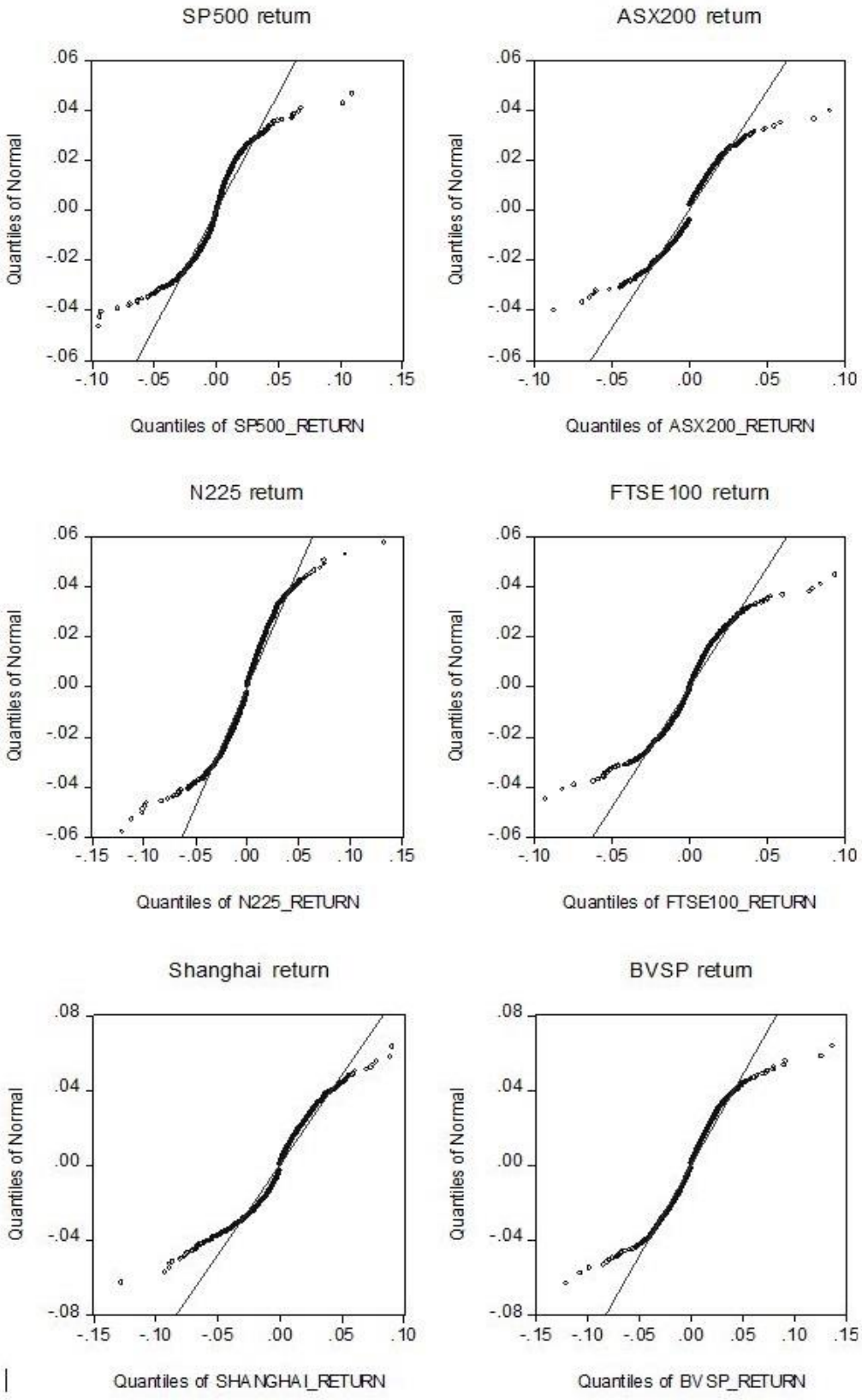
Bar Plots



Histograms

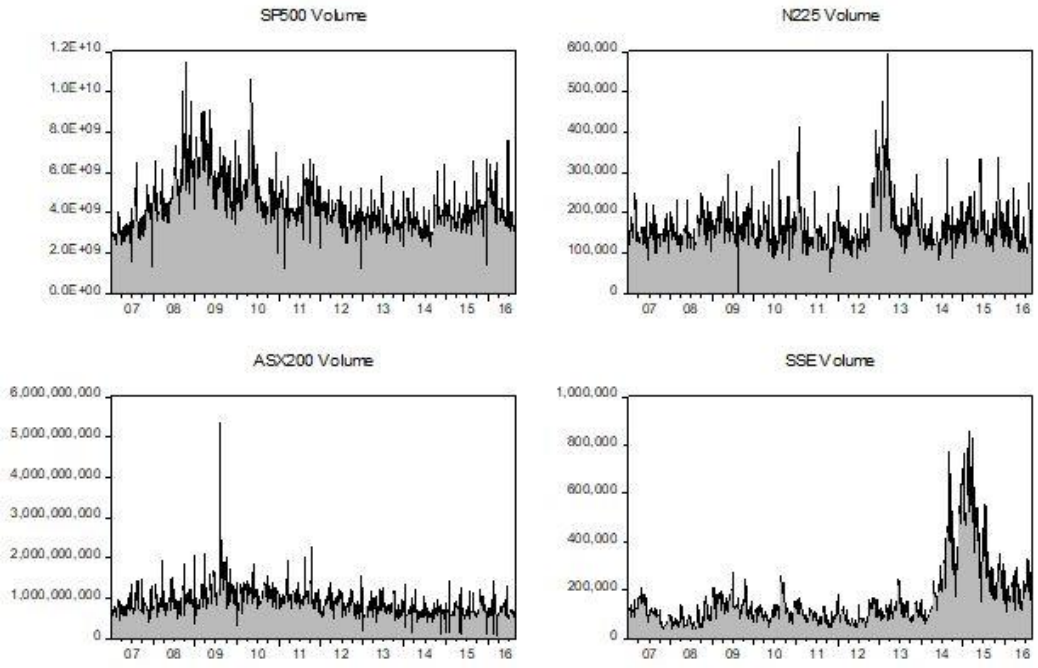

SP500 return
ASX200 return
N225 return
FTSE100 return
Shanghai return
BVSP return
Frequency

Q-Q Plots

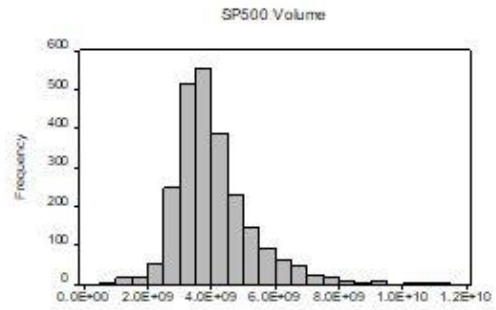

SP500 return
Quantiles of Normal
Quantiles of SP500_RETURN
ASX200 return
Quantiles of ASX200_RETURN
N225 return
Quantiles of N225_RETURN
FTSE 100 return
Quantiles of FTSE100_RETURN
Shanghai return
Quantiles of SHANGHAI_RETURN
BVSP return
Quantiles of BVSP_RETURN

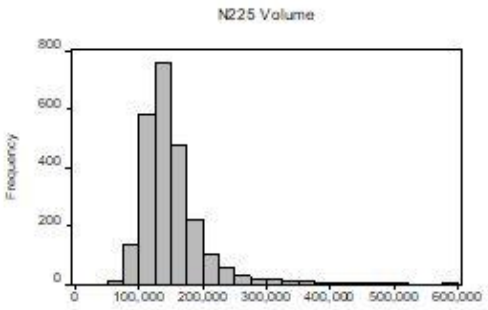
B. FIGURES RELATED TO DAILY TRADE VOLUME

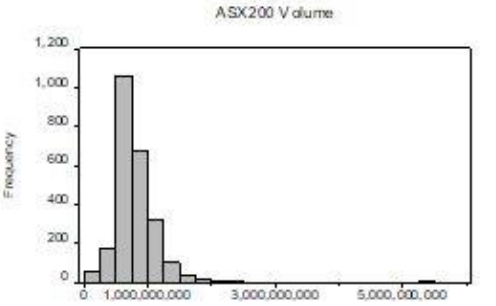
Area Graphs

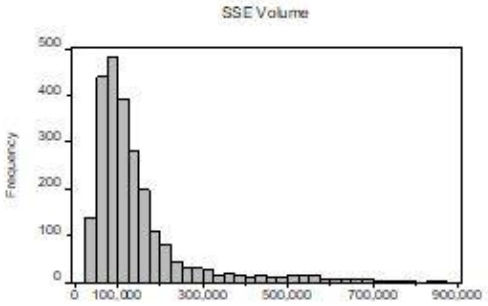


Histograms


SP500 Volume
Frequency
600
500
400
300
200
100
0
0.0E+00
2.0E+09
4.0E+09
6.0E+09
8.0E+09
1.0E+10
1.2E+10

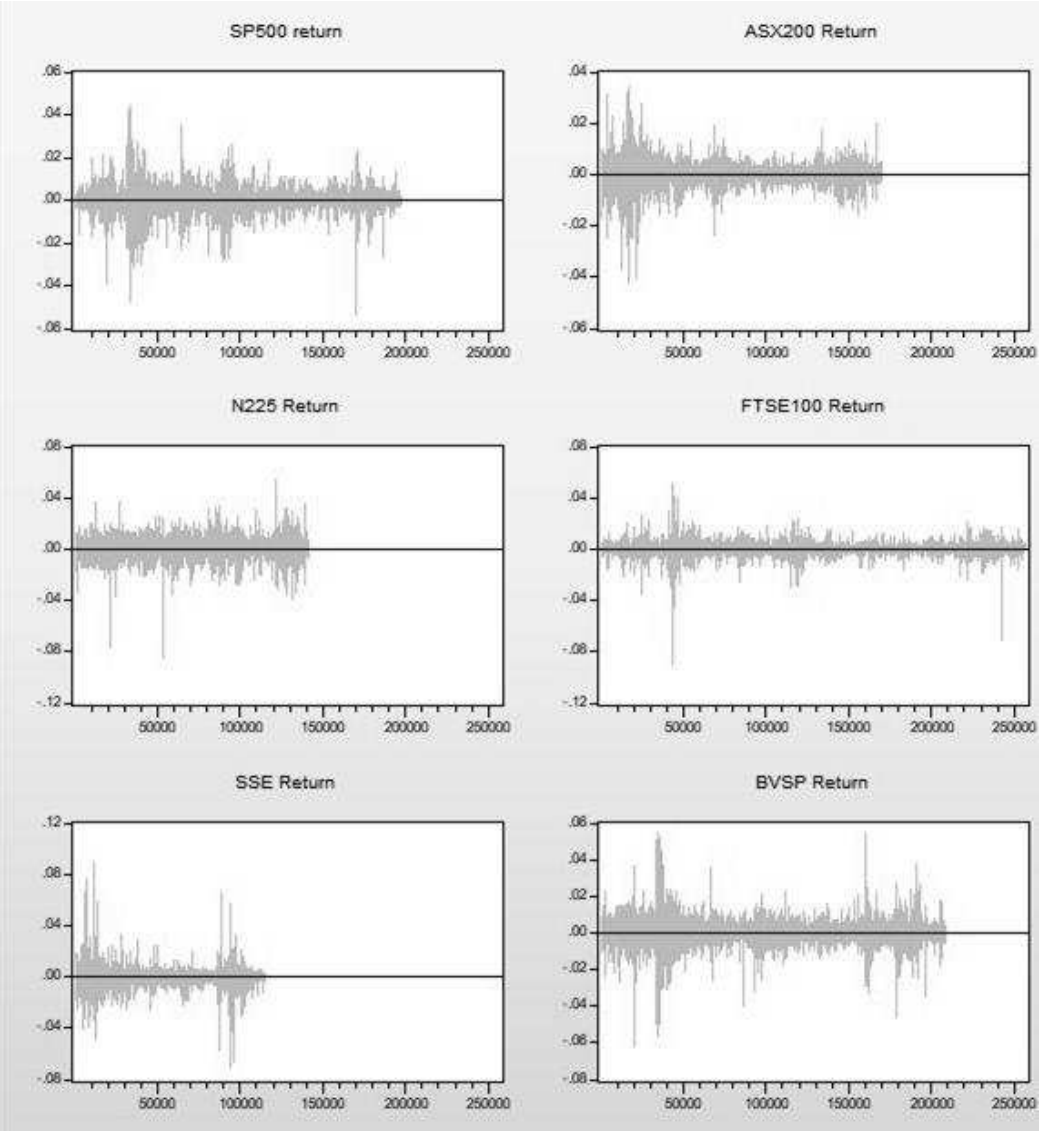

N225 Volume
Frequency
800
600
400
200
0
0
100,000
200,000
300,000
400,000
500,000
600,000


ASX200 Volume
Frequency
1,200
1,000
800
600
400
200
0
0
1,000,000,000
3,000,000,000
5,000,000,000

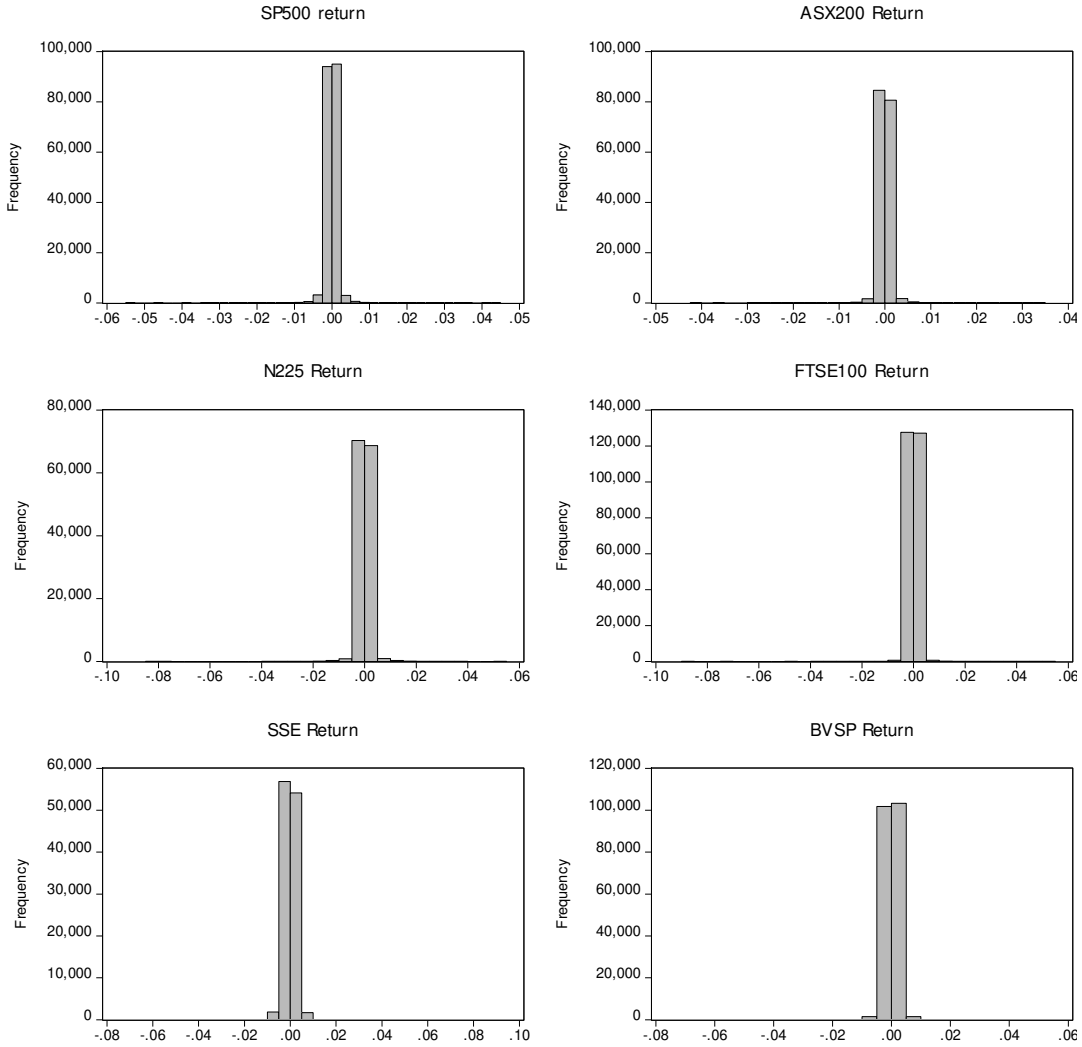

SSE Volume
Frequency
500
400
300
200
100
0
0
100,000
300,000
500,000
700,000
900,000

C. FIGURES RELATED TO INTRADAY RETURN RATES

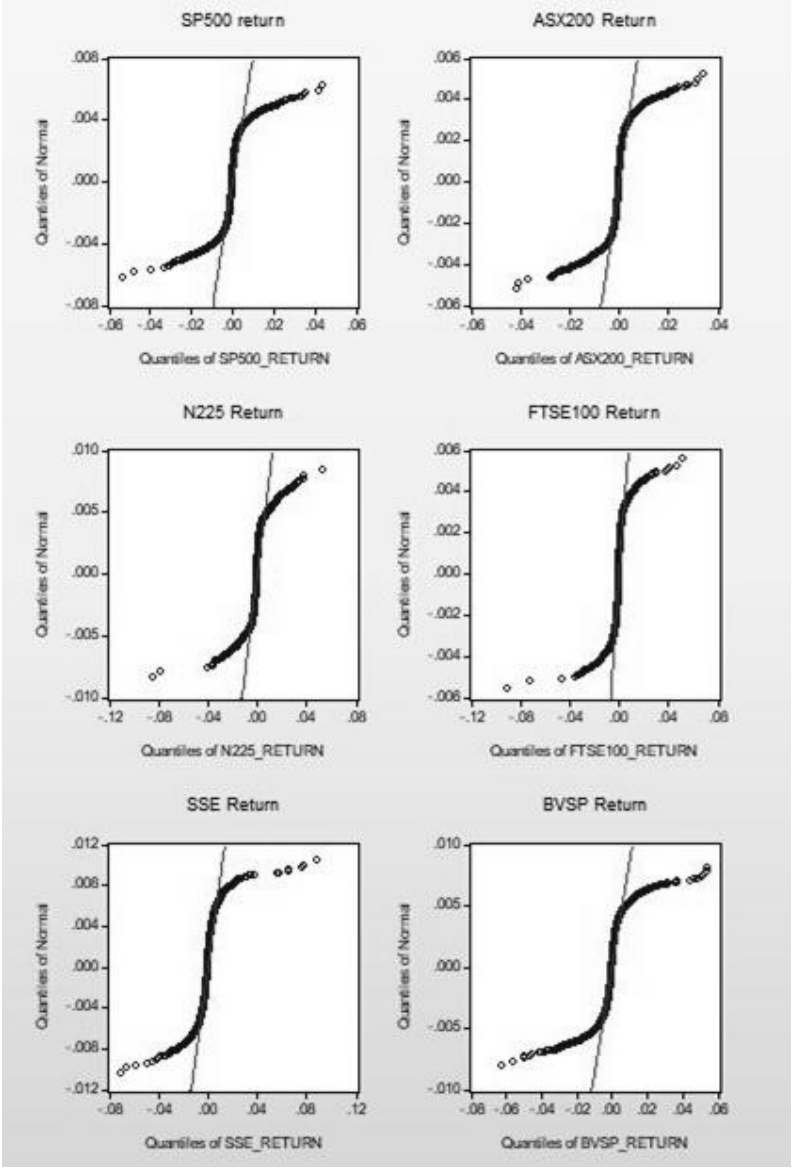
Bar Graphs



Histograms

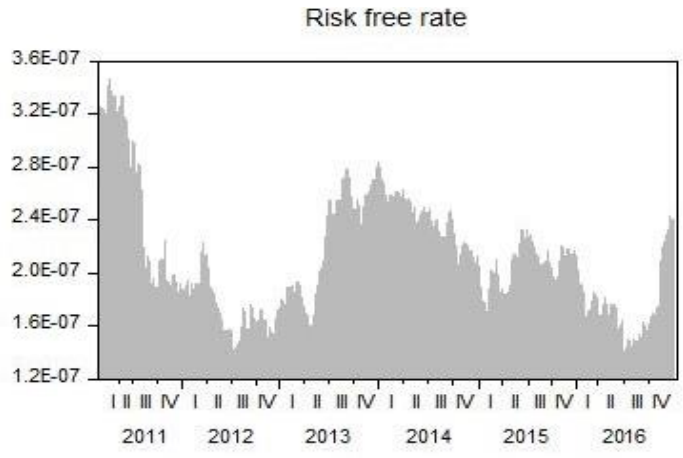

SP500 return
Frequency
100,000
80,000
60,000
40,000
20,000
0
-.06 -.05 -.04 -.03 -.02 -.01 .00 .01 .02 .03 .04 .05
ASX200 Return
Frequency
100,000
80,000
60,000
40,000
20,000
0
-.05 -.04 -.03 -.02 -.01 .00 .01 .02 .03 .04
N225 Return
Frequency
80,000
60,000
40,000
20,000
0
-.10 -.08 -.06 -.04 -.02 .00 .02 .04 .06
FTSE100 Return
Frequency
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
-.10 -.08 -.06 -.04 -.02 .00 .02 .04 .06
SSE Return
Frequency
60,000
50,000
40,000
30,000
20,000
10,000
0
-.08 -.06 -.04 -.02 .00 .02 .04 .06 .08 .10
BVSP Return
Frequency
120,000
100,000
80,000
60,000
40,000
20,000
0
-.08 -.06 -.04 -.02 .00 .02 .04 .06

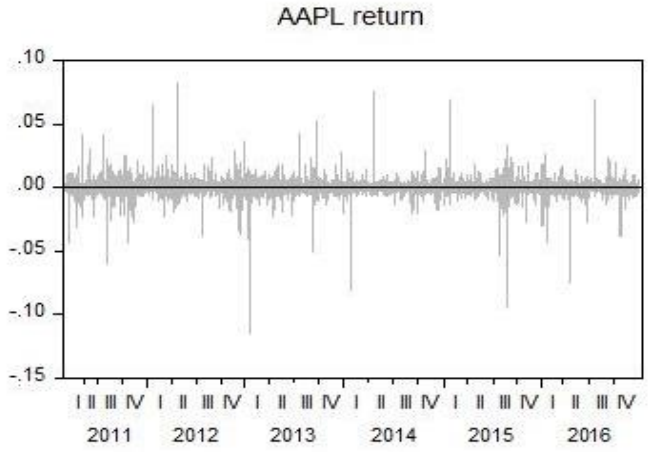
Q-Q Plots

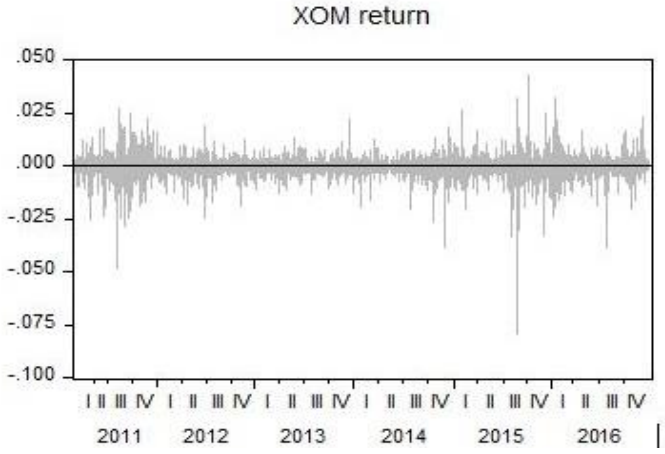

SP500 return
Quantiles of Normal
Quantiles of SP500_RETURN
ASX200 Return
Quantiles of Normal
Quantiles of ASX200_RETURN
N225 Return
Quantiles of Normal
Quantiles of N225_RETURN
FTSE100 Return
Quantiles of Normal
Quantiles of FTSE100_RETURN
SSE Return
Quantiles of Normal
Quantiles of SSE_RETURN
BVSP Return
Quantiles of Normal
Quantiles of BVSP_RETURN

D. FIGURES RELATED TO COMPANY RETURN RATES

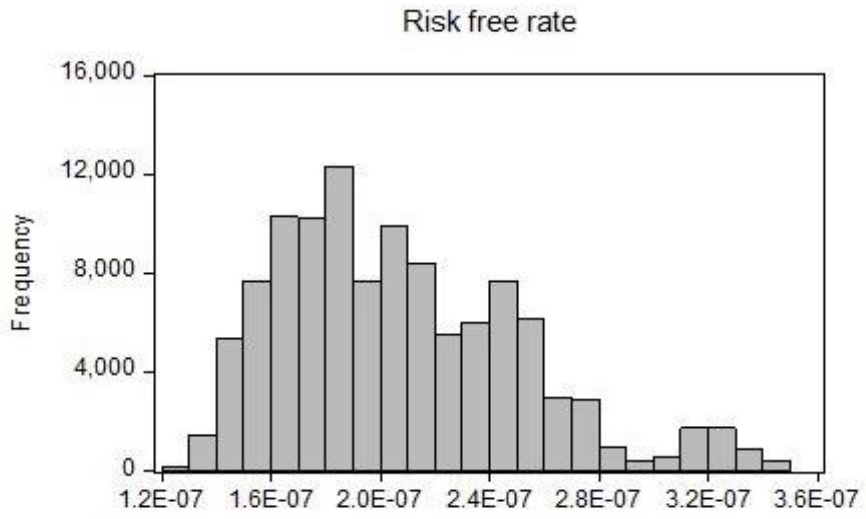
Bar Graphs

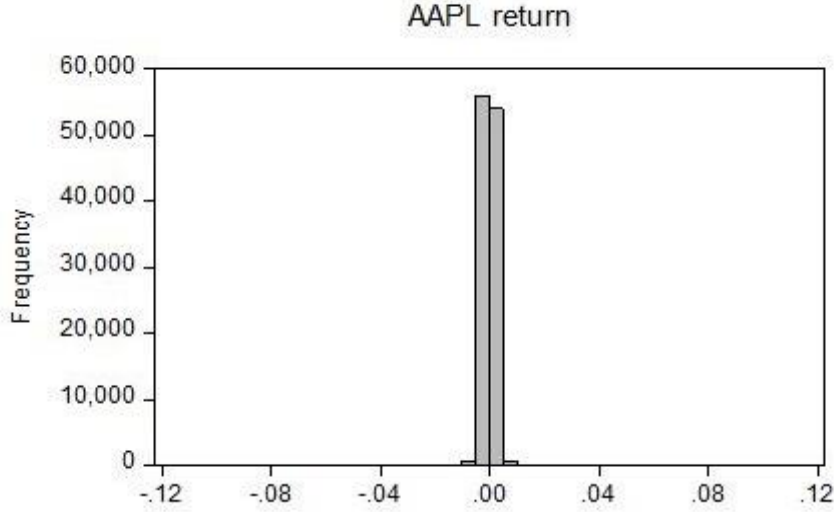






Histograms


Risk free rate
Frequency
16,000
12,000
8,000
4,000
0
1.2E-07
1.6E-07
2.0E-07
2.4E-07
2.8E-07
3.2E-07
3.6E-07


AAPL return
Frequency
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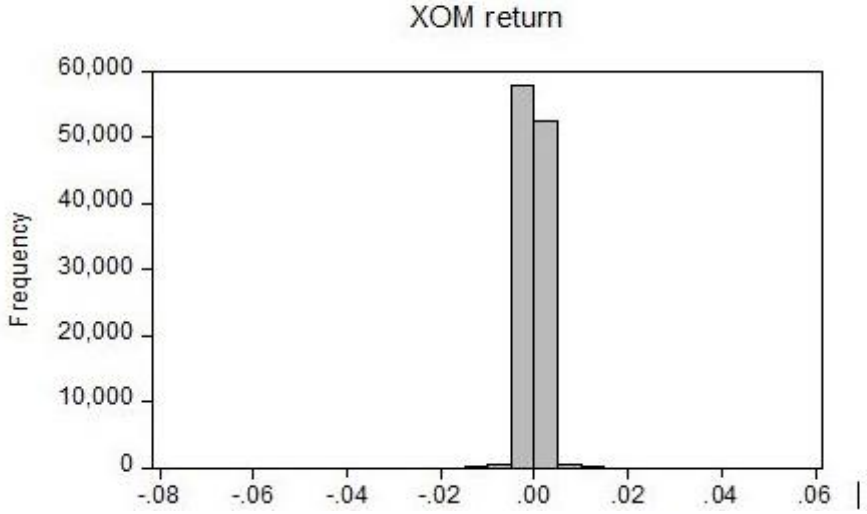
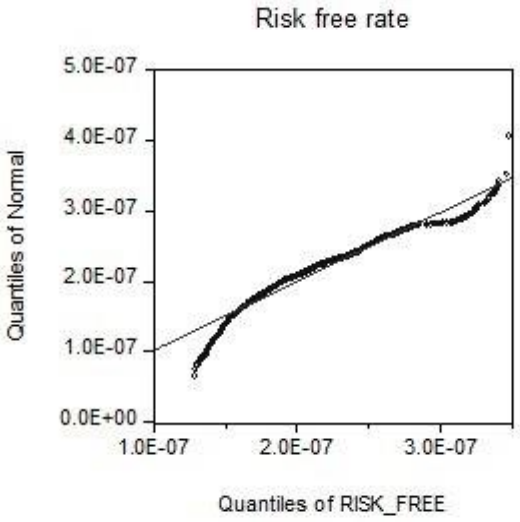
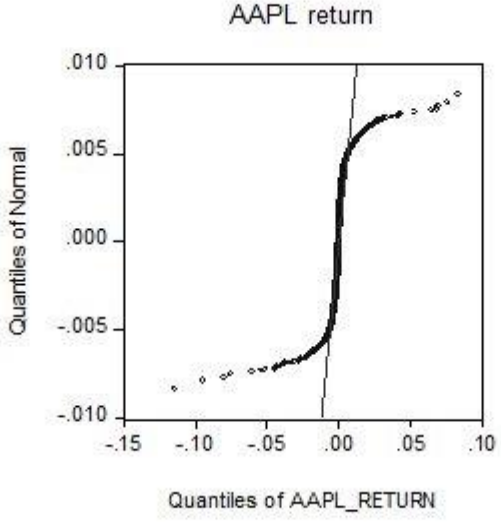
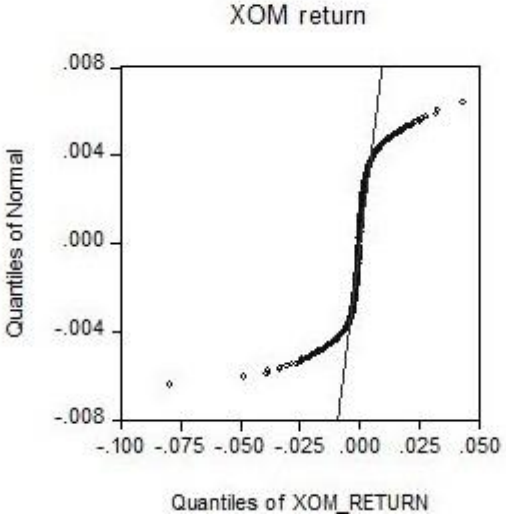
50,000
40,000
30,000
20,000
10,000
0
-.12
-.08
-.04
.00
.04
.08
.12


XOM return
Frequency
60,000
50,000
40,000
30,000
20,000
10,000
0
-.08
-.06
-.04
-.02
.00
.02
.04
.06

Q-Q Plots


Risk free rate
Quantiles of Normal
5.0E-07
4.0E-07
3.0E-07
2.0E-07
1.0E-07
0.0E+00
1.0E-07
2.0E-07
3.0E-07
Quantiles of RISK_FREE

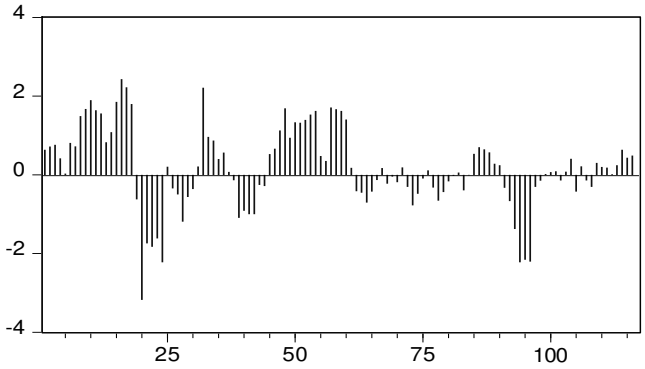

AAPL return
Quantiles of Normal
.010
.005
.000
-.005
-.010
-.15
-.10
-.05
.00
.05
.10
Quantiles of AAPL_RETURN


XOM return
Quantiles of Normal
.008
.004
.000
-.004
-.008
-.100
-.075
-.050
-.025
.000
.025
.050
Quantiles of XOM_RETURN

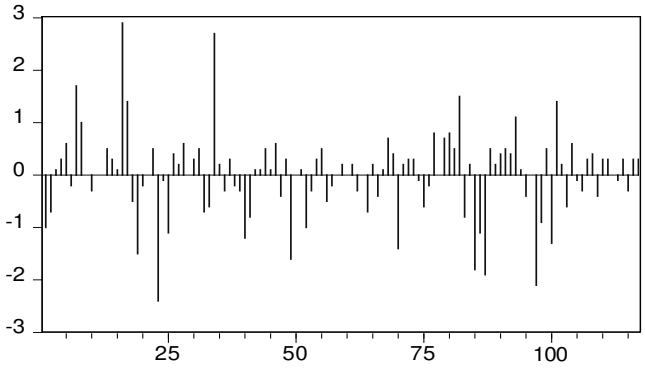
E. MACROECONOMIC ANNOUNCEMENTS

Spike Graphs

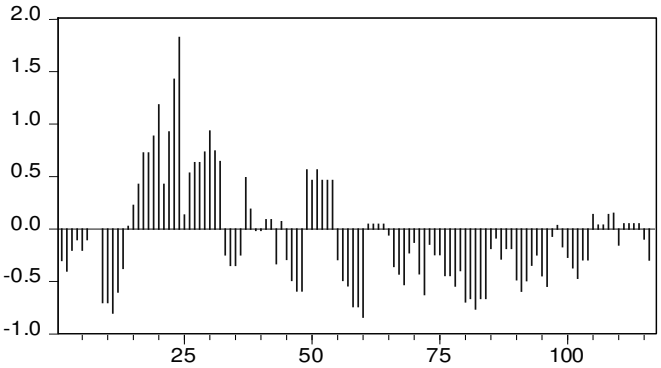
CPI Surprise



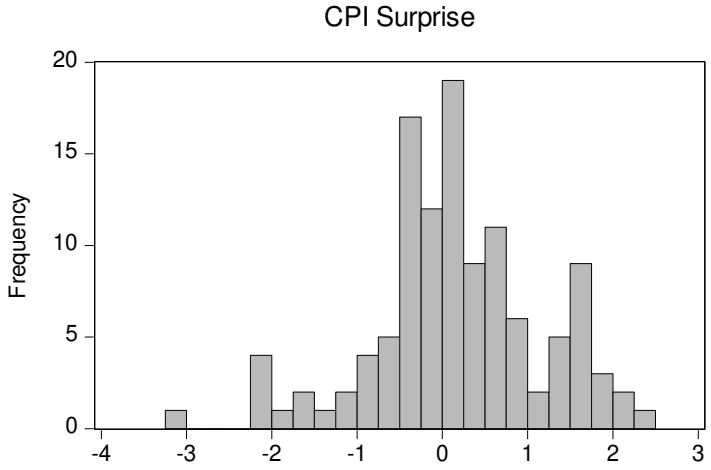
GDP Growth Surprise

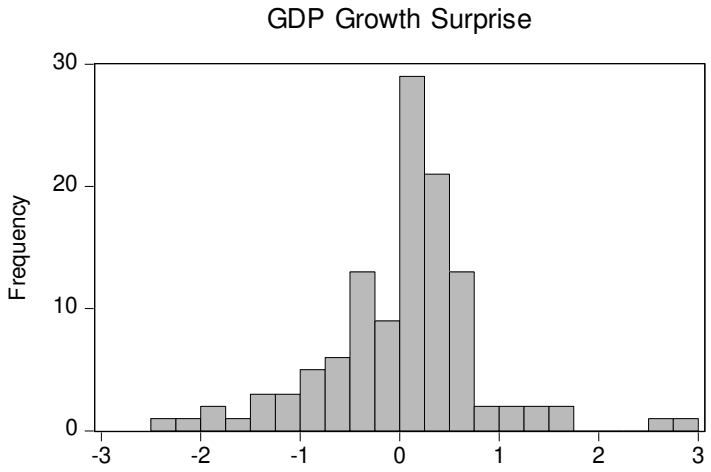


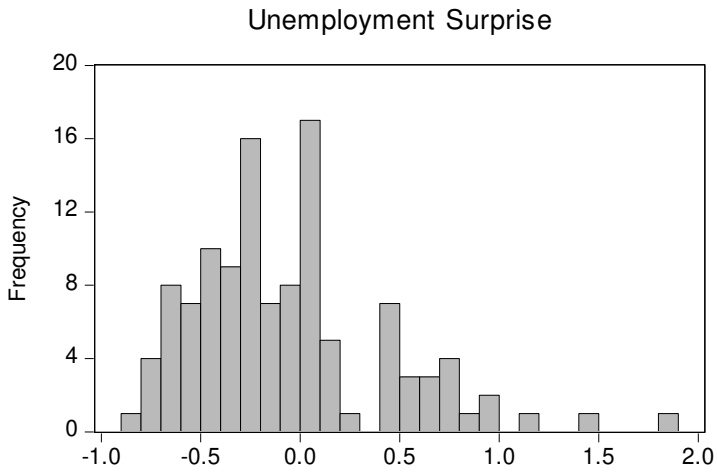
Unemployment Surprise



Histograms


CPI Surprise
Frequency
20
15
10
5
0
-4
-3
-2
-1
0
1
2
3


GDP Growth Surprise
Frequency
30
20
10
0
-3
-2
-1
0
1
2
3


Unemployment Surprise
Frequency
20
16
12
8
4
0
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0

Vector Autoregression Estimates
Date: 03/02/18 Time: 15:17
Sample (adjusted): 1/05/2007 12/30/2016
Included observations: 2516 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	SP500_RETURN	N225_RETURN	FTSE100_RETURN	SHANGHAI_RETURN	BVSP_RETURN	ASX200_RETURN
SP500_RETURN(-1)	-0.184735	0.433023	0.325672	0.152070	0.036745	0.121047
	(0.03215)	(0.03167)	(0.02849)	(0.04318)	(0.04387)	(0.02785)
	[-5.74559]	[13.6720]	[11.4324]	[3.52215]	[0.83758]	[4.34659]
SP500_RETURN(-2)	-0.132598	0.125627	0.073271	0.119429	-0.009976	0.063338
	(0.03324)	(0.03274)	(0.02945)	(0.04463)	(0.04535)	(0.02879)
	[-3.98932]	[3.83692]	[2.48808]	[2.67578]	[-0.21996]	[2.20005]
N225_RETURN(-1)	-0.004356	-0.215775	-0.022948	-0.090716	-0.012649	-0.027918
	(0.02107)	(0.02076)	(0.01867)	(0.02830)	(0.02875)	(0.01825)
	[-0.20671]	[-10.3939]	[-1.22903]	[-3.20555]	[-0.43990]	[-1.52944]
N225_RETURN(-2)	-0.008224	-0.024222	-0.029883	-0.023020	-0.017134	-0.040379
	(0.01770)	(0.01743)	(0.01568)	(0.02376)	(0.02414)	(0.01533)
	[-0.46476]	[-1.38962]	[-1.90605]	[-0.96878]	[-0.70968]	[-2.63455]

Var Model (continued)

FTSE100_RETURN(-1)	0.001056	0.105586	-0.406507	0.028578	-0.028437	0.021248
	(0.03138)	(0.03091)	(0.02780)	(0.04213)	(0.04281)	(0.02718)
	[0.03365]	[3.41629]	[-14.6236]	[0.67829]	[-0.66428]	[0.78189]
FTSE100_RETURN(-2)	-0.038106	-0.030569	-0.146827	-0.025775	-0.069674	-0.024769
	(0.03023)	(0.02978)	(0.02679)	(0.04060)	(0.04125)	(0.02619)
	[-1.26034]	[-1.02639]	[-5.48112]	[-0.63484]	[-1.68893]	[-0.94584]
SHANGHAI_RETURN(-1)	-0.003745	-0.042841	-0.012408	-0.021424	0.021536	0.006102
	(0.01533)	(0.01510)	(0.01358)	(0.02058)	(0.02091)	(0.01327)
	[-0.24439]	[-2.83781]	[-0.91382]	[-1.04101]	[1.02992]	[0.45972]
SHANGHAI_RETURN(-2)	-0.005783	0.010862	-0.003807	0.006474	-0.034790	0.005198
	(0.01535)	(0.01512)	(0.01360)	(0.02061)	(0.02094)	(0.01329)
	[-0.37679]	[0.71848]	[-0.27999]	[0.31413]	[-1.66138]	[0.39101]
BVSP_RETURN(-1)	-0.037339	-0.005406	0.011156	0.013322	-0.106947	-0.011414
	(0.02049)	(0.02019)	(0.01816)	(0.02752)	(0.02796)	(0.01775)
	[-1.82192]	[-0.26777]	[0.61440]	[0.48406]	[-3.82456]	[-0.64297]
BVSP_RETURN(-2)	0.016423	0.021974	0.011222	0.018588	0.007234	0.012875
	(0.02050)	(0.02019)	(0.01816)	(0.02752)	(0.02796)	(0.01775)
	[0.80131]	[1.08839]	[0.61800]	[0.67540]	[0.25869]	[0.72526]

Var Model (continued)

ASX200_RETURN(-1)	0.197645	0.452883	0.313019	0.154545	0.247770	-0.094112
	(0.02957)	(0.02913)	(0.02620)	(0.03971)	(0.04035)	(0.02561)
	[6.68357]	[15.5469]	[11.9472]	[3.89183]	[6.14073]	[-3.67431]
ASX200_RETURN(-2)	0.120074	0.048896	0.107772	-0.033722	0.043923	-0.034430
	(0.03117)	(0.03070)	(0.02761)	(0.04185)	(0.04253)	(0.02700)
	[3.85240]	[1.59255]	[3.90266]	[-0.80570]	[1.03281]	[-1.27534]
C	0.000243	-6.16E-05	1.29E-06	3.93E-06	0.000137	-2.41E-05
	(0.00026)	(0.00026)	(0.00023)	(0.00035)	(0.00035)	(0.00022)
	[0.93833]	[-0.24152]	[0.00561]	[0.01131]	[0.38643]	[-0.10764]
R-squared	0.037481	0.394216	0.182706	0.045995	0.023646	0.018531
Adj. R-squared	0.032866	0.391312	0.178787	0.041421	0.018965	0.013825
Sum sq. resids	0.421938	0.409426	0.331210	0.760838	0.785507	0.316541
S.E. equation	0.012984	0.012790	0.011503	0.017435	0.017715	0.011246
F-statistic	8.122297	135.7366	46.62865	10.05633	5.051650	3.938194
Log likelihood	7366.150	7404.019	7670.719	6624.482	6584.341	7727.707
Akaike AIC	-5.845111	-5.875214	-6.087217	-5.255550	-5.223641	-6.132518
Schwarz SC	-5.814986	-5.845088	-6.057091	-5.225425	-5.193516	-6.102392
Mean dependent	0.000181	3.84E-05	5.07E-05	5.31E-05	0.000125	6.63E-06
S.D. dependent	0.013202	0.016393	0.012694	0.017807	0.017886	0.011324
Determinant resid covariance (dof adj.)	6.68E-24					

Var Model (continued)

Determinant resid covariance	6.47E-24
Log likelihood	45749.85
Akaike information criterion	-36.30513
Schwarz criterion	-36.12438

G. TURKISH SUMMARY / TÜRKÇE ÖZET

ABD makroekonomik açıklamalarının seçili ülkelerin borsaları üzerindeki etkilerinin analizi

Tez konusu ve literatür

Yatırımcıların geleceğe dair beklentilerine göre karar aldıkları ve yatırım yaptıkları yaygın olarak bilinen bir gerçektir. Ve beklentilerle desteklenen bu kararlar piyasadaki talep hacmini belirleyerek finansal piyasalar üzerinde önemli bir etki yaratması mümkün. Ülkelerin tarihleri önceden belirlenmiş makroekonomik anonslar yapması beklenti belirleyicilerinin önemli bir bölümünü oluşturmaktadır. Yeni bir bilgi geldiğinde bu bilginin beklenmeyen kısmı yatırımcıların beklendilerinde değişikliğe yol açar. Yatırımcılar, makroekonomik değişimlerin sonuçları hakkında tahminlerde bulunur ve bu prognozu eylemlerinde dikkate alırlar. Böylece, piyasalarda ticaret hacmi, fiyatlar, volatilite gibi değerler değişmeye başlar.

Bu konuda geniş bir literatür mevcut ve çeşitli göstergelerin farklı hisse senedi piyasaları üzerindeki etkisiyle birlikte, ekonomik duyuruların ülkeler arası etkileri de birçok araştırmacı tarafından ele alındı. Makroekonomik haberlerin finansal ve para piyasaları üzerindeki etkileri konusundaki çalışmalar başka alanlarla karşılaştırıldığında kısmen yenidir. Çoğunluk olarak, son senelerde bu spesifik araştırma alanındaki literatür, ampirik çalışmalardan oluşmaktadır. Ancak, bazı çalışmalar konuyu teorik açıdan ele almakta ve yatırımcıların ve pazarların makroekonomik haberlere nasıl tepki verdikleri üzerine modeller geliştirmektedir. Bazı ampirik çalışmalarda ülkeyle ilgili makroekonomik haberlerin ve açıklamaların yerel hisse senedi ve para piyasaların üzerindeki etkisi incelenirken, bazı araştırmacılar büyük ekonomilere sahip ülkelerden gelen makroekonomik haber ve duyuruların yabancı borsa ve para piyasalarına olan etkisini

incelemektedir. Son kategori altındaki çalışmaların çoğu, yerel pazarlardaki etkinin analizini de içermektedir. Bunların yanı sıra, iki veya daha fazla hisse senedi piyasası arasında eş-hareket veya korelasyonu araştıran bazı çalışmalar da vardır. Yerel piyasalar üzerinde yapılan araştırmaların ciddi bir kısmını ABD ekonomisiyle ilgili haberlerin ABD piyasalarına olan etkisini farklı yönlerde ele alan çalışmalar oluşturmaktadır. Genel olarak araştırmaların odak noktası gelişmiş ekonomiler olsa da son birkaç senede gelişmekte olan ekonomiler üzerinde de çalışmalar yapılmaktadır.

Bu alandaki önemli teorik çalışmalara, Kim ve Verrecchia (1991) tarafından yapılan çalışma iyi bir örnek teşkil eder. Ampirik çalışmalar içinde ise, Nowak ve diğ. (2011), Nikkinen ve Sahlström (2001), Andersen ve diğ. (2007), Korkmaz, Çevik ve Atukeren (2012) gibi araştırmacıların yaptığı çalışmalar örnek olarak gösterile bilir.

Bu tez, makroekonomik değişiklikler hakkında yapılan tarihleri önceden belirlenmiş açıklamaların 2007 ve 2016 yılları arasındaki 10 yıl boyunca finansal piyasalar üzerindeki etkisinin çeşitli yönlerini incelemektedir. Analizin ana odak noktası Amerika Birleşik Devletleri'dir. Nominal GSYİH (Dünya Bankası) değerine bakıldığında dünyanın en büyük ekonomisine sahip olan ABD, dünya ekonomisinin önemli bir bölümünü oluşturuyor. ABD'deki herhangi bir büyük makroekonomik değişim, diğer ülkelerin ekonomilerinde ve piyasalarında de değişikliklere yol açabilir. Bu tezde, Amerika Birleşik Devletleri ekonomisinin 3 makroekonomik göstergesi (GSYİH Büyümesi, Tüketici Fiyat Endeksi, İşsizlik) ABD ve diğer ekonomilerin hisse senedi piyasalarını etkileyecek olası değişkenler olarak alınmıştır.

Tezin ana odak alanı, Amerika Birleşik Devletleri'nin yerel ve dış borsalar üzerindeki makroekonomik duyurularının etkisini ve etkilerin olası nedenlerini analiz etmektir. Hisse senedi endekslerinin getirilerinin ortak hareketine ve makroekonomik duyuruların birkaç şirket üzerindeki etkisinin analizine ilişkin ek analizler de bu tezde yer almaktadır. Tezin çoğu bölümünde GARCH ve EGARCH modelleri kullanılmaktadır. Bununla birlikte, tezin 4-cü ve 7-ci sırasıyla VAR ve OLS modelleri de uygulanmıştır.

Analizde kullanılan veri kaynakları, modeller ve yöntemler ve diğer şeylerle ilgili her bir bilgi ayrı-ayrı bölümlerde mevcuttur.

Veri Kaynakları

5-ci bölümde yapılan analizlerde 4 ülkenin borsalarından 4 borsa endeksi için günlük ticaret hacmi verileri kullanılmıştır. Veriler 01.01.2007 - 01.01.2017 tarihleri arasındadır. Verilerin önemli bir kısmı Yahoo! Finans veritabanından alınmıştır. Seçilen endekslerden sadece 1 tanesi (ASX200) Yahoo! Finans veri tabanında bulunmadığından Investing.com web sitesinden indirilmiştir. Her çeyrek için GSYİH Büyümesi, aylık TÜFE ve aylık işsizlik oranlarına ilişkin makroekonomik açıklama tarihi, 01.01.2007'den 01.01.2017'ye kadar olan 10 yıl için toplanmıştır. Üç aylık GSYİH büyümesi için planlanan tarihler ABD Ekonomik Analiz Bürosu (US BEA) veritabanında bulunabilir. GSYİH için her çeyreğe ilişkin 3 adet açıklama (ileri, ön, final) yapılır. Bu duyuruların çoğu, her ayın son haftasında sabah 8: 30'da (ABD saati) yapılır. Aylık TÜFE ve İşsizlik duyuru tarihlerine İşgücü İstatistikleri Bürosu'ndan (US BLS) erişilebilir. İşsizlik raporu her ayın başında, TÜFE raporu ise her ayın ortasında yayınlanmaktadır. Her ikisi de sabah 8:30 ABD saatinde ilan edilir. IMF Dünya Ekonomik Görünümü'nün (World Economic Outlook) yayınlanma tarihleri, kullanılan başka bir veri kümesidir.

Tezin 6-cı bölümünde yürütülen analizlerde 6 ülkenin borsalarından 6 borsa endeksi için 5 dakikalık günlük logaritmik getiri verileri kullanılmıştır. Veriler 01.01.2007'den 01.01.2017'ye kadar olan süreyi kapsamaktadır.

Finam.ru veritabanı, analiz edilen tüm endeksler için gün içi verileri indirmek için kullanılmıştır.

Üç aylık GSYİH Büyümesi, aylık TÜFE ve aylık işsizlik için makroekonomik açıklamalar 01.01.2007'den 01.01.2017'ye kadar 10 yıl boyunca toplanmıştır. Ayrıca, duyuruların önceden öngörülmeyen kısmını hesaplamak için aynı zaman dilimi için duyuru beklentileri kullanılmıştır.

GSYİH Büyüme verileri ABD Ekonomik Analiz Bürosu'nda (US BEA) mevcuttur. Her çeyrek için 3 adet ilan (ileri, ön, final) yapılır. Bu duyuruların çoğu, her ayın son haftasında sabah 8: 30'da (ABD saati) yapılır. Üç aylık GSYİH Büyümesinin beklenen değerleri için Wall Street Journal tarafından sağlanan Ekonomik Öngörü Anketi kullanılmaktadır. Bu, 60 farklı ekonomistin tahminlerini toplayan ve tahmin edilen değerleri ortalama olarak kamuya açıklayan bir anket sistemidir.

Aylık TÜFE ve İşsizlik duyuruları için ABD Çalışma İstatistikleri Bürosu (US BLS) kullanılır. İşsizlik raporu her ayın başında yayınlanmakta ve her ayın ortasında TÜFE raporu yayınlanmaktadır. Her ikisi de sabah 8:30 ABD saatinde ilan edilir. TÜFE ve İşsizlik için öngörülen değerler Uluslararası Para Fonu, Dünya Ekonomik Görünümü (World Economic Outlook) veritabanından yılda iki kez sağlanan gelecek yıllara ilişkin beklentiler dahil olmak üzere toplanmıştır.

Her bölümde ayrı ayrılıkta yapılan analizlerde kullanılmış olan verilerin istatistik özellikleri ve Jarque-Bera normallik testlerinin sonuçları, gereken durumlarda birim kök testleri sunulmuştur. Tez dahilinde sunulması önemli olmayan verilerin özelliklerini gösteren bazı grafikler Ek Bölümlerde yer almıştır.

Analizler ve Sonuçlar

Amerika Birleşik Devletleri ile birlikte analiz edilmek üzere seçilen ülkeler Avustralya, Japonya, Birleşik Krallık, Çin ve Brezilya'dır. 3. Bölümde, bu ülkelerdeki ekonomik durum analiz edilmekte, dış borçları, mevcut mali rezervleri ve ABD ile olan ticari dengeleri sunulmakta ve birbirleriyle karşılaştırılmaktadır. Bunlar dış ekonomilerden gelen etki seviyesinde önemli faktörler olduğunu varsaydığımız değişkenlerdir. Görülen o ki, ülkeler arasında söze geçen konularda ciddi farklar mevcut. Çin ve Brezilya düşük dış borca ve yüksek mali rezervlere sahipken, diğer ülkeler GSYİH'ye oranda yüksek dış borçlara ve düşük mali rezervlere sahip. Ülkelerin ABD ile ticaret ilişkileri de bir-birinden farklı seviyelerde.

Ülkelerin finansal piyasalarını temsil etmek için her finansal piyasadan 1 adet hisse senedi endeksi seçilmiştir. Bunlar ABD için S & P 500, Avustralya için ASX 200,

Japonya için Nikkei 225, Birleşik Krallık için FTSE 100, Çin için SSE Kompozit Endeksi ve Brezilya için BVSP'dir.

4. bölümde, piyasaları temsil etmesi için seçilmiş endekslerin günlük getiri oranları arasındaki eş-hareket analiz edilmektedir. Endeksler arasındaki korelasyonlar hesaplanmıştr. Günlük getiriler arasındaki eş-hareketi analiz etmek için Vector Autoregressive modeli kullanılıyor. Ayrıca, hangi endekslerin S & P 500 getirilerini etkilediğini ve bunun tersini saptamak için İkili Granger Nedensellik testini kullanıyoruz. İkili Granger Nedensellik testi sonuçları, dünyanın en büyük borsalarından birini temsil etmesi beklenen S & P 500'ün günlük getirilerinin, diğer endekslerden etkilenmekten ziyade, diğer endekslere neden olma olasılığının daha yüksek olduğunu göstermektedir. Sadece ASX200, S & P 500 ile iki yönlü bir ilişkiye sahip gibi görünüyor, yani ikisi de birbirlerinin günlük getirilerini etkiliyor. Korelasyon sonuçlarına bakarsak, ABD temsilcisi endeks S & P 500'ün günlük getirilerinin FTSE100, ASX200 ve BVSP'nin getirileriyle güçlü bir pozitif korelasyona sahip olduğunu görebiliyoruz. Ancak S & P 500 ve Asya ülkelerinin hisse senedi endeksleri (N225 ve SSE) arasındaki korelasyonlar çok düşüktür, ancak yine de olumludur. Bunun dışında FTSE100 ve BVSP, ASX200 ve BVSP, FTSE100 ve ASX200 çiftleri de yüksek oranda pozitif korelasyona sahiptir.

Makroekonomik açıklamalar yapıldığı zaman yatırımcıların yapılmış açıklamanın bilgi içeriği hakkında farklı görüşlere sahip olacağı, aynı bilgiyi bazı yatırımcıların iyi, bazılarının ise kötü haber olarak algılayacağı ve bunun da borsada pozitif ticaret hacmi yaratacağı beklenmektedir. Bölüm 5'te bu fikri test etmek için, ABD'de yapılmış makroekonomik duyuruların tarihlerini kukla değişkenler olarak kullanıyor ve S & P 500, ASX200, N225 ve SSE'nin günlük ticaret hacimleri üzerindeki etkisini analiz edeiyoruz. Bunlardan başka, modele yayınlandığı tarihlerde ticaret hacminde herhangi bir artış olup olmadığını görmek için IMF World Economic Outlook tarihlerinin kukla değişken olarak ekledik, ancak etkinin istatistiksel olarak anlamlı olmadığı bulundu. Güncel literatürden farklı olarak, günlük ticaret hacminin analizinde, Genelleştirilmiş Otoregresif Koşullu Heteroskedastisite (GARCH) ve Üstel GARCH (EGARCH) modelleri

kullanılmıştır. Kullanılan verilerin sözü geçen modellere uygun olup olmadığını kontrol etmek için Artırılmış Dickey-Fuller birim kök testi kullanılır.

Modeldeki artık terimlerin herhangi bir modelde normal olduğu varsayılmamış ve mümkün olan en iyi sonucu elde edebilmek için 3 tip artık terimi (normal, Genelleştirilmiş Hata, student-t) kullanılarak aynı model 3 kere tekrarlanmıştır. Ardından, Bayesian Bilgi Ölçütü (BIC) 3 modeli karşılaştırmak ve en uygun olanı seçmek için kullanılmıştır. Ayrıca, ayrıca modellerdeki gecikme dönemini belirlemek için de Bayesian Bilgi Ölçütü kullanılmıştır.

3 makroekonomik göstergenin (GSYİH Büyümesi, TÜFE ve İşsizlik) duyurulduğu tarihler ve IMF WEO raporunun yayınlanma tarihleri kukla değişkenler olarak kullanılmaktadır. Yani, her bir gösterge için açıklamaların yapıldığı tarihlerde bağımsız değişkenin değeri 1, diğer günlerde ise 0'dır.

Bir önceki günkü ticaret hacmi (diğer durumda ticaret hacmindeki değişim) olası otokorelasyon etkisinden kaçınmak için modele bağımsız bir değişken olarak dahil edilmiştir.

Bu bölümde elde edilen en önemli bulgulardan biri, ABD'nin makroekonomik açıklamalarının etkisinin, dış piyasaların ticaret hacminde eksi, yerel piyasada ise pozitif olması. ABD'de gerçekleşen makroekonomik duyuruların Avustralya ve Japon hisse senedi piyasalarında pozitif bir hacim yaratmadığı, bunun yerine daha düşük ticaret hacimlerine neden olduğu görülebilir. Bu durum, yatırımcıların ABD borsalarına odaklanmasının ve yerel pazarda daha az alım satımının yapılmasının bir sonucu olabilir. Ancak bunu kesin olarak söylemek için yeterli kanıt yok ve bu düşüncenin gelecekte ayrıntılı bir analize ihtiyacı vardır. Çin'in büyük mali rezervleri ve düşük kamu borcu olan bir ülke olması nedeniyle Çin ile ilgili sonuçlar oldukça beklenendi. Bahsedilen değerler dış faktörlerin Çin hisse senedi piyasasını etkilemesini zorlaştırabilir. Böylece, yatırımcıların dış haberlere tepki verme olasılığı daha düşüktür. Yapılan analizlerden elde edilen bir diğer bulgu ise, hisse senedi endekslerinin hiçbirinin IMF'nin yayınladığı Dünya Ekonomik Görünüm'ün (World Economic Outlook) yayınlanma tarihlerine tepki göstermemesidir.

6. bölümde, makroekonomik duyuruların bilgi içeriğinin 6 ülkenin hisse senedi endekslerin gün içi 5 dakikalık getirileri ve oynaklık dalgalanmaları üzerindeki etkisi test edilmektedir. Duyuruların sürpriz bölümünün ve sürprizlerin karesinin ayrı ayrı etkisini test ediyoruz. Ayrıca, pozitif ve negatif sürprizler önce tek bir değişken olarak modele eklenmiş, sonrasındaysa iki ayrı değişken olarak eklenerek analizler tekrarlanmıştır. Tezin bu bölümünde analiz için EGARCH modeli kullanılmıştır. ARCH / GARCH modelleri için kullanılan getiri verilerinin uygun olup olmadığını kontrol etmek için Artırılmış Dickey-Fuller birim kök testi kullanılır.

Sürprizin etkisinin ilanın yapıldığı ilk 5-10 dakikalık sürede en iyi şekilde gerçekleşebileceği varsayılmaktadır. Yapılan varsayıma göre, bir ülkenin borsası anonsun yapıldığı süre içerisinde çalışmadığı takdirde, borsa ertesi gün açık kaldıktan sonra ilk 10 dakika içinde etkinin gerçekleşmesi beklenir.

Bir piyasanın yatırımcıları, ABD'nin makroekonomik göstergelerinin piyasaları üzerinde bir etkisi olacağını düşünürse, gelen sürpriz bilgilerinin yorumlanmasına bağlı olarak taleplerini artıracak veya azaltacağı varsayılmaktadır. Yatırımcılar bilgiye hızlı bir şekilde ulaşabileceğinden - ilan yapılır yapılmaz, ilan yapıldıktan sonra birkaç dakika içinde cevap vermelidirler.

Tezin bu bölümünde yapılan rasyonel ve adaptif beklentileri olan yatırımcıların varsayıldığı modeller arasındaki farklılıklar, yatırımcı davranışlarını ve düşünme şekillerini belirlemede yardımcı olacaktır. Bu karşılaştırmanın, yatırımcıların büyük kuruluşlar ve profesyonel ekonomistler tarafından açıklanan beklentileri kendileri için beklenen değerler olarak kabul edip etmedikleri veya en son resmi duyuruyu beklenen değer olarak aldıkları ya da her ikisinin de yapıldığı sonucuna ulaşılmasına yardımcı olması bekleniyor.

Bu tezin çoğu bölümünde, insanların beklentilerini rasyonel bir şekilde oluşturduğunu ve Uluslararası Para Fonu Dünya Ekonomik Görünümü ve Wall Street Journal Ekonomik Tahminler veritabanından planlanan makroekonomik duyurular için beklenen değerleri aldığını varsayarız. Daha sonra, “sürpriz” i hesaplamak için resmi duyuru ile daha önce beklenen değer arasındaki farkı

buluyoruz. Ek olarak, bu kez S & P 500 için yapılan analizleri, yatırımcıların makroekonomik göstergenin bir sonraki resmi değerinin en son resmi olarak ilan edilen değerle aynı olacağını düşündüklerini varsayıyoruz. Daha sonra, sonuçları önceden yapılmış S & P 500 getirileri ve volatilitesi üzerinde olan etkiyle karşılaştırdık ve sonuç olarak ekonomide her iki tür yatırımcının da olabileceği sonucuna vardık. Rasyonel veya adaptif beklentileri varsayarak etkiyi analiz eden literatür örnekleri vardır. Ancak en iyi bilgimize göre, bu tez çalışması gün içi verileri kullanarak hisse senedi piyasalarındaki makroekonomik duyuruların etkilerini analiz eden çalışmalar arasında beklentilerin iki türünü aynı anda analiz edip karşılaştıran ilk tezdir.

Dış borçları GSYİH'e oranda çok düşük, rezervleri ise çok yüksek olmasından dolayı ABD'den gelen harici haberlerin etkisinin Çin üzerinde Bölüm 5'teki analizler sonucunda da görüldüğü gibi düşük olması ve mevcut analizden elde edilen sonuçların bu fikri desteklemesi bekleniyordu. Ayrıca Brezilya da Çin gibi düşük kamu borcuna ve büyük mali rezervlere sahip bir ülkedir. Bu nedenle, Çin hisse senedi endeksinin analizinden elde edilen sonuçlara dayanarak, dış kaynaklı haber bültenlerinin etkisinin, yüksek dış borcu olan ülkelere kıyasla Brezilya'da daha az olması beklenmektedir. Bu bölümden çıkan sonuçlar ileri sürülen fikri desteklemektedir. Düşük dış borç ve yüksek rezervlere sahip ülkelerin aksine, yüksek dış borç ve düşük mali rezervleri olan ülkelerle ilgili sonuçlara baktığımızda, sürprizlerin etkilerinin çoğu zaman önemli olduğunu görüyoruz. Bu nedenle, ülkelerin yüksek borçları ve düşük rezervleri olduğunda ABD'den gelen sürpriz haberlere daha duyarlı oldukları sonucuna varabiliriz.

Nowak ve diğ. (2011), sürprizlerin etkisinin gelişmekte olan piyasalardaki etkisinin fiyatlardan ziyade volatilite üzerinde daha fazla olduğunu göstermektedir. Bu tezde analiz edilen ülkeler için de aynı fikri söylemek mümkün. Ayrıca, bu, yalnızca gelişmekte olan ülkeler için değil, gelişmiş ülkeler için de geçerli. Yukarıdaki sonuçlardan başka, sürprizin büyüklüğünün çoğu zaman sürprizin pozitif ve ya negatif olmasından daha önemli faktör olduğunu söyleyebiliriz. Sürpriz büyüdükçe, getiri veya getiri dalgalanmaları yükselir.

Hem Bölüm 5 hem de Bölüm 6'da sonuçlar gösteriyor ki, daha düşük dış borç ve daha yüksek mali rezervleri olan ülkelerin finansal piyasaları ABD'den gelen haberlerden daha az etkilenmeye eğilimlidir. Bu iddiayı test etmek ve daha güvenilir sonuçlara varmak için, Bölüm 7'de, bu değişkenlerin ABD ile olan ticari ilişkilerinin değerleriyle birlikte hisse senedi endekslerinin ortalama aylık varyansları üzerindeki etkisi analiz edilmektedir.

ABD dışındaki ülkeler için seçilen makroekonomik değişkenlerin borsadaki oynaklığı etkileyip etkilemediğini belirlemek için çeşitli modeller kullanılarak panel veri analizi kullanılmıştır. Kullanılan ilk model, tüm verilerin bir araya toplandığı En Küçük Kareler (OLS) modelidir.

Bu modelde piyasaların daha hassas olmasına neden olması beklenen 4 değişkenin değerleri bağımsız değişkenler olarak kullanılmıştır. Sözü geçen değişkenler daha önce de bahsedildiği gibi, dış borç, mali rezervler, ABD ile toplam ticaretin değeri ve ABD ile ticaret açığının değeridir. Modelde White standart hatalar ve kovaryans ve yatay kesit SUR ağırlıkları kullanılmıştır.

Analiz için kullanılan ikinci model, yukarıda bahsedilen modelde olduğu gibi aynı açıklayıcı değişkenleri içerir, ancak bu kez kesitsel Rastgele Efekt (Random Effect) modelini kullanır. Yine, analizde White standart hatalar ve kovaryans kullanılmıştır.

Üçüncü model aynı zamanda ilk 2 model ile aynıdır, bu kez kesitsel Sabit Etkili Model (Fixed Effect) kullanılmıştır. Model için White standart hatalar ve kovaryans ve yatay kesit SUR ağırlıkları kullanılmıştır.

ABD'nin sürpriz haberlerini içeren bir model kullanılarak tüm ülkelerin GARCH varyansları elde edildiğinden, ABD dışındaki ülkeler için ABD ile olan ilişkilerin borsadaki oynaklık üzerinde bir etkiye sahip olmasını bekleriz. O yüzden bu değişkenler modelin bir parçasıdır.

ABD için ise, günlük GARCH varyanslarının aylık ortalamaları, S & P 500 getirilerinin duyarlılığı için proxy olarak kullanılmaktadır. Standart GARCH (1, 1) modeli kullanılmıştır. S&P 500'ün oynaklığı üzerine çeşitli faktörlerin etkisini test etmek için Amerika Birleşik Devletleri'nin makroekonomik değişkenleri açıklayıcı

değişkenler olarak kullanılmıştır. Bu değişkenler ABD'nin GSYİH değeri, toplam dış borçları, toplam mali rezervleri, dış ticaretinin hacmi ve ticaret açığıdır.

ABD dışındaki ülkelerin piyasaları üzerinde yapılan analizlerin sonuçlarına göre, dış borcun GSYİH'ya oranının getiri volatilitesi üzerindeki etkisi beklentileri karşılamadı. Şaşırtıcı bir şekilde piyasaların hassaslığı üzerinde olumsuz etkiye sahiptir. Sabit Efekt modelini kullanırken ise dış borcun etkisi istatistiksel olarak önemsizdir. Uluslararası rezervler ve ABD ile ticaret dengesi de volatilite üzerinde önemli bir olumsuz etkiye sahiptir. ABD ile toplam ticaret ise volatiliteyi olumlu yönde etkilemektedir.

Analizlerin sonuçlarına bakıldığında, bir ülkenin uluslararası rezervleri yükseldikçe borsalarının daha az duyarlı hale geldiği sonucuna varılabilir. Bu, piyasadaki yatırımcıların ülke ekonomisine daha fazla güvenmesinden kaynaklanabilir. Bir ülkenin ABD ile arasındaki toplam ticaretin değerinin GSYİH'e oranı ABD ile ekonomik ilişkilerin iyi bir göstergesi olabilir, bu nedenle ABD ile büyük ticaret hacmine sahip olmak dış faktörlere daha duyarlı bir borsaya yol açabilir. Öte yandan ABD ile olan pozitif ticaret dengesi, borsada volatilitenin düşük olmasına izin veriyor.

Amerika Birleşik Devletleri için yapılan analizlerin sonuçları, ABD'nin toplam dış borcunun, toplam ticaret ve ticaret dengesinin S&P 500 endeksinin ortalama aylık volatilitesi üzerinde istatistiksel olarak anlamlı bir etkiye sahip olmadığını göstermektedir. Bunun yerine, GSYİH ve uluslararası rezervler, S & P 500'ün varyanslarını negatif olarak etkilemektedir. ABD ekonomisi büyüdükçe ve ABD'nin uluslararası rezervleri yükseldikçe, borsa daha az dalgalı hale gelmektedir. Her iki durum da ekonomi için olumlu işaretler olduğundan, bu sonuçlar oldukça beklenilendir.

Bu tez çalışmasında ortaya koyulan başka bir soru, bulunan sonuçların uzun vadede doğru olup olmadığı. Yatırımcılar gelen bilgileri doğru değerlendiriyor mu? Yoksa sadece anlık şok olarak gelen bilgilere verdikleri tepki gerçek nedenlere dayanmıyor mu? Bu soruyu cevaplamak için, Bölüm 8'de, seçilen makroekonomik göstergelerin, analiz edilen endekslerin aylık getiri oranları üzerindeki etkisini test ediyoruz.

Göstergelerin, gün içi 5 dakikalık getiriler üzerindeki etkisine benzer olarak aylık getiri oranları üzerinde istatistiksel olarak anlamlı bir etkisi varsa, o pazarın yatırımcılarının gelen bilgileri değerlendirmede iyi olduğunu varsayıyoruz.

Tezin bu bölümünde, ABD'deki makroekonomik göstergelerle ilgili mevcut resmi bilgilerin 6 farklı ülkeden 6 hisse senedi endeksinin aylık getirileri üzerindeki etkisini kontrol etmek için En Küçük Kareler modeli kullanılmıştır.

Elde edilen sonuçlar göz önüne alındığında, Çin borsa yatırımcılarının dış ekonomilerden gelen sonuçları yorumlamada oldukça başarılı oldukları sonucuna varabiliriz. İngiliz, Avustralya ve Brezilya borsalarının yatırımcıları, dış etkiyi değerlendirmede iyi değildir. BVSP'nin yatırımcıları, ABD ekonomisinin etkisini hafife alırken, ASX200 ve FTSE 100 yatırımcıları aşırıya kaçıyor. Japon ve ABD hisse senedi piyasalarının oyuncuları, ABD'nin makroekonomik değişkenlerinin hisse senedi piyasalarına olan etkisini takdir etmede oldukça iyiler, ancak muhtemelen etki yönünü değerlendirememektedirler. En iyi bilgimize göre, aynı ülkeleri analiz eden mevcut literatürlerden hiçbiri benzer analizlerle ilgilenmez.

Hisse senedi endeksleri ile birlikte, Bölüm 9'de, aynı makroekonomik analizin ABD'nin en büyük firmalarından 2-sine, Apple Inc. ve Exxon Mobil Corp'a olan etkisini de test ediyoruz. Tezin bu bölümünde, Genelleştirilmiş Otoregresif Koşullu Heteroskedastisite (GARCH) modeli ile Sermaye Varlık Fiyatlandırma Modelini (CAPM) aynı anda kullanılıyor. CAPM, ortalama denklem olarak, GARCH / EGARCH ise varyans denklemi olarak kullanılır. Bu, literatürde yaygın olarak kullanılan bir yöntem değildir ve bu iki modeli herhangi bir şekilde birlikte kullanan sadece birkaç örnek vardır. Bu bölümde ABD borsasında listelenmiş ayrı-ayrı şirketlerin de makroekonomik haber sürprizlerinden etkilendiği sonucuna vardık. Bu bölüm ayrıca CAPM ve GARCH / EGARCH modellerini birlikte kullanılmış olması açısından için dikkat çekicidir.

Bölüm 5, Bölüm 6 ve Bölüm 9'daki gecikme seçimiyle ilgili analizlerin sonuçlarına bakıldığında, GARCH (1,1) ve EGARCH (1,1) modellerinin analiz için oldukça yeterli olduğu söyleyebiliriz. Yani, gecikme döneminin arttırılmasının önemli ölçüde daha iyi modele yol açmayacağı, aksine modelin oluşturulması için harcanan

zamanı arttıracağı görülmektedir. Bunun dışında artık terimi türünün seçimi için yapılan analizler normal ve Genelleştirilmiş Hata dağılımları yerine Student'in t dağılımını kullanmanın daha iyi olduğunu göstermektedir. Bu dağılım kullanılarak yapılan modeller diğerleriyle kıyasta daha düşük Bayesian Bilgi Ölçütü değerleri veriyor. Bu bulgular gelecekte yapılacak olan benzer çalışmalar için gerekli olacakdır. Tez boyu yapılmış olan ekonometrik analizlerde EViews programı kullanılmıştır.

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TEZİN TÜRÜ / DEGREE: Yüksek Lisans / Master ☑ **Doktora** / PhD ☐

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