ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL OF ARTS AND SOCIAL SCIENCES

INVESTOR SENTIMENT EFFECT ON GLOBAL EVENTS: EVIDENCE FROM INTERNATIONAL STOCK MARKETS

M.Sc. THESIS

Mine Ceren ŞEN

Department of Management

Management M.Sc. Programme

JUNE 2019

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İSTANBUL TEKNİK ÜNİVERSİTESİ ★ SOSYAL BİLİMLER ENSTİTÜSÜ

YATIRIMCI DUYARLILIĞININ KÜRESEL OLAYLAR ÜZERİNDEKİ ETKİSİ: ULUSLARARASI BORSALARDAN ÖRNEKLER

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Mine Ceren ŞEN, an **M.Sc.** student of ITU **Graduate School of Arts and Social Sciences** student ID **403171018**, successfully defended the **thesis/dissertation** entitled "INVESTOR SENTIMENT EFFECT ON GLOBAL EVENTS: EVIDENCE FROM INTERNATIONAL STOCK MARKETS", which she prepared after fulfilling the requirements specified in the associated legislations, before the jury whose signatures are below.

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To my mom and dad who are the most precious gifts I have in this world,

FOREWORD

The main objective of this thesis is to determine the investor sentiment effects on international stock markets based on various global events. Although there are plenty of studies related to investor sentiment and stock market behavior considering global events separately, this thesis aims to provide a better insight of investor sentiment phenomenon through the markets, by combining both sides and exploring the effects related to different incidents.

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June 2019 Mine Ceren ŞEN

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ABBREVIATIONS

AAII : American Association of Individual Investors

ADX : Abu Dhabi Securities Exchange

AEX : Amsterdam Exchange Index

ARCH : Autoregressive Conditional Heteroskedasticity

ASE : Amman Stock Exhange

ATG : Athens General Composite Index

BEL 20 : Euronext Brussels

BIST 100 : Borsa Istanbul

BLOM : Beirut Stock Exhange

CAC 40 : Cotation Assistée en Continu

CBOE : Chicago Board Options Exchange

CCI : Consumer Confidence Index

CEFD : Closed End Fund Discount

CPI : Consumer Price Index

DAX : Deutscher Aktien Index

DJIA : Dow Jones Industrial Average

EGARCH : Exponential Generalized Autoregressive Conditional Heteroskedasticity

EGX 30 : Egyptian Exchange Price Index

FTSE 100 : Financial Times Stock Exchange

FTSE MIB : Milano Indice di Borsa

GARCH : Generalized Autoregressive Conditional Heteroskedasticity

GARCH-M : Generalized Autoregressive Conditional Heteroskedasticity in Mean

GDP : Gross Domestic Product

GJR-GARCH: Glosten, Jagannathan and Runkle Generalized Autoregressive Conditional Heteroskedasticity

HSI : Hang Seng Index

IBEX 35 : Índice Bursátil Español

II : Investors' Intelligence

IPO : Initial Public Offering

ISEQ : Irish Stock Exchange Equity Overall Index

ISIL **:** Islamic State of Iraq and the Levant

KSE 100 **:** Karachi Stock Exchange 100 Index

KOSPI **:** Korea Composite Stock Price Index

MCCI **:** Michigan Consumer Confidence Index

MOEX **:** Moscow Exchange

MXSE IPC **:** Mexican Stock Exchange

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

NBER **:** National Bureau of Economic Research

Nikkei 225 **:** Japan's Nikkei 225 Stock Average

NYSE **:** New York Stock Exchange

OMXC 20 **:** Copenhagen Stock Exchange

PCR **:** Put – Call Ratio

PPI **:** Producer Price Index

PSI 20 **:** Portugese Stock Index

QE **:** Qatar Stock Exhange

SSEC **:** Shanghai Stock Exchange Composite Index

S&P 500 **:** Standard and Poor’s 500 Composite Index

TASI **:** Tadawul All Share Index

TA 35 **:** Tel Aviv Stock Exchange

TWSE **:** Taiwan Stock Exchange

VIX **:** Volatility Implied Index

WIG **:** Warszawski Indeks Giełdowy

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INVESTOR SENTIMENT EFFECT ON GLOBAL EVENTS: EVIDENCE FROM INTERNATIONAL STOCK MARKETS

SUMMARY

The Efficient Market Hypothesis was acknowledged among academic society a generation ago. The hypothesis depends on the idea that if any mispricing occurs, the market will return instantaneously to its equilibrium price since it would be immediately arbitraged away. Hence, the stock market is full of events like the Black Monday Crash which occurred in 1987. Thus, traditional financial models have faced difficulty in fitting these patterns.

Since the traditional finance models are found inadequate in explaining financial anomalies through the market, the researchers have been in an attempt to generate alternative models that consider behavioral and psychological factors. Thus, the suggested behavioral finance phenomenon depends on two basic assumptions that the investors are subject to sentiment and that there are limits to arbitrage. They specifically assume that investors are irrational. This is indicated as investor sentiment and defined briefly as investor opinion that is mostly influenced by emotion. The literature implies that investor sentiment may influence the decisions through investments and is related to stock returns. Also, many studies exert significant evidence that the concept of investor sentiment causes overreaction and the overreaction leads to excess volatility in stock returns.

Today's world is more engaged than ever due to globalization and the flow of information is faster than ever. Therefore, people can learn about the incidents that happen on the other side of the world immediately. This relation through different regions of the world increases the probability of them to affect one another in many aspects. Previous studies also indicate that incidents such as wars, terror activities and elections have substantial effects on the stock market behavior.

The main objective of this thesis is to determine the investor sentiment effects on the stock market indices of various countries with regards to selected global events. To comprehend the influences of investor sentiment significantly, the conditional volatilities of the stock markets are examined. An EGARCH model is applied to investigate the impacts of investor sentiment on the conditional volatilities of stock returns since it is easy to interpret, it helps to overcome the non-negativity constraints and to understand the asymmetric effects substantially.

There exist several investor sentiment proxies appointed in the literature. In this thesis, daily trading volume data of the stock market indices of countries, in which the selected events occurred, is selected as an investor sentiment measure. However, instead of using trading volume directly in the model, a regression analysis is applied where trading volume data is the dependent variable and various macroeconomic variables such as Gross Domestic Product (GDP), Consumer Price Index, (CPI), Producer Price Index (PPI), Unemployment Rate, Money Supply, Industrial Production and Treasury Bill Yields are the independent variables. Also, the Michigan

Consumer Confidence Index, for the US, and Consumer Confidence Index, for the rest of the countries, data are employed as dummy variables in the regression. Consequently, the residuals of these analyses are applied as investor sentiment index in the EGARCH model.

The thesis is analyzed under twelve global events. In all cases, the daily closing values of selected stock market indices, from the US (DJIA), the UK (FTSE 100), France (CAC 40), Japan (Nikkei 225), China (SSEC), Turkey (BIST 100), Greece (ATG), Egypt (EGX 30) and many other indices that are thought to be influenced by such events are taken and the logarithmic returns of them are applied. Then, the stock market returns are employed as dependent variables and the investor sentiment indices that are constructed using trading volume data are appointed as independent variables in the EGARCH model.

Through the observed global events, it is determined that there exists an investor sentiment effect on the selected stock markets associated with the incidents that are 2001, September 11 Terrorist Attacks, 2001, Turkish Economic Crisis, 2005, London Train Bombings, 2008, Global Financial Crisis, 2008, Wenchuan Earthquake, 2010, Greek Sovereign Debt Crisis, 2011, Japan Earthquake and Tsunami, 2015, Paris Terrorist Attacks, 2016, Brexit Referendum and 2016, US Presidential Election.

The investor sentiment associated with the crises, which are 2001, Turkish Economic Crisis, 2008, Global Financial Crisis and 2010, Greek Sovereign Debt Crisis, constitutes substantial impacts. For 2001, Turkish Economic Crisis, Turkey, Brazil, Germany, Japan, the UK and the US are affected whereas, for 2008, Global Financial Crisis, the US, China, Germany, Japan, Russia, Turkey and the UK are influenced by investor sentiment. Also, 2010, Greek Sovereign Debt Crisis exerts significant impacts in Greece, Belgium, Italy, Spain and Poland. Moreover, the investor sentiment related to the political events, that are 2016, Brexit Referendum and 2016, US Presidential Election, generate intense effects. For, 2016, Brexit Referendum, the UK, Belgium, France, Germany, Italy, Netherlands, Spain, Turkey and the US are affected, meanwhile for 2016, US Presidential Election, China, France, Germany, Japan, Mexico, South Korea and Turkey are affected by investor sentiment.

The investor sentiment associated with the terrorist activities, which are 2001, September 11 Terrorist Attacks, 2005, London Train Bombings and 2015, Paris Terrorist Attacks, lead to considerable impacts. For, 2001, September 11 Terrorist Attacks, Turkey and Pakistan are affected whereas, for 2005, London Train Bombings, the UK, France, Netherlands and Spain are influenced by investor sentiment. Also for 2015, Paris Terrorist Attacks, there exist impacts of investor sentiment in Belgium, Germany and Portugal. However, the investor sentiment related to natural disasters is not as effective as for the other event groups, through the markets. The only influence of investor sentiment is observed in China, regarding 2008, Wenchuan Earthquake incident and South Korea, regarding 2011, Japan Earthquake and Tsunami event.

Among all selected global events, the investor sentiment related to political events seems to generate the greatest impacts over the selected stock market indices. The results indicate substantial evidence that the effects of investor sentiment with regards to the crises, political events and terror activities exert great influences through the international stock markets as well as the local markets. However, in contrast, the effects of investor sentiment associated with the Wenchuan Earthquake happen to be local.

Regardless of the geographical location, the political structure or the economic power of the countries, high investor sentiment effects are indicated through the selected global incidents. Also, the stock market indices of several developed countries such as France (CAC 40), Germany (DAX), the US (DJIA), the UK (FTSE 100) and Japan (Nikkei 225), and the stock market indices of various developing countries which are Turkey (BIST 100) and China (SSEC) happen to have significant investor sentiment effects associated with the selected incidents.

YATIRIMCI DUYARLILIĞININ KÜRESEL OLAYLAR ÜZERİNDEKİ ETKİSİ: ULUSLARARASI BORSALARDAN ÖRNEKLER

ÖZET

Etkin Piyasalar Hipotezi, çok uzun zamandan beri akademik çevreler tarafından kabul görmüş bir olgudur. Bu hipotez, borsada herhangi bir yanlış fiyatlandırma gerçekleşmesi durumunda, hızla arbitraj yapılarak bunun çözüleceğine ve borsanın kolaylıkla denge fiyatına döneceği esasına dayanmaktadır. Fakat borsa, 1987 yılında gerçekleşen ve Kara Pazartesi olarak adlandırılan olaya benzer birçok duruma şahit olmuştur. Geleneksel finans modelleri, bu gibi durumlara uyum sağlamakta zorluklar yaşamaktadır.

Geleneksel finans modelleri, borsalara ilişkin finansal anormallikleri açıklamakta güçlük çekmektedir. Bu sebeple araştırmacılar davranışsal ve psikolojik faktörleri göz önünde bulunduran alternatif modeller oluşturmaya çalışmaktadır. Davranışsal finans kavramı iki temel esasa dayanmaktadır. Bunlardan ilki yatırımcıların bir duyarlılığa sahip olduğu, diğeriyse arbitrajın limitli olduğu temeline dayanmaktadır. Spesifik olarak belirtmek gerekirse, yatırımcıların irrasyonel davranışlar sergilediklerine inanılmaktadır. Bu olgu, yatırımcı duyarlılığı olarak ifade edilmektedir. Yatırımcı duyarlılığı ise kısaca, çoğunlukla duygulardan etkilenen yatırımcı kararları olarak tanımlanmaktadır.

Hızla gelişen literatürde yapılan çalışmalar doğrultusunda, yatırımcı duyarlılığının yatırım kararlarını etkileyebildiği ve borsa endekslerinin getirileri üzerinde etkileri olduğu gözlemlenmektedir. Aynı zamanda, yatırımcı duyarlılığının aşırı tepki verilmesine yol açtığı ve bu aşırı tepkinin ise borsa endekslerinin getirileri üzerinde fazladan volataliteye sebebiyet verdiği hakkında, önemli kanıtlar elde edilmesini sağlayan birçok çalışma yapılmıştır.

Günümüzde dünya, globalleşmenin de etkisiyle, hiç olmadığı kadar iç içedir. Aynı zamanda bilginin akışı eskiye nazaran oldukça hızlıdır. Dolayısıyla bireyler dünyanın öbür ucunda gerçekleşen bir olayı kolaylıkla ve hızlıca öğrenebilmektedir. Dünyanın farklı bölgeleri arasındaki bu ilişki, bu bölgelerin birbirini etkileme ihtimalini artırmaktadır. Aynı zamanda geçmiş çalışmalar, savaşlar, terör aktiviteleri ve seçimler gibi olayların borsa davranışları üzerinde kayda değer etkileri olduğunu belirtmektedir.

Bu tezin temel amacı, önemli küresel olaylar göz önünde bulundurularak, çeşitli ülkelerin borsa endeksleri üzerindeki yatırımcı duyarlılığı etkisini gözlemlemektir. Yatırımcı duyarlılığının etkilerini anlamlı bir biçimde algılayabilmek adına, borsa getirilerinin koşullu volataliteleri incelenmektedir. Bu nedenle, bir EGARCH modeli kullanılmaktadır. Uygulaması kolay bir model olduğu kadar, aynı zamanda, pozitif ve negatif şokları ayırmada ve asimetrik etkileri anlamakta yardımcı olduğundan ötürü analizler için EGARCH modeli seçilmiştir.

Literatürde çeşitli yatırımcı duyarlılığı göstergelerinden bahsedilmektedir. Bu tezde, yatırımcı duyarlılığı göstergesi olarak, tezde ele alınan olayların gerçekleştiği farklı

ülkelere ait borsaların günlük işlem hacmi verileri kullanılmaktadır. Fakat, işlem hacmi verileri direkt olarak modele koyulmadan, bu veriler Gayri Safi Yurtiçi Hasıla, Tüketici Fiyat Endeksi (TÜFE), Üretici Fiyat Endeksi (ÜFE), İşsizlik Oranı, Para Arzı, Endüstriyel Üretim ve Hazine Bonosu Faiz Oranı gibi makroekonomik değişkenlerle regresyona sokulmaktadır. Ayrıca, her bir ülkenin Tüketici Güven Endeksi verileri regresyonda kukla değişken olarak kullanılmıştır. Amerika'da gerçekleşmiş olan olaylar için ise Tüketici Güven Endeksi olarak Michigan Tüketici Güven Endeksi verileri dikkate alınmış ve aynı biçimde regresyona kukla değişken olarak eklenmiştir. Sonuç itibariyle, bu analizlerin artıkları, yatırımcı duyarlılığı endeksi olarak kullanılıp EGARCH modeline aktarılmıştır.

Bu çalışmada on iki adet farklı küresel olay ele alınıp incelenmektedir. Her bir olay için, seçilmiş ülkelerin borsa endekslerinin günlük kapanış verileri alınmış ve her birinin logaritmik getirileri hesaplanmıştır. Amerika için DJIA, İngiltere için FTSE 100, Fransa için CAC 40, Almanya için, DAX, Türkiye için BIST 100, Yunanistan için ATG ve Mısır için EGX 30 borsa endekslerinin verileri dikkate alınmıştır. Aynı zamanda, tezde incelenen küresel olaylardan etkilenebileceği düşünülen farklı ülkelerin borsa endeks verileri de kullanılmıştır. Ardından, borsa endeks getirisi verileri bağımlı değişkenler ve işlem hacmi verileri kullanılarak elde edilen yatırımcı duyarlılığı endeksi verileri bağımsız değişkenler olarak atanıp EGARCH modeline eklenmiştir.

İncelenen küresel olaylar doğrultusunda, 2001'de gerçekleşen 11 Eylül Saldırıları, 2001 yılı etrafında meydana gelen Türkiye Ekonomik Krizi, 2005'te gerçekleşen Londra Tren Saldırıları, 2008 yılı etrafında meydana gelen Global Finansal Kriz, 2008'de gerçekleşen Wenchuan Depremi, 2010 yılı etrafında Yunanistan'da ortaya çıkan Borç Krizi, 2011'de gerçekleşen Japonya Depremi ve Tsunami, 2015 yılında meydana gelen Paris Terör Saldırıları, 2016 yılında gerçekleşen Brexit Referandumu ve 2016 yılında Amerika'da meydana gelen Başkanlık Seçimi gibi olayların üzerinde kayda değer bir yatırımcı duyarlılığı etkisi olduğu gözlemlenmiştir.

Yatırımcı duyarlılığının, bu tezde incelenen olay gruplarından biri olan krizler üstünde anlamlı etkileri olduğu saptanmıştır. Bu olaylar 2001 yılı etrafında gerçekleşen Türkiye Ekonomik Krizi ile 2008 yılı etrafında meydana gelen Global Finansal Kriz ve 2010 yılı etrafında gerçekleşen Yunanistan Borç Krizidir. Türkiye'de ortaya çıkan ekonomik krize ilişkin yatırımcı duyarlılığı etkilerinin gözlemlendiği ülkeler Türkiye, Brezilya, Japonya, Almanya, Amerika ve Birleşik Krallık olarak sıralanabilir. Bunun yanısıra, 2008 yılı etrafında Amerika'da ortaya çıkan Global Finansal Kriz ele alındığında, Amerika, Çin, Almanya, Japonya, Rusya, Türkiye ve Birleşik Krallık üstünde kayda değer yatırımcı duyarlılığı etkilerine rastlanmıştır. Aynı zamanda, 2010 yılı etrafında Yunanistan'da gerçekleşen borç krizine ilişkin yatırımcı duyarlılığı etkileri Yunanistan başta olmak üzere, Belçika, İtalya, İspanya ve Polonya'da gözlemlenmiştir.

Bu tezde incelenen bir diğer olay grubu olan politik olaylar üzerinde de, krizler üstünde olduğu gibi, önemli yatırımcı duyarlılığı etkileri saptanmıştır. Bu politik olaylar 2016 yılında meydana gelen Brexit Referandumu ile yine 2016 yılında Amerika'da gerçekleşen Başkanlık Seçimidir. Referanduma ilişkin yatırımcı duyarlılığı etkilerinin gözlemlendiği ülkeler Birleşik Krallık, Belçika, Fransa, Almanya, İtalya, Hollanda, İspanya, Türkiye ve Amerika iken, Amerika'da 2016 yılında gerçekleştirilen başkanlık seçimi doğrultusunda yatırımcı duyarlılığı etkisi gösteren ülkeler Çin, Fransa, Almanya, Japonya, Meksika, Güney Kore ve Türkiye olarak sıralanabilir.

Tezde incelenen terör aktivitelerinden 2001'de gerçekleşen 11 Eylül Saldırıları, 2005'te meydana gelen Londra Tren Saldırıları ve 2015'te gerçekleşen Paris Terör Saldırıları üzerinde de kayda değer yatırımcı duyarlılığı etkileri gözlemlenmiştir. 11 Eylül Saldırıları doğrultusunda yatırımcı duyarlılığı etkisi gösteren ülkeler Türkiye ve Pakistan iken, 2005'de gerçekleşen Londra Tren Saldırılarına ilişkin yatırımcı duyarlılığı etkilerine Birleşik Krallık başta olmak üzere, Fransa, Hollanda ve İspanya'da rastlanmıştır. Aynı zamanda 2015 yılında meydana gelen Paris Terör Saldırıları doğrultusunda incelenen ülkelerden Belçika, Almanya ve Portekiz'de yatırımcı duyarlılığı etkileri saptanmıştır.

Seçilen tüm küresel olaylar göz önüne alındığında, en fazla yatırımcı duyarlılığına sebebiyet veren olaylar, politik olaylar olarak tespit edilmiştir. Uygulanan analizler sonucunda, krizler, politik olaylar ve terör saldırılarına ilişkin yatırımcı duyarlılığının yerel borsalarla birlikte uluslararası borsalar üzerinde de önemli etkileri olduğu görülmüştür. Buna karşın, 2008 yılında meydana gelen Wenchuan Depremi doğrultusunda oluşan yatırımcı duyarlılığı etkilerinin yerel olduğu gözlemlenmiştir.

Ele alınan küresel olaylar dikkate alınarak yapılan çalışmalar neticesinde, coğrafi konumları, politik yapıları ve ekonomik güçlerine bakılmaksızın, çeşitli ülkelere ait farklı borsa endeksleri üzerinde güçlü yatırımcı duyarlılığı etkileri olduğu tespit edilmiştir. Aynı zamanda, tezde ele alınan küresel olaylar doğrultusunda yatırımcı duyarlılığı etkisine rastlanan olaylar göz önünde bulundurularak, bazı ülkelerin borsa endeksleri üzerinde, diğer endekslere kıyasla daha büyük etkiler gözlemlenmiştir. Almanya (DAX), Amerika (DJIA), Birleşik Krallık (FTSE 100), Fransa (CAC 40) ve Japonya (Nikkei 225) gibi gelişmiş ülkelerin borsa endeksleri ile Çin (SSEC) ve Türkiye (BIST 100) gibi gelimekte olan ülkelerin borsa endekslerinde kaydadeğer yatırımcı duyarlılığı etkilerine rastlanmıştır.

1. INTRODUCTION

A generation ago, the Efficient Market Hypothesis was acknowledged among all academic society. The securities markets were widely assumed to be intensely efficient in the reflection of information about individual stocks. The accepted thought, revealed by Fama et al. (1969), indicates that the news spread very rapidly through the markets and new information is reflected in the stock prices immediately. Thus, neither fundamental analysis, mainly the analysis of financial information that helps investors to select undervalued stocks, nor technical analysis, the study of predicting future prices with past stock prices, would allow an investor to achieve above-average returns without acknowledging the above-average risk.

The Efficient Market Hypothesis depends on the idea of a random walk, which is a term used to describe "a price series where all subsequent price changes present random departures from former prices" (Malkiel, 2003). The basic idea of a random walk is that the flow of information is untrammelled which leads to instantaneous reflection of information through the stock prices. Fama (1965) also indicates that the series of price changes have no memory, therefore, the antecedents cannot be used to predict the future. Therefore, tomorrow's news will only be reflected by tomorrow's price changes and independent of today's price changes. However, the news is unpredictable by nature and will lead to random and unpredictable price changes. Consequently, the prices utterly reflect all available information and the investors will get a rate of return as abundant as which is obtained by the experts.

Efficient Market Hypothesis also asserts that if any mispricing occurs, the market will return instantaneously to its equilibrium price since it would be immediately arbitraged away. Hence, Baker and Wurgler (2007) state that "the stock market history is full of events like the Great Crash of 1929, the Tronics Boom of the early 1960s, the Go-Go Years of the late 1960s, the Nifty Fifty bubble of the early 1970s, the Black Monday crash of October 1987 and the Dot.com bubble of the 1990s". The traditional financial models have faced difficulty in fitting these patterns.

By the beginning of the 21st century, the precedence of the Efficient Market Hypothesis had become low on propensity. Even before, in the 1990s, the focus of academic discussion yielded to developing models of human psychology. Through this attention, the field of behavioral finance, which is finance that is more comprehensive with respect to social science considering both psychology and sociology (Shiller, 2003), has been developed. It is considered as a modern approach through the financial markets which arose as a solution to the inadequacy in explaining market reactions with traditional finance theories. Specifically, behavioral finance suggests that some financial phenomenon can better be described using models which suppose that some traders are not completely rational.

Statman (1999) indicates that people are "rational" in standard finance, also known as traditional finance, and they are "normal" in behavioral finance. Traditional finance asserts that the debate between investors who pursue abnormal profits drives the prices to their fundamental value, which is the "discounted sum of expected future cash flows, where the discount rate is coherent with a normatively acceptable choice specification" (Barberis and Thaler, 2003). Thus, behavioral finance suggests that asset prices deviate from their fundamental values, which is the concept of mispricing, and the deviations are caused by traders who are not definitely rational.

Behavioral finance theories have two core principles which are limits to arbitrage and psychology. The limits to arbitrage, initially highlighted by Shleifer and Vishny (1997) is based on the idea that arbitrage is risky, costly and limited. Whereas, psychology determines the kinds of deviations from full rationality, including biases that arise from the beliefs and the preferences of people. Biases such as conservatism and representativeness, studied previously by Tversky and Kahneman (1974) and Griffin and Tversky (1992), help to understand investor psychology.

Two types of traders exist in the market, which are information traders, also known as arbitrageurs, and noise traders (Black, 1986; Shefrin and Statman, 1994). Arbitrageurs can be defined as who act by considering fundamental information and processing all information rationally, whereas there exist not a precise definition in the literature that identifies noise traders. De Long (2005) indicates that noise traders are "who trade on poor information or sometimes no information at all". According to Tetlock (2006), noise traders are people "who have hedging incentives or irrational reasons to trade". Also, Wang (2001) defines them as who misperceive their noise as information.

There exist two types of risk that limit arbitrage, which are fundamental risk and noise trader risk. Fundamental risk, which is the most apparent risk that arbitrageur faces, can be limited by short selling a substitute security. However, substitute securities are mostly imperfect and inadequate in removing the whole fundamental risk. Consequently, the arbitrageur will still be affected by the risk that is exclusive to his portfolio. Noise trader risk, which is mentioned initially by De Long et al. (1990) and studied further by Shleifer and Vishny (1997), can briefly be defined as the risk that mispricing, which is misused by the arbitrageur, deteriorates in the short-run. The arbitrageur will be subject to the risk that pessimistic investors, who become more pessimistic, lower the stock price more, even he comes up with an excellent substitute for short selling.

In their study, De Long et al. (1990) also determine that irrational noise traders both affect stock prices and earn greater returns, and indicate that investors are subject to sentiment. The definitions of sentiment range in a wide spectrum. While most definitions include non-Bayesian beliefs on risks and returns, Brown and Cliff (2004) state that "sentiment is the anticipations of market participants". Baker and Wurgler (2007) define investor sentiment as "a belief about future cash flows and investment risks which is not justified by the facts at hand". It can also be defined briefly as investor opinion, generally affected by emotion.

This thesis depends on the investor sentiment methodology, which is an alternative method to traditional finance theories. Investor sentiment methodology, or mainly noise trader approach, depends on two basic assumptions. The first one implies that not all investors are completely rational, they act using their beliefs in claiming risky assets and they are subject to sentiment. Besides, the other assumption is that arbitrage, which is trading utterly by rational investors, is risky and costly. Thus, betting against sentimental investors have limits to arbitrage.

The literature states that investor sentiment, or noise trading, can influence the decisions through investment and is related to future stock returns. Using closed-end fund discounts for measuring investor sentiment, Lee et al. (1991) indicate that "changes in sentiment affect fund share prices", the difference between these prices and the net asset values. Brown and Cliff (2005) use Investors Intelligence as an investor sentiment measure and examine that investor sentiment estimates market returns over the next one to three years. In consistence, Schmeling (2009) investigates

the connection between investor sentiment and future stock returns for various countries and determines that sentiment substantially predicts the expected returns. Hirshleifer (2001) indicates that noise trading causes overreaction and the overreaction leads to excess volatility in returns.

In this thesis, trading volume is used as an investor sentiment measure. The initial reason for this is that Baker and Stein (2004) analyze the phenomenon as a proxy in detailed and it is considered to be practical and plausible to use this measure. Secondly, it is easier to find convenient trading volume data for the stock markets of many countries. Lastly, it is accessible for long periods for various stock market indices. Nevertheless, the most important aspect of choosing trading volume is that it appears to be the only compatible approach to obtain an investor sentiment measure which can be compared across a wide range of countries.

Al-Thaqeb (2018) claims that "Today's world is more connected than ever due to globalization and developments in technology. Through advancements in technology, the flow of information has become more fluid and faster than ever before, individuals can learn about events that are taking place on the other side of the world instantaneously". This relationship between different regions of the world strengthens the ability of them to impact one another in many aspects. Therefore, the impact of environmental, political, economic and social events on the stock market has been broadly discussed in the literature. A wide range of studies indicates that events such as elections, wars, environmental accidents, terror activities and energy crises exert remarkable influence on market behavior.

Regarding the literature, some major global events are considered and studied in this thesis. The events are classified into four groups in Section 2, which are crises, natural disasters, political events and terror activities. Each group consists of three major incidents that have worldwide effects. However, the analysis on each event is conducted separately, to evaluate the influences of investor sentiment in every incident respectively.

Literature is full of event studies, broadly discussed in Section 2, which are examined in different perspectives. For instance, Ferraira and Karali (2015) examine how major earthquakes influenced the returns and volatility of various stock market indices. They use an event study methodology based on regression and create a dummy variable to

express the whole earthquakes selected in the study. They also construct a GARCH (1,1) model that the conditional mean and variance equations are a function of the dummy variable. Consequently, they indicate that financial markets recover instantly after the shocks that the earthquakes generate. In consistence, Corbet et al. (2018) examine whether and how the terrorist events within Europe affect the stability of domestic stock markets, adopting a GARCH framework. They employ GARCH, EGARCH and GJR-GARCH models respectively. They indicate that incidents like bombings and explosions generate stock market volatility whereas events such as infrastructure attacks and hijackings do not generate widespread volatility effects.

There also exists plenty of research conducted on investor sentiment effect on various stock markets. For instance, Verma and Verma (2007) evaluate the influence of investor sentiment on DJIA and S&P 500 by estimating a multivariate EGARCH model and using AAII as an investor sentiment proxy. They conclude that investor sentiment substantially determines the stock market volatilities. Also, Wang (2018) adopts GARCH, GJR-GARCH and EGARCH models to determine the role of institutional investor sentiment in the mean-variance relation. He points out that institutional investors, that affect the mean-variance relation, are sentiment traders.

The main purpose of this study is to determine whether investor sentiment, which is measured by an investor sentiment index which is presented applying trading volume data, have a substantial impact on stock returns and conditional volatility of the stock returns, considering various major global events and can be used to examine returns and conditional volatilities of stock market indices in several stock markets.

Regarding the literature, an EGARCH model is constructed in this thesis, to investigate the returns and conditional volatility of stock returns for various stock market indices, taking different global events into consideration. EGARCH method is chosen since the model helps to overcome the non-negativity constraints and to understand the asymmetric effects particularly.

The thesis outline is as follows: Initially, the literature is examined in many aspects, in Section 2, thoroughly where investor sentiment is defined broadly, its history is evaluated, various investor sentiment measures are introduced and discussed, the impacts of investor sentiment proxies are examined, events that will be used in the analyses are indicated and investigated in different perspectives. After the extensive

literature review, in Section 3, the hypotheses of the thesis are mentioned and the research questions are expressed briefly. In Section 4, methodology considering the literature is discussed briefly, the method that is applied in this thesis is indicated and the equations of the analyses are constructed. Also, the data which is considered in the thesis are represented. Later in Section 5, the findings of the analyses and the results of each hypothesis are presented. Finally, in Section 6, the discussions on the results are expressed, a brief conclusion of the thesis is mentioned and the further implications that might be useful are discussed.

2. LITERATURE REVIEW

2.1 Investor Sentiment

Traditional financial models state that investors tend to act by using all existing information and measuring probability. In other words, traditional finance can be said to rely on models in which behavior of the investors is considered rational. The rational investor is defined as someone who has "well-defined preferences" and forms "precise beliefs" by means of Bayesian logic. However, as many studies document, "stock price over or underreaction to extreme shocks cannot be reconciled with finance-theoretic approaches" since the traditional financial models do not take the psychological and sociological factors into account, that presumably affect asset prices and the decision process through investment (Sayim and Rahman, 2015). Hence, the traditional finance models are found inadequate in explaining the over and underreaction through the market, the researchers have been in the attempt to generate alternative models which rely both on behavioral and psychological factors. This phenomenon which is called behavioral finance challenges the assumption about rational investors that traditional financial models suggest, while it also premediates that some financial anomalies can be best expressed using models which assume an investor irrationality.

Therefore, studies have been conducted to explain this irrationality with a behavioral approach. This is indicated to as investor sentiment and can be described as investor opinion that is generally affected by emotion. Shefrin (2008) states that "Definitions of sentiment range from roughly worded statements about the mistakes and errors of investors, which are model specific". Also, Brown and Cliff (2004) claim that "Academic researchers, financial analysts, and the media categorize the term in a wide spectrum and use it in a variety of ways". Most definitions include non-Bayesian beliefs about risks and returns or the use of nontraditional choices (Wurgler, 2012). Some researchers believe that investor sentiment is a "tendency to trade on noise instead of information", while the term is specially referred to as investor optimism or pessimism (Uygur, 2015). Baker and Wurgler (2007) indicate that investor sentiment is "a belief about future cash flows and investment risks that is not justified by the facts

at hand". Irrational investors, which are subject to investor sentiment, trade on some psychological impulses or sentiment rather than stock fundamentals.

The alternative model that researchers in behavioral finance have been studying on, depends on two basic assumptions. The initial assumption laid out by De Long et al. (1990) is that irrational noise traders with inaccurate stochastic beliefs both have an impact on prices and earn greater expected returns, which in short indicates that investors are subject to sentiment. The other assumption that is highlighted by Shleifer and Vishny (1997) states that arbitrage is costly, risky and limited. Consequently, rational investors, also known as arbitrageurs, are not completely effective in bringing prices to fundamental values as the standard model would assume.

According to this work, Barberis et al. (1998) use biases such as representativeness and conservatism, which are subject to individual investor psychology, to express how investors over- or underreact to previous returns. They also benefit from the studies of Tversky and Kahneman (1974) and Griffin and Tversky (1992) which provide psychological evidence in conservatism and representativeness heuristics. They find considerable evidence that the stock prices overreact to persistent patterns of good or bad news whereas they underreact to earnings announcements and events that are similar.

In consistence, Daniel et al. (1998) offer a theory on "investor overconfidence" and "biased self-attribution", which indicates that investors overreact to signals of private information and underreact to signals of public information. Barberis and Thaler (2003) also mention that individual investors might show overconfidence, herding behavior and speculation, which may give rise to substandard trading decisions that might not be arbitraged away promptly. Considering this information, it is demonstrated that investor sentiment contributes to the stock valuation and the markets' volatility modelling.

2.1.1 Investor sentiment effect on the stock market

The literature implies that investor sentiment, which can influence investment decisions, is related to future stock returns. For instance, Fisher and Statman (2000) study on the relation between investor sentiment and stock market returns to investigate investor biases in market forecasts and return opportunities. They evaluate sentiments of large, medium and small investors. They find a high but imperfect

correlation between sentiment changes of small and medium investors and no correlation between changes in the sentiment of large investors and others. In contrast, Brown and Cliff (2004) determine that the strongest involvement is in between institutional sentiment and large stocks. This finding provides suggestions to the literature, which argues "noise" traders are individuals that influence small stocks. The term "noise" is initially used by Black (1986) as contrast to information in financial markets, making the concept of noise trading widespread among the literature.

Baker and Wurgler (2006) study on how investor sentiment has impacts on the cross-section of stock returns. They determine that when the sentiment measures, in the beginning, are low, subsequent returns are slightly high for the stocks which are small, young, unprofitable, non-dividend-paying or distressed, and the stocks that have high volatility. Besides, when sentiment is high, these kinds of stocks earn slightly low subsequent returns. Baker and Wurgler (2007) indicate that stocks that are difficult to arbitrage or to value are the most influenced by sentiment.

Consistent with these findings, Bathia and Bredin (2013) indicate that value stocks are influenced by investor sentiment and they observe that when sentiment is high, future returns are low and vice versa. Also, further research conducted by Piccoli and Chaudhury (2018) provides strong evidence that "the overreaction is more pronounced when there is low investor sentiment rather than high". They mention that this is because when sentiment is low, pessimism increases and confidence decreases. Therefore, the investors perceive an extreme incident with higher contrast and they are more concerned to overreact more.

Investigating the relationship between investor sentiment and future stock returns for various countries, Schmeling (2009) finds that sentiment is a substantial indicator of expected returns across the countries. He finds that the influence of sentiment on returns is higher for countries that are culturally more inclined to herd in investing and for countries that have less market integrity or less efficient regulatory institutions. He mentions that institutional quality and cultural factors are effective in determining the relation of sentiment and return. Since culture does not easily change, he asserts that the sentiment effects will be permanent in countries with a herding culture.

In consistence, Corredor et al. (2013) also state that the sentiment generates a substantial influence on returns. They examine the role of stock characteristics and

country-specific factors in expressing the impact. After controlling the country-specific impacts, they determine that stock characteristics are highly relevant in expressing the effect of investor sentiment on stock returns. They also mention that other factors like cultural or institutional differences may have a significant role. Aissia (2016) investigates the home and foreign constituents of investor behavior and finds that both home and foreign investor sentiments affect stock returns. This overcome indicates that equity home bias is also a significant constituent of investor sentiment.

Hirshleifer (2001) indicates that noise trading causes overreaction and the overreaction leads to excess volatility in returns. Verma and Verma (2007) examine the relative impacts of fundamental and noise trading on conditional volatility. They find substantial positive impacts of investor sentiment on stock returns and significant negative effects of investor sentiment on volatilities, both for institutional and individual investors. Yu and Yuan (2011) show the investor sentiment effect on the mean and variance tradeoff of the market. They indicate that the expected excess return and the conditional variance of the stock market in low sentiment periods are positively related. However, they observe that there is no relation in high sentiment periods. Consistently, Wang (2018) studies on the role of institutional investor sentiment in the mean and variance relation. During bearish periods, the market returns seem to be positively related to the market's conditional volatility, whereas, during bullish periods, they are negatively related to volatility. He also mentions that the institutional investors are also subject to sentiment.

2.1.2 Measuring investor sentiment

In the literature of finance, measuring investor sentiment and quantifying its effects has been a big issue. Therefore, various research has been conducted abundantly through the history of the financial markets. Currently there exist many sentiment measures such as the ones which are constructed for academic purposes, daily indices and the ones that are used by traders for various objectives, such as closed-end fund discount, market liquidity, consumer confidence indices, net mutual fund redemptions, implied volatility of index options investor intelligence surveys and ratio of odd-lot sales to purchases (Uygur and Taş, 2012). Since there exist a variety of measures, it is determined that there is not an investor sentiment gauge that is accurate and efficient.

These measures can be studied under three approaches. The first one uses biases in individual investor psychology such as overconfidence, conservatism and representativeness (Barberis et al., 1998; Daniel et al., 1998) to explain how individual investors overreact or underreact to past returns. The second approach applies survey-based techniques which ask people about their considerations and anticipations about the stock market and aspire to generate a proxy of investor sentiment that seizes the mood of the investors. It includes the American Association of Individual Investors (AAII) and Investors Intelligence (II) surveys. Also, the Consumer Confidence Index which is studied by Schmeling (2009) exists in this group. The third approach uses specific financial data which benefit from different proxies such as trading volume and mutual fund flows. These are known as market-based proxies, which are generated from empirical puzzles such as IPO underpricing and closed-end fund discount.

Baker and Wurgler (2007) use proxies such as dividend premium, number of first-day returns on IPOs and equity share in new issues, in order to measure the investor sentiment. They regress each proxy on macroeconomic data to eliminate the impacts of the fundamental macroeconomic news. Following this study, investor sentiment indices for six major stock market indices are constructed by Baker et al. (2012). The indices are then decomposed into one global and six-country specific indices. In their study, they use proxies such as volatility premium, initial public offering (IPO) data and market turnover.

Consistently, Hudson and Green (2015) constitute two new indices in order to analyze UK market-wide and institutional investor sentiment. They use the advances to declines ratio, the closed-end fund discount, the Money Flow Index, the put-call open interest ratio, the put-call trading volume ratio, realized volatility, the Relative Strength Index and trading volume proxies to measure investor sentiment. Hwang (2011) studies the effect of country-specific sentiment on security prices and determines that a country's popularity among Americans influences the demand for securities of US investors from that country and causes deviation of security prices from their fundamental values. He uses country closed-end fund discount, Country Popularity Score, dividend yield, expense ratio, home market valuation ratio, Institutional Holdings, inverse security price, turnover ratio and US market valuation ratio as sentiment proxies.

Uygur and Taş (2012) use the change in the daily and weekly trading volumes as an investor sentiment proxy. They examine the measurement of sentiment in two subdivisions which are market-based proxies and direct surveys. Market-based proxies are which extract sentiment implicitly from measures like closed-end fund discount and put-call ratio. Direct surveys use surveys and questionnaires in order to measure investor sentiment. This approach consists of proxies such as the Michigan Consumer Confidence Index and the Yale School of Management's Stock Market Confidence Index. In their study, Uygur and Taş (2014) use a new proxy for investor sentiment an apply a regression analysis where weekly trading volumes of market indices are the dependent variables and several macroeconomic variables are the independent variables. Then, the residuals of this process are appointed as investor sentiment proxies.

Regarding the literature, the possible market-based proxies, direct surveys and other measures which are subject to sentiment are mentioned respectively.

2.1.2.1 Market-based proxies

Closed-end fund discount

Closed-end funds are investment companies which issue a fixed number of shares and then trade on stock exchanges. Closed-end fund discount (CEFD) is the average difference between the net asset value of actual security holdings of the fund and the market price of the fund. One of the most puzzling remarks in financial markets indicates that closed-end funds are traded at a discount, with the acceptance of the markets being efficient and arbitrage opportunities being rare.

Lee et al. (1991) try to explain this puzzle in terms of investor sentiment. Besides, Zweig (1973), Berk and Stanton (2004) and Spiegel (1997) use rational approaches expressing closed-end fund discounts in terms of tax liabilities, agency costs and illiquidity of assets. Neal and Wheatley (1998) study on mutual fund redemptions, the ratio of odd-lot sales to purchases and CEFDs in order to examine their forecast power. They conclude that net redemptions and fund discounts are adequate in predicting the size premium. Hence, the odd-lot ratio is found insufficient in the prediction of returns. Although CEFD is applied as a favorable investor sentiment proxy in various research, Qui and Welch (2004) believe that considering only the closed-end fund discount as a proxy may not be a sufficient indicator of investor sentiment.

Dividend premium

The premium for dividend-paying stocks is thought to be inversely related to sentiment and used as a proxy. The dividend premium is defined by Baker and Wurgler (2004) as the "difference between the average market-to-book value ratios of dividend payers and nonpayers". Fama and French (2001) indicate that when dividends are at a premium, firms are more likely to pay them whereas they are less likely to pay when they are at discount. Baker and Wurgler (2006) mention that dividend-paying stocks have a predictable income stream that investors comprehend as a remarkable characteristic of safety.

Initial public offering (IPO) data

Initial public offerings are argued to if they might be expressed by investor enthusiasm or not. Rational firms may take advantage of the prevalent market sentiment to raise new equity. Therefore, the IPOs tend to come in waves that relate to periods of overvaluation or undervaluation. Another aspect of initial public offerings is that they are subject to underpricing. When they first go public, they face a significant price increase on their first trading day since the equity that the companies sell is in a tendency to be underpriced. Also, the IPO market is mostly considered to be very sensitive to sentiment. Based on these facts, some researchers indicate that IPO data can be used as an investor sentiment proxy. Consequently, Baker and Wurgler (2007) use high first-day returns on IPOs and the volume of IPO as proxies of investor sentiment.

Equity shares in new issues

This is a more comprehensive measure of equity financing activity which measures not just IPOs but all equity offerings. Baker and Wurgler (2000) find evidence that the "share of equity issues in total new equity" and "debt issues" is a strong predictor of US stock market returns. However, they are inadequate in finding a link between equity share and subsequent returns in an efficient market. Therefore, Baker and Wurgler (2007) use this proxy to express it in terms of sentiment.

Mutual fund flows

Brown et al. (2002) determine that fund flows have positively contemporaneous correlations with stock returns. Frazzini and Lamont (2008) use mutual fund flows as an individual investor sentiment measure for different stocks and ascertain that high sentiment predicts low future returns in the long run. Goetzmann et al. (2004) examine

the correlation matrix of the net daily flows, a set of mutual fund flows, over a period of a year-and-a-half and conclude that the matrix has structure, assuming a relatively high level of correlated behavior across the US mutual fund investors.

Trading volume

Baker and Stein (2004) use market liquidity, also known as trading volume, as a sentiment proxy. They mention that if short-selling is costlier than opening and closing positions, irrational investors which are more likely to trade, add liquidity, when they are optimistic and buying rising stocks rather than when they are pessimistic and buying falling stocks.

By using the individual buy and sell dollar volumes in NYSE, Kaniel et al. (2008) construct an investor sentiment index which is known as the Net Investor Sentiment. They indicate that, most probably, the individual investors who trade on the NYSE will respond to the liquidity needs of institutions and gain abnormal returns by availing their counterparties demand for immediacy, at least in the short run.

Volatility implied index (VIX)

Market Volatility Index, well known as "investor fear gauge" (Whaley, 2000), measures "investor expectations for market volatility in the following 30 days as implied by the skew of S&P 500 index options" (Bandopadhyaya and Jones, 2008). There exist various academic papers that have used the VIX as an investor sentiment measure. When studying hedge fund returns, Dash and Moran (2005) use the VIX as a proxy for investor sentiment. Considering VIX, Smales (2016) examines the relationship between changes in investor fear levels and financial market returns. Kurov (2010) also uses the VIX index to estimate the impact of monetary policy decisions on the stock market investors' sentiment. He finds that, in bear market periods, monetary policy shocks have a substantial impact on investor sentiment.

Put-call ratio

Even though several put-call ratios (PCRs) are consistent in the literature, the widely used one depending on the data gathered by the Chicago Board Options Exchange (CBOE). CBOE adds all of the put and call options, which are traded on individual equities and various indices, together each day. The put-call ratio can be briefly defined as the volume of put option contracts divided by the volume of call option contracts.

In order to examine the skewness of the risk-neutral density implied by options prices for individual stocks, the put-call ratio is used by Dennis and Mayhew (2002) as an investor sentiment proxy. Also, Bandopadhyaya (2006) uses the put-call ratio to better understand which investor sentiment measure best reflects actual market movement.

Other market proxies

Combining direct and indirect sentiment measures, Beer and Zouaoui (2013) develop a new sentiment index that consists of proxies which are Michigan Consumer Confidence Index, Investors' Intelligence, CEFDs, mutual fund flows, average monthly returns on IPOs and number of IPOs given in a month. As mentioned earlier, Baker and Wurgler (2007) develop an investor sentiment index, instead of using an individual proxy. The index consists of proxies which are closed-end-fund discount, dividend premium, equity share in new issues, number of first-day returns on IPOs and trading volume based on NYSE turnover. To remove the impacts of fundamental macroeconomic news, they regress each proxy with macroeconomic variables that are industrial production, growth in employment, real growth in durable, non-durable, and services consumption and NBER recession indicator.

There exist several other studies on the literature. Using the trading records of individual investors, Kumar and Lee (2006) study whether the stock returns are affected by retail trading. Besides CEFD and market turnover, Qiang and Shu-e (2009) choose the growth rate of investor accounts as an indirect investor sentiment measure. They confirm that investor sentiment is a systematic factor that affects stock prices. Fisher and Statman (2006) use indirect measures such as price-to-earnings (P/E) ratios and dividend yields and bullish sentiment index as a direct measure for investor sentiment. However, none of them is found reliable.

Using percentage change in margin debt, equity fund flow, CEFD, PCR, dividend premium, IPO first day returns and IPO volume as proxies for investor sentiment, Bathia and Bredin (2018) examine whether incorporating several investor sentiment measures in conditional asset pricing models can help to seize the impact of liquidity, momentum, value and size effects on risk-adjusted returns of US individual stocks. Greenwood and Nagel (2009) examine whether the inexperienced investors affect the formation of asset price bubbles, by using retail investor trading data as a proxy. It is concluded that younger investors are more prone to buy technology stocks at the peak of the Internet Bubble than their older colleagues.

2.1.2.2 Direct surveys

American Association of Individual Investors Sentiment Survey (AAII)

Since 1987, the members of the American Association of Individual Investors (AAII), who are selected randomly, have been answering the same simple question each week. The participants are asked whether they assume the stock market would be bullish, bearish or neutral in six months period. The outcomes of these questions are collected into the AAII and offer comprehension about the mood of individual investors (AAII, 2018).

Instead of using an indirect measure of investor sentiment, Brown (1999) uses the data collected for the AAII. He detects that individual investor sentiment is related to the closed-end funds' increased volatility, that also causes the CEFD to be employed as an investor sentiment proxy. Also, Fisher and Statman (2003) investigate the AAII survey of individual investors and find a statistically significant positive relationship between changes in consumer confidence and changes in the sentiment of individual investors.

Investors' Intelligence (II)

In their study, Lee et al. (2002) use Investors' Intelligence as an investor sentiment index. Investors' Intelligence of New Rochelle is a notable proxy that predicts market movements precisely. Each week, editors read and rate 135 independent advisory services. the letters are classified as bullish, bearish or correction in dependence on the prediction of the market. The sentiment index is then computed as the "ratio of the number of investment advisory services" which are bullish regarding the number of all bullish and bearish investment advisory services.

Michigan Consumer Confidence Index (MCCI)

The University of Michigan Consumer Research Center offers a consumer confidence index derived from monthly surveys of consumers since 1978. They conduct 500 telephone interviews with adult men and women from across the US, which ask questions about personal finances, business conditions and buying conditions, and collect information on consumer expectations with regard to the overall economy.

Lemmon and Portniaguina (2006) employ MCCI as an investor sentiment proxy. They develop a time-series framework and conclude that consumer confidence is useful in revealing the time variation in equity portfolio returns, especially the premium-sized.

Zhang (2008) also uses the MCCI in addition to market-based proxies and other survey measures. Qui and Welch (2004) use both the MCCI and CEFD in order to indicate that sentiment changes influence the excess return of the stocks, specifically with small market capitalization.

Yale School of Management's Stock Market Confidence Index

Yale School of Management organized a series of survey questionnaires that depend on stock market outlook, in an attempt to quantify investor confidence. The survey sample is separated into two groups as wealthy individual investors and institutional investors. Then, the survey results are used to construct four stock market confidence indices, which are one-year, buy-on-dips, crash and valuation confidence indices, each derived from the respondents' answers to a single question asked consistently since 1989. Zhang (2008) uses one-year and valuation confidence indices in her study.

2.1.2.3 Other measures

Using the fraction of positive and negative words in two columns of financial news from the New York Times, Garcia (2013) studies the effect of sentiment on asset prices between the period of 1905 and 2005. In consistence with the previous study, Tetlock (2007) uses daily content from the Wall Street Journal columns and examines the interactions between the media and the stock market. He indicates that extremely high or low pessimism predicts high market trading volume and high media pessimism predicts downward pressure on market prices. He determines that the results are consistent with theoretical models of noise.

Da et al. (2015) use daily Internet search volume from millions of households in order to reveal the market level sentiment and construct a new investor sentiment measure named as Financial and Economic Attitudes Revealed by Search (FEARS). They find that, between 2004 and 2011, FEARS predict temporary increases in volatility, short term return reversals and mutual fund flows. They also determine that the results are coherent with the investor sentiment theories.

2.2 Global Events

Due to the developments in technology and globalization, today's world is more engaged than ever. The flow of information has also become more fluid and faster than ever. Therefore, people can instantaneously learn about the incidents that occur on the

other side of the world. “This connection between different regions of the world strengthens the ability of them to influence one another economically, socially and politically”. (Al-Thaqeb, 2018).

If the financial markets pick up information about a forthcoming event, the stock prices can be shifted by that event, days or weeks before it occurs and continue to affect stock prices for some time (Schweitzer, 1989). The effect of economic, environmental, political and social events on stock markets has been comprehensively discussed in the literature. Previous studies indicate that events such as elections, wars, environmental accidents, terror activities, energy crises and monetary policy exert a significant impact on the behavior of the markets. However, the duration or the scope of this effect may differ substantially from one event to another or from one country or region to another.

Consequently, in this section, some major global events are considered and classified into four groups, which are crises, natural disasters, political events and terror activities, in order to determine their impact on different stock markets significantly.

2.2.1 Crises

2.2.1.1 1997, Asian financial crisis

The Asian Financial Crisis began with the collapse of the Thai baht on July 2, 1997, when the Thai Government waived the dollar exchange rate peg. The crisis that was followed by erosion in Hong Kong, has had devastating effects on East Asian countries which are Thailand, Indonesia, Malaysia and Korea. The volatility of daily returns in global equity markets increased substantially when the crisis began. The disastrous effects of the crisis in East Asia not only influenced the countries in this region but also put the global financial system under tremendous stress (Mishkin, 1999).

Various studies are conducted to explain the effects of the Asian Financial Crisis. Tuluca and Zwick (2001) examine the co-movement of daily returns from several Asian and non-Asian markets before and after the crisis. Joe and Oh (2017) investigate foreign investor behavior in the Korean stock market after the Asian Financial Crisis. By determining “the cross-country time-varying correlations among the stochastic constituents of the stock prices” for Indonesia, Malaysia, Korea, Thailand and the Philippines between the crisis and the tranquil period, Khan and Park (2009) determine the presence of herding contagion in the stock markets during the crisis of 1997. They

find strong evidence that the investors rapidly fled from Asian economies when the crisis erupted in Thailand.

Michayluk and Neuhauser (2006) study on stock price behavior in the US around 1997 market decline and aim to determine whether it is persistent with the overreaction hypothesis. They conclude that there exists an overreaction over the day and the week following the 1997 market decline. Using Taiwan's stock market, Lin (2006) examines the relations between equity returns, return volatility and stock purchasing and selling activities by foreign investors and local institutional investors before, during and after the Asian Financial Crisis. He finds little evidence of change through equity flows and market returns in Taiwan's stock market. However, he presents that the Asian crisis has an impact on the relation between equity flows and market volatility. Additionally, he mentions that foreign investors have swiftly increased their investments after the crisis and exert a higher impact on the Taiwan stock market in the post-crisis periods than in the crisis periods.

2.2.1.2 2001, Turkish economic crisis

Since the 1990s, Turkey has been experiencing economic difficulties and suffering from repetitive crises. However, in February 2001, Turkey had faced one of the most intensive economic crises in its history, which was stimulated by the disagreement between the President and the Prime Minister as well as the unstable coalition government and serious internal and external borrowing (Okumus and Karamustafa, 2005). The crisis struck the capital, money and stock markets and also vitiated the financial system that had almost collapsed (Temiz and Gokmen, 2009). The crisis was considered to be more than a financial crisis since it was the consequence of various components such as political factors, absence of good governance, corruption, deficient transparency, government intervention in the economy and poor legal system (Koch and Chaudhary, 2001).

Although the incident was severe in many aspects, there is little literature on 2001, Turkish Economic Crisis and its impacts. By controlling balance sheet currency exposure, international involvement and firm size, Gonenc and Aybar (2006) analyze the effect of business group affiliation and concentrated ownership on the Turkish firms' performance in the period of 2001 financial crisis. They determine that firms which have higher concentrated ownership, lower the stock market performance

before and during the crisis period whereas business group affiliation does not exert any influence.

Considering the 1994 and 2001 crises in Turkey, Tamgac (2011) evaluate the impact of fundamentals and self-fulfilling expectations in these periods. He asserts that in addition to the fundamentals in the economy, shifts in devaluation expectations of the representatives played a significant role. Focusing on the consequences of the 2001 financial crisis in Turkey, Dufour and Orhangazi (2009) investigate the effects of the on capital and labor. They imply that both the international and the industrial capitals benefited from the crisis.

Okumus et al. (2005) explore the effects of the February 2001 economic crisis on the Northern Cyprus tourism sector. They state that the considered event has both positively and negatively influence the tourism industry in Northern Cyprus. Thus, the negative impacts are greater than the positive effects. In consistence, Okumus and Karamustafa (2005) analyze the influence of the 2001 economic crisis on the tourism industry in Turkey. Apart from its negative impacts, the incident is also considered to have positive effects. However, these impacts are undervalued. They also conclude that factors such as national culture, financial resource availability and economic development level of a country influence the way that such an incident is evaluated, responded and managed.

2.2.1.3 2008, Global financial crisis

The Global Financial Crisis period is considered as the first and the most dangerous global crisis since the Great Depression which occurred in the 1930s. The financial crisis was triggered by the collapse of the United States housing market and the following sub-prime mortgage market crash in the summer of 2007. The contagion began in 2007 when sky-high home prices in the United States finally turned decisively downward. It spread out rapidly, initially to the complete US financial sector and then to financial markets that are overseas. Later, it developed into a full-blown international banking crisis with the collapse of the investment bank Lehman Brothers on September 15, 2008. Soon, the crisis was followed by a global economic downturn, the Great Recession which was afterwards determined that had begun in the United States in December 2007. This was considered as the third longest recession in the

United States since World War II. Subsequently, Germany, Japan and China were locked in recession as many smaller countries followed.

There exist plenty of literature on 2008, Global Financial Crisis and its consequences on the stock market since it is a significant event that has huge effects among the world. Focusing on the contagion risk triggered by the subprime crisis of September 2008, Boubaker et al. (2016) estimate the contagion between the US equity market and selected developed and emerging stock markets over the period 2005 and 2014. They find considerable evidence that there exist contagion effects between the US stock market and the developed and emerging equity markets after the financial crisis.

Yang and Chen (2015) study on the dynamic process of herd behavior in Greater China and the US stock markets during different periods of the 2008 financial crisis. They analyze the generalized impulse responses of domestic market returns and investor sentiment and conclude that investors are more prone to pursue the market consensus during and after the financial crisis. Kim et al. (2015) find that the US financial crisis unignorably affects emerging Asian countries, however, this effect is short-lived. They also indicate that foreign investors have a potentially substantial part in channelling foreign crises to domestic economies.

Using local events experienced in the US, Al-Thaqeb (2018) investigates the relation across various international markets' returns. He evaluates the response of international markets to major US political, economic, environmental, and national security events that also include the 2008 financial crisis. He shows that international markets overtly underreact to positive local events in the United States and overreact to negative local events, especially when the incident occurs instantly. Hoffmann et al. (2013) show how individual investor perceptions change and drive trading and risk-taking behavior during the 2008 financial crisis. They mention that investor perceptions shift remarkably during the crisis, with less volatile risk tolerance and risk perceptions than return expectations. During the worst months of the crisis, the return expectations of investors and the risk tolerance decrease, while their risk perceptions raise, and investor perceptions recover towards the end of the crisis.

Namouri et al. (2018) investigate the relationship between investor sentiment and the stock market returns for the G7 countries and the US, to enlighten the investor sentiment effect on incidents such as the 1987 crash, internet bubble and subprime

mortgage crisis. They find that the heterogeneity among investors cannot be ignored and that it may yield some nonlinearity, time-variation, and threshold effects in stock return dynamics. Zouaoui et al. (2011) find that the investor sentiment effect on stock markets is greater for the countries which are culturally more prone to herd-like behavior and overreaction, and for the countries with low efficient regulatory institutions.

2.2.1.4 2010, Greek sovereign debt crisis

The Eurozone debt crisis is mainly about "unsustainable budget deficits" and government debt of a number of Eurozone nations. It is considered as the initial experience with an economic crisis in a currency union in the modern history of the world. In April 2010, Greece requested an EU/IMF bailout package to deal with this fiscal crisis. A few days later S&P has reduced Greece's rating to BB+ and lowered its view of Portugal. Not surprisingly, these incidents affected stock markets around the world. In May 2010, the "series of austerity measures" which was proposed by the Greek Government and "fears that a potential default would agitate the Eurozone financial markets" influenced the European banks that held Greek bonds (Spyrou, 2013). This impact ultimately effused to other European countries.

Several studies are conducted on how Greek Sovereign Debt Crisis affects the stock markets and its impacts on investor perceptions. Analyzing the 2008 Global financial and the European sovereign debt crises, Chan-Lau et al. (2015) attempt to distinguish the effects of different factors on equity returns of banks, sovereign risk, economic growth prospects, funding conditions and investor sentiment. Using VAR methodology, Samarakoon (2017) analyzes the contagion of the Eurozone debt crisis on developed and emerging stock markets. He demonstrates that a negative contagion from the crisis countries to other stock markets exists. Samitas and Tsakalos (2013) study on the correlation dynamics among the Greek and European markets during the Eurozone debt crisis. They find existence of a contagion effect during crash periods but not during the Greek debt crisis.

Shen et al. (2015) examine the contagion effect of the European debt crisis on the stock market of China. They indicate that the crisis contagion effect on the psychology of investors in the Chinese capital market is limited, whereas its impact on the macroeconomic channel is substantial. Chang and Leblond (2015) argue that the

confidence of investors rests to a large extent on the expectation of the Eurozone's solidarity. Spyrou (2013) evaluates the yield spreads' determinants for the European markets in crisis. He concludes that apart from the fundamental variables, investor sentiment is a statistically notable factor for both the level and changes of yield spreads.

By investigating the "contagion effects of GIPSI (Greece, Ireland, Portugal, Spain and Italy), USA, UK and Japan markets on BRIICKS (Brazil, Russia, India, Indonesia, China, South Korea and South Africa) stock markets", Ahmad et al. (2013) examine the financial contagion in an emerging market setting. The empirical outcomes indicate that Ireland, Italy and Spain are the most contagious among GIPSI countries, during the Eurozone crisis period. Using data for multiple European banks, Mink and De Haan (2013) evaluate the effect of news about Greece and news about a Greek bailout on bank stock prices in 2010. They conclude that except for the news associated with the Greek banks, news about Greece does not cause abnormal returns to occur while news about a bailout does. Nevertheless, they determine that sovereign bond prices of Portugal, Ireland, and Spain are responsive to both news about Greece and a Greek bailout.

2.2.2 Natural disasters

2.2.2.1 2005, Hurricane Katrina

Since the early 1990s, the increased risk of hurricanes striking the US has received considerable attention. Hurricane Katrina, which swept into New Orleans on 29 August 2005, caused devastation along much of the north-central Gulf Coast. Since New Orleans, Louisiana flooded hours after the storm had moved inland, as the levee system catastrophically failed, the most severe loss of life and property damage occurred there (Tsai and Chen, 2010). Katrina was guessed earlier to have caused between $100 billion and $125 billion worth of damage (Boettke et al., 2007).

There exist plenty of literature on catastrophic events, especially natural disasters. Krämer and Schich (2008) evaluate the effect of the 20 largest natural or man-made disasters, in terms of insured losses, on several insurance industry stock indices. Grace et al. (2005) examine recent trends in the insurance markets and discuss how these markets are likely to change in response to the reassessment of hurricane risk. Hewitt

(2012) determines market efficiency surrounding several hurricanes in the immediate post-landfall period.

Also, various studies are conducted on Hurricane Katrina and its impacts, considering different perspectives. Baade et al. (2007) examine how Katrina is similar to Hurricane Andrew and Rodney King riots events, and how these similarities might influence the recovery of New Orleans following the storm. Blau et al. (2008) investigate the close proximity of the landfalls of two of the most notable hurricanes which are Katrina and Rita, and examine market anticipation and reaction to both. Boettke et al. (2007) examine the resiliency of community recovery after Hurricane Katrina.

Chatzivasileiadis et al. (2017) analyze the response of the market to hurricane news coverage and how the memory of Katrina influenced the investor decisions during hurricanes Ike, Irene, Sandy and Patricia. The results show that investors react positively to hurricanes as events but negatively to the amount of news associated with the hurricanes. The positive reaction, however, seems to fade away in a 20-day period. They also conclude that the memory of Hurricane Katrina still has an effect on the reaction of investors during hurricanes Ike, Irene, Sandy and Patricia.

Tsai and Chen (2010) investigate the possible effect of several incidents, including Hurricane Katrina, among interest rate, real house price and stock market dynamic interactions, in the US. They show evidence that the correlation between Federal Funds Rate (FFR) and Real House Price (RHP), and between FFR and Dow Jones Industrial Average (DJIA) markets response more to extraordinary incidents than other pairwise markets. They also observe that the returns, influenced by Hurricane Katrina, had positive and negative changes which have short-term effects.

2.2.2.2 2008, Wenchuan earthquake

On May 12, 2008, at 2:28 pm, a major earthquake, known as the Wenchuan Earthquake, with the magnitude of 8.0 struck in Sichuan, Mainland China. It is considered as one of the deadliest earthquakes ever recorded. Even months after the main tremor, strong aftershocks, some of which exceeded the magnitude of 6.0, continued to hit the area. Apart from the severe property damage it caused, this unforeseen incident left thousands of injured and dead. It also left approximately 5 million people homeless. Besides, Wenchuan Earthquake caused “a level of anxiety

and fear in Mainland China so powerful and widespread that is incomparable to any natural disasters the country faced within the previous years" (Shan and Gong, 2012).

The studies about the Wenchuan Earthquake are diversified. For instance, the study of Deng et al. (2013) uses the 2008 Wenchuan Earthquake as a natural experiment to examine how the housing market reacted to this disastrous event. Another study conducted by Deng et al. (2015) appoints the Wenchuan Earthquake in order to determine if the emergence of a natural disaster can lead to an extreme fear of living on the upper floors. Using data of the response of Chinese firms to the 2008 Wenchuan Earthquake, Qiu (2013) evaluates whether the decision and amount of firm charitable giving in response to catastrophic incidents are associated with the firm's post-performance.

Little literature exists about the 2008 Wenchuan Earthquake and its impacts on the stock markets. Siddiqui and Rawal (2017) identify the impact of three natural disasters, which are the Wenchuan Earthquake of 2008, Tohoku Earthquake and Tsunami of 2011 and the US Hurricane Sandy of 2012 on cointegration among selected world stock market indices. Considering the Wenchuan Earthquake, Shan and Gong (2012) investigate the effects of investor sentiment on stock returns. Consistent with investor sentiment literature, they indicate that in the 12 months following the Wenchuan Earthquake, stock returns are substantially lower for Chinese-listed firms which are headquartered nearer the epicenter than for firms which are further away.

2.2.2.3 2011, Japan earthquake and tsunami

The Great East Japan Earthquake, which is also known as "2011 Tohoku Earthquake", struck at 2:46 p.m. on March 11, 2011, is the most powerful known earthquake to hit Japan (Hood et al., 2013). Also, it is considered as one of the five worldwide earthquakes to register a 9.0 or higher magnitude in the past one hundred years. The tsunami it triggered was its most damaging aspect leaving thousands of dead and damaging considerable property. The most notorious damage of the earthquake was that three nuclear reactors failed and exploded which caused the Fukushima nuclear incident. The Tohoku Earthquake was classified as a level-seven event on the International Nuclear Event Scale and said to pose a risk equal to the worst nuclear power plant accident in the history, which is the Chernobyl disaster. These events had a notable negative impact on the economy of Japan.

In this context, several studies are conducted on the 2011 Japan Earthquake and its consequences on the stock markets. Asongu (2012) investigates if the Japanese Earthquake, tsunami and nuclear disaster had impacts on the stability of the correlation structure in international stock and foreign exchange markets. Ferreira and Karali (2015) examine how major earthquakes influenced the returns and volatility of various stock market indices. They assume that financial markets recover instantaneously after the shocks brought out by the earthquakes. The outcomes also prove that the volatility of the stock market is not affected by the earthquakes, except for Japan. Fakhry et al. (2018) analyze the long and short-run impacts of the earthquake on the Japanese equity, debt and FX markets. They find evidence that the influence of the Tohoku Earthquake on the financial markets is short lived.

Valizadeh et al. (2017) investigate how the impacts of 2011, Japan Earthquake spread across the Japan stock market and the stock markets of its trading partners. They examine the short and long-run effects of the earthquake on several sector indices in the Japanese stock markets and its major trading partners which are China and United States, and minor trading partners that are Germany, France, Italy and Spain. The outcomes suggest that stock markets of Japan and its trading partners were not easily and immediately recovered after the earthquake. However, the direction of the influence on Japan's trading partners differs among the sectors, while the earthquake adversely had impacts on most of the determined sectors, some sectors benefited.

Considering 120 Japanese and 100 US aggregate natural disaster incidents, Wang and Kutan (2013) investigate the impact of natural disasters on the insurance sector and on the composite stock market in Japan and the United States. They conclude that investors do not have to panic when a natural disaster occurs in both Japan and the United States since the effect is shifted away at the market level in both countries. Although the United States insurance sector suffers from natural disasters, the insurance sector in Japan gains.

Hood et al. (2013) study the investor reaction in Japan to the 2011 Tohoku Earthquake and concentrate on individual and foreign investor behavior. In their research, it is found that a significant loss in the stock market took place instantly after the earthquake, the Nikkei opened at 12299 on the day of the earthquake and fell as far low as 8228 in the week after the earthquake. In consistence, Luo (2012) finds a negative shock brought by the earthquake in six major stock markets. Kamesaka

(2013) indicates that although the Japanese stock prices dramatically plummeted after the earthquake, they have become stable within a few weeks after the disaster.

2.2.3 Political events

2.2.3.1 2011, Arab spring

On December 18, 2010, Mohamed Bouazizi, a young vegetable seller from Sidi Bouzid, a small town in Tunisia, was tragically suicided in protest. “His plight, which came to symbolize the injustice and economic hardship afflicting many Tunisians, inspired street protests throughout the country against high unemployment, poverty, and political repression” (Mnif, 2017). The incident not only affected Tunisia but also triggered a revolutionary wave of demonstrations and protests in the Arab World. These widespread protests and demand for reforms, Arab Spring movements, have led to varying degrees of political changes.

There exists some literature on the Arab Spring and its impacts on the stock markets, regionally and internationally. Jeribi et al. (2015) investigate the influence of political uncertainty, triggered by the Tunisian Revolution, on the volatility of major sectoral stock indices in the Tunisian Stock Exchange (TSE). They apply the fractionally integrated exponential generalized autoregressive conditional heteroscedasticity model (FIEGARCH), which provides a direct shock persistence and also measures the asymmetric volatility. Abdelbaki (2013) investigates the effect of political instability, economic instability and external incidents related to the Egyptian revolution, on the stock market performance. He concludes that political instability plays a significant role in affecting the function of stock markets. Seddiki (2015) evaluates whether the financial turbulence, with regards to the political instability after the Arab Spring, spread to other stable countries. The results indicate that causality appeared rapidly, following the crisis, only on cases such as Tunisia to Jordan and Egypt to Morocco.

Chau et al. (2014) examine the influence of political uncertainty, triggered by the civil uprisings in the Arab World, on the volatility of major stock markets in the MENA region. They mention that Arab Spring and the political turbulence have contributed to the volatility of MENA stock markets, specifically for the Islamic indices. However, there exists little or no remarkable effect on their interaction and integration with the world stock markets. Ahmed (2017a) evaluates the “role of foreign capital flows in the volatility of the Egyptian equity market, and whether this role has changed” according

to the domestic political events. He indicates that the total trades of foreign individual investors have no substantial effect on the EGX volatility, before or during the 2011 uprising. In contrast to that, there exists a substantial positive relation between volatility and foreign institutional trading. Also, he finds that sell trades by foreign individual and institutional investors lead to a notable impact on volatility.

Following the Arab Spring, Egypt had two presidential elections and a military coup. Ahmed (2017b) analyzes the impact of these political events on the equity market behavior of the country, both in terms of returns and volatility. The outcomes of the analysis prove that while the presidential elections of 2012 and 2014 have an important positive price effect on EGX100, the military coup has a remarkable negative effect. Moreover, political uncertainty efficiently influences the risk-return profiles of almost all sectors, with variant degrees of intensity. Broadly, the impacts of price and volatility are mostly seen in banks, financial services excluding banks and chemicals sectors. Whilst food and beverages and construction and materials sectors are determined to be the least responsive to these incidents.

Considering the media coverage of Ebola and Arab Spring, Giudice and Paltrinieri (2017) investigate the overreaction to these specific major events. They determine that investors overreact to these negative major incidents, even if related to a small portion of the continent as Ebola, withdrawing their savings from the funds. They state that media coverage has a significant role in influencing the behavior of the investors, the higher the number of articles about the Arab Spring and Ebola, the higher the withdrawals. Mnif (2017) studies the effect of political uncertainty triggered by the civil uprisings, on the behavior and characteristics of Tunisian stock market cycles over time. He determines that following civil uprisings, the amplitude and volatility of Tunisian stock market cycles have raised considerably. However, the shock was abrupt and transitory, so in the long-run, the amplitude and volatility of stock cycles are redeemed.

2.2.3.2 2016, Brexit referendum

With the UK referendum on European Union membership, shortly Brexit, most of the British citizens have decided that the United Kingdom should leave the European Union. Apart from the consequences for the UK, this situation is a political tragedy for the EU since a member state is leaving initially. Brexit not only shook the European

financial markets but also exerted a noticeable influence on the global financial markets. This referendum event was unique since it was unpredictable until the final day and the influence of the referendum result would undoubtedly be substantial in any case, as a vote for "leave" would refer to an increase of uncertainty specifically in the UK financial markets (Bashir et al., 2019).

Considering the significant uncertainty related to Brexit, researchers have a desire to understand the effects of Brexit on financial markets. In this context, Belke et al. (2018) evaluate the interactions between UK policy uncertainty around Brexit and the UK financial market volatilities. They find that the policy uncertainty caused by the Brexit Referendum resulted in huge spillovers with unprecedented magnitudes to financial markets. They also analyze the Brexit effect on the stock returns in 19 different countries and provide evidence that an increase in the possibility of Brexit has intense impacts especially on European stock markets. Burdekin et al. (2018) confirm that the UK vote to leave the EU had remarkable negative impacts on world stock markets. However, Quaye et al. (2016) mention that Brexit was far from unexpected since the referendum was first announced four months ago and it should not have led to any financial "tsunami" on the financial markets.

Smales (2017) uses the Brexit Referendum as a "novel event to study the impact of political uncertainty on financial markets outside the typical election cycle". He concludes that political uncertainty has a positive relation with uncertainty in financial markets. However, he finds that political uncertainty is mostly significant for investors. Bashir et al. (2019) look for behavioral shifts in stock markets, before and after the UK's Brexit Referendum. They find instant impacts in the UK markets as compared to other European markets. Also, they indicate that the negative correlation between the UK, Germany, France and Netherlands stock market indices point that the international investors invest more prospectively in the stock markets.

Sita (2017) investigates how sentiment contributed to the "build-up of volatility of the FTSE 100 components" in the aftermath of the "yes" decision to the UK Brexit. He mentions that following the referendum result, the FTSE fell from 6338 to 5806 in the first 10 minutes of trading on Friday, June 24, 2016. He also indicates that apart from the FTSE, the DJIA dropped nearly 450 points less than half an hour on the opening of Friday, June 24, 2016. He concludes that investor sentiment was especially high on

June 24, 2016, as both FTSE and the pound lost grounds. However, he finds that the sentiment is elusive.

2.2.3.3 2016, US presidential election

The US presidential elections have always received widespread attention across the globe. As a country with "sovereign force in military power, economic and currency strength, investment source and destination, technology and sociological issue", the US president changes have a significant influence on the global markets (Setiawan and Basana, 2018).

On September 26, 2016, post-debate polls regarded Hillary Clinton to have defeated Donald Trump in the first Presidential debate (Wolfers and Zitzewitz, 2016). This lead to a sudden shift in the dynamics of the race by raising the occasions of Clinton presidency while decreasing the chance of Trump presidency. Therefore, most observers were surprised by the election of Donald J. Trump as the 45th President of the United States of America on November 8, 2016. (Wagner et al., 2018). The election's unexpected outcome led to remarkable reactions in the financial markets.

Although the event leads to significant effects on the financial markets, there exists little literature on how 2016, US Presidential Election affects the stock markets. Bouoiyour and Selmi (2017) determine the effects of political uncertainty on stock market performance around the period of the 2016 US Presidential Election. Using the event study methodology, they focus on the market reaction to new political events announcements. Their research reveals that Trump's win had a substantial influence on the company valuations for US stock price indices such as S&P 500, DJIA and NASDAQ. Consistent with the study of Bouoiyour and Selmi (2017), Pham et al. (2018) investigate the impacts of the 2016 US Presidential Election, and the incidents that occur in the run-up to the Election Day, on the US stock market. They mention that the banking sector was influenced negatively through the election. However, the impact was considered to be short. Their outcomes also indicate that the life insurance sector was the most influenced sector as it is faced with a huge uncertainty due to Trump's plan to replace Obamacare.

Shaikh (2017) examines the global equity, FX and VIX markets after 2016, US Presidential Election. Additionally, the effects of the presidential election on the investor sentiment index have been evaluated by using various global volatility

indices. The results apparently show that global equity market has been into a turbulence phase during the election period and almost all markets have responded substantially on the election poll announcement day. Also, the equity markets like Australia, India and Mexico lost higher among the other markets. Moreover, he finds that the purchasing power of eight FX markets out of nine have declined against the US Dollar. The results conclude that the VIX level across the global equity market increased remarkably, due to election uncertainty, and it goes to the normal level as the presidential election is announced.

Angelini et al. (2018) analyze the relationship between financial markets and the post-election main sentiment on Donald Trump. Using poll data of post-election of Trump as a sentiment, they evaluate the relationship among stock, currency, and commodities markets. They determine that the change of Trump's favorable opinions causes a positive change on the stock market and Treasury bond returns whereas it causes a negative change on Gold. Sagita (2017) examine the impacts before and after Donald Trump's election as the president of the United States, on the Indonesian stock market. Using the data series of the value of DJIA and Indonesian Composite Index (ICI), he evaluates the formation of shock, due to the president change in the US, on the share prices at the Indonesian stock market. He determines that after the election of Trump, the DJIA has increased significantly. Also, he concludes that DJIA has a positive influence on the ICI after Trump was elected.

2.2.4 Terror activities

2.2.4.1 2001, September 11 terrorist attacks

Terrorism is a phenomenon that has stuck on humanity for centuries. It carries with it a "great psychological weight and impact" in addition to physical and human losses (Goel et al., 2017). On September 11, 2001 suicide terrorists crashed hijacked commercial airplanes into the World Trade Center twin towers and the Pentagon, murdering more than 3,000 people (Nikkinen and Vähämaa, 2010). Besides the direct effects like loss of human life and property destructions, the terrorist attacks also left dramatic economic impacts. An hour after the second airplane hit the World Trade Center, Wall Street closed trading. It reopened after three days, at a loss of more than 7% on the DJIA. The shock in the US market caused by the terrorist attacks gave rise to a simultaneous downturn across nearly all major regions (Mun, 2005).

An extensive literature exists on terror activity and its impacts on stock markets. Johnston and Nedelescu (2005) explore the response of financial markets and the reactions of authorities to the terror attacks. They exert considerable evidence that the financial markets which are diversified, liquid and sound, were efficient in absorbing the shocks of the terrorist attacks. Arin et al. (2008) investigate the effects of terrorism on six different financial markets by applying a time-series framework. They conclude that terror has a substantial effect on both stock markets the volatility of the stock market. Also, the magnitude of the impacts is higher in emerging markets.

Motivated by the investor sentiment literature, Drakos (2009a) examines whether terrorism leads to an important negative influence on daily stock market returns for several countries, in the years 1994 – 2004. He suggests that terrorist activity induces substantially lower returns on the day that the terrorist incident happens. Additionally, he states that the negative impact of terrorist activity is considerably reinforced when terrorist events exert higher psychosocial impact.

Using a dataset that covers all important incidents and that directly pertain to the major economies of the world, Brounrn and Derwall (2010) examine the impacts of terrorist attacks on stock markets. They assert that financial markets respond intensely to terror incidents. However, they recover swiftly and soon return to its usual, while only the September 11th attacks caused long-term effects. Nikkinen and Vähämaa (2010) investigate the influence of three major terror events, which are September 11, 2001 attacks in New York and Washington DC, the March 11, 2004 attacks in Madrid and the July 7, 2005 attacks in London, on stock market sentiment. They utilize probability densities implied by options prices to determine that terrorist attacks adversely affect stock market sentiment.

There also exist some research conducted on September 11, 2001 terror attacks specifically. Burch et al. (2016) exploit the 9/11 terrorist incident to analyze the interaction between retail and institutional traders and how prices respond to a market-wide crisis. Mun (2005) examines the contagion effects of the 9/11 terrorist attacks for both return and volatility, across the major markets. He finds that there was a severe drop in market returns and a concomitant rise in market volatility instantly after the attacks. Examining 10 daily stock market indices, Charles and Darné (2006) determine the impacts of the terrorist event that occurred on September 11, 2001, on international stock markets. They conclude that the international stock markets exposed large

shocks as a reaction to the terrorist attacks and its aftermath. They also find that US macroeconomic news announcements can exert a huge influence on the US and European stock markets.

2.2.4.2 2005, London train bombings

July 7, 2005, London bombings were a "coordinated terrorist bomb blast series" that hit the city's public transportation system during the morning rush hour (Ramiah, 2012). The bombs which were detonated in three crowded subway trains exploded within 50 seconds at 8:50 am. Later that day, at 9:47 am, a fourth explosion took place on the upper deck of a London bus in Tavistock. 52 people were killed and 700 people were injured in the terrorist attacks.

Several studies are conducted on different catastrophic terror incidents. Chesney et al. (2011) study the influence of terrorism on the stock, bond and commodity market behavior. The terrorist events that occurred in 25 countries over a period of 11 years are considered in the research. While conducting their study, they present various methodologies that are event study, non-parametric and filtered GARCH–EVT approaches. Drakos (2009b) investigates the cross-country variation in the stock market respond to major terrorist incidents while providing a behavioral-based explanation for the diffusion of the shocks of terrorist events. In his study, he considers the 2002 Moscow attack, 2003 Istanbul attack, 2004 Madrid attack and 2005 London attack as terrorist incidents. He finds that terrorist shocks are diffused through the channel supplied by terrorism risk perception and countries with higher (lower) terrorism risk perception are more prone to generate a higher (lower) stock market reaction.

There also exist various studies that concentrate specifically on selected terror events. Kollias et al. (2011) evaluate how two major terrorist attacks in Madrid and London influenced stock exchanges in Spain and the UK. They conclude that the general effect on the stock markets for both was temporary. Spiliers (2015) examines how stock markets responded to the 2004 Madrid bombings, the 2005 London bombings, the 2015 Paris attacks and the 2016 Brussels attacks. He also identifies five industries that might be influenced by terrorism and finds that almost all of them had faced negative impacts through London and Madrid attacks. They also determine that London

bombings have impacts on both European markets and UK national markets, as expected.

Liargovas and Repousis (2010) investigate the reaction of Greek banks' stocks to three important international terrorist incidents which are September 11, 2001 Attacks in New York, Madrid Train Bombing on March 11, 2004, and London Train Bombing on July 7, 2005. They find that the attacks of September 11 profoundly influenced all periods around the incident, resulting in substantial negative cumulative average abnormal returns. Also, the London terrorist incident led to negative significant returns 10 days before the attack and positive significant returns following the event whereas Madrid terrorist event had no substantial effect on the Greek banks' stocks. Ramiah et al. (2010) study on the effects of five terrorist attacks on the Australian industries. Due to close ties between Australia and the western world, London Train Bombings would have been thought to have an impact on the Australian stock market. However, the stock market's reaction to the attack was muted, although the Water sector was affected by the event in a negative way.

By using an event study methodology, Ramiah (2012) investigates the impacts of five international terrorist incidents on equities listed on the Malaysian Stock Exchange. Since Malaysia is an ex-colony of the British Empire, the London Train Bombings were expected to affect the Malaysian market. However, the market appeared to be resilient to the incident. Graham and Ramiah (2012) apply an event study methodology to determine the effect of five terrorist attacks, occurred in New York World Trade Centre, Bali, Madrid, London, and Mumbai, on Japanese industries. They determine that the response of Japanese stock markets to the London attack is insignificant on both returns and systematic risks in Japan.

2.2.4.3 2015, Paris terrorist attacks

On January 7, 2015, in Paris, multiple assassinations on Charlie Hebdo offices, followed by the hostage-taking event at a Jewish supermarket two days later, caused 17 deaths and left 22 injured behind. On November 13, 2015, several organized "multisite terrorist attacks" took place again in Paris, pursued by suicide bombings and mass shootings (Estrada and Koutronas, 2016). There were 100 dead and 368 injured on these attacks as reported officially. These coordinated terror strikes in Paris is marked as the deadliest terror attack in Europe since the 2004 Madrid bombings.

In the literature on determining the effects of Paris Terrorist Attacks on financial markets, various methods are applied. Using an event study methodology, Mnasri and Nechi (2016) analyze the influence of terrorist attacks, including Paris attacks, on the volatility of stock markets in 12 MENA countries, and look for regional financial integration. They indicate that the effect of terrorist attacks on the volatility of the financial markets lasts about 20 trading days, which is thought to be long in contrast to the term effect of similar events in developed markets. They also find considerable evidence of regional financial integration. By employing GARCH methodology, Apergis and Apergis (2017) explore the impact of the Paris Terrorist Attacks on the stock returns and the volatility for the significant companies in the global defense industry. They imply that the terrorist event exerts a positive effect on the stock returns and volatility.

Showing that the adjustment of stock prices is persistent with the assumption of efficient capital markets, Kolaric and Schiereck (2016) analyze the dynamics of airline stock prices surrounding the terrorist attacks which occurred in Paris and Brussels. They determine that the terrorist attacks in Paris and Brussels had substantially negative effects, which do not last long, on the valuation of airline companies. However, they conclude that smaller airlines are less influenced by the attacks than their global counterparts. Ramiah et al. (2019) use an event study methodology consummated with several techniques, such as the non-parametric ranking test and kernel regression, to find out if 20 terrorist attacks, including Paris attacks, generated abnormal returns. They find that the equity markets react instantly to terror activities, whereas there exist delayed reactions in commodity markets.

Estrada and Koutronas (2016) construct an economic impact of terrorist attack model (EITA Model) to evaluate the optimum number of potential terrorist events that can have an impact on the regional economic performance. Roland (2016) exposes and interprets the fear stimulated by terrorism in financial markets, and separates rational market responses from irrational and fear-driven investor reactions. In this context, she observes the Volatility Index (VIX) and change in 10-year Treasury yield surrounding terror events to identify irrationality. She analyzes events which also include 2015 Paris attacks and finds consistently heightened post-event volatility. She also observes that there is a decline in the duration of VIX response to terror over time.

Corbet et al. (2018) examine the impact of both domestic and international terrorist attacks within European stock markets' volatility. They mention that domestic terrorism substantially influences domestic stock market volatility, whereas international terrorism within Europe does not show salient stock market volatility in Ireland and Spain. They also indicate that bombings and explosions within Europe lead to market volatility through all exchanges. They conclude that the growth of ISIL-inspired terror since 2011 is determined to have direct impacts on stock market volatility in France, Germany, Greece, Italy and the UK.

3. DATA AND METHODOLOGY

This thesis depends on the hypothesis that investor sentiment generates substantial impacts on both stock returns and conditional volatility of returns for selected stock market indices, regarding the considered global events. It is mentioned earlier in Section 2 that investor sentiment influences the returns and volatility of the stock markets. Also, the effects of global events on the stock market indices of several countries are discussed respectively. This study combines both sides and implies that the stock market indices of selected countries are affected by investor sentiment in the meantime of an event occurrence. In order to capture and compare these influences significantly, different types of incidents are selected.

To evaluate the investor sentiment effects significantly through the crises, 2001, Turkish Economic Crisis, 2008, Global Financial Crisis and 2010, Greek Sovereign Debt Crisis events are analyzed in the study. Although the incident was severe in many aspects, there is little literature on 2001, Turkish Economic Crisis and its impacts. Most studies concentrate on the economic influences of the crisis, rather than its financial responses. In contrast, there exists plenty of literature on the 2008 worldwide financial crisis, considering its effects on the stock market indices of various countries and different sectors. Also, herd behavior and contagion among many countries are determined in multiple studies. Moreover, there exist some studies related to investor behavior during the incident. For instance, Namouri et al. (2018) and Zouaoui et al. (2011) evaluate the relevance of investor sentiment to the stock market returns for various countries. However, they mostly focus on threshold effects, herding behavior and overreaction. Several studies are also conducted on how Greek Sovereign Debt Crisis influences the stock markets and its effects on investor perceptions. Mostly, contagion among various countries is studied during the period of the crisis. This thesis employs an extensive look through the stock market behavior of different countries which may be related to the crises and denotes the investor sentiment effects during the periods considered.

To determine the impacts of investor sentiment substantially through the natural disasters, 2005, Hurricane Katrina, 2008 Wenchuan Earthquake and 2011, Japan Earthquake and Tsunami incidents are selected in the study. There is limited literature on investor behavior for the period when Hurricane Katrina happened, whereas various studies are conducted considering its effects on market reaction. Also, there are different studies that evaluate the Wenchuan Earthquake incident. Some of these studies proceed on firm responses whereas some depend on community reactions to the event. In consistence with the aim of this thesis, Shan and Gong (2012) study on the impacts of investor sentiment on stock returns for China. Hence, they only consider China in their research, which provides no evidence of other countries.

The 2011 Great East Japan Earthquake, also known as the Tohoku Earthquake, created disastrous effects with the magnitude of 9.0 and the nuclear incident was considered to be the most notorious damage of the event. As it has significant consequences, multiple studies are carried out in order to capture its effects substantially. However, they mostly concentrate on the impacts on stock markets, excluding the investor sentiment phenomenon. By contrast with the previous studies that concentrate on these natural disasters, this research concentrates on the investor sentiment effects, through international stock markets, which are related to the incidents.

To evaluate the investor sentiment effects significantly through the political events, 2010, Arab Spring, 2016, Brexit Referendum and 2016, US Presidential Election events are analyzed in the study. There exists some literature on Arab Spring and its consequences that mostly focus on political uncertainty and how the stock markets respond to that instability. Also, there are studies that search for the overreaction to such an incident and the role of media coverage in the responses to the event. However, earlier studies are insufficient to explain the Arab Spring in terms of investor sentiment.

The impacts of the Brexit Referendum event on financial markets are studied heretofore since there exists a significant uncertainty related to the referendum. Therefore, many research is conducted to capture the stock market responses of various countries, mostly the UK, to the incident. However, there exists no literature that concentrates on investor perceptions during such an event. There also exists little literature on how the US Presidential Election period affects the stock markets, even though the event leads to significant impacts on the financial markets. Many studies

that are performed mostly depends on market performance, the incidents that occur until the election day and the market responses after Trump's win. Moreover, Shaikh (2017) evaluates the effects of the election on investor sentiment index by using various volatility indices. Thus, this thesis aims to fill a gap in the literature and applies an investor sentiment methodology to gain substantial outcomes on the impacts of political events.

To evaluate the investor sentiment effects significantly through the terrorist activities, 2001, September 11 Terrorist Attacks, 2005, London Train Bombings and 2015, Paris Terrorist Attacks events are analyzed in the study. An extensive literature exists on terror activities, especially on September 11 Terrorist Attacks and its consequences on the stock markets. Many studies not only focus on this incident but also consider various terrorist events that have significant influences on the stock markets. However, most studies concentrate on market reactions to such events.

Several studies examine the London Train Bombings, in addition to many other catastrophic terror incidents. They concentrate specifically on the stock market responses and the impacts of the events on various countries and industries. Considering the 2015 Paris Terrorist Attacks event as one of the most affected terrorist incidents, there exist several approaches to determine its effects on stock returns and volatility, market performance and investor perceptions. Nevertheless, the literature does not cover an investor sentiment perspective through this event. Thereby, in studying the impacts of the terror events, this study takes on a particular approach that benefits from investor sentiment methodology.

3.1 Model

With regards to the hypothesis of the thesis, in this study, the investor sentiment effect on international stock markets, associated with various global events is investigated and modelled. The conditional volatilities of the stock returns are determined to observe the impacts of investor sentiment on the markets substantially.

Volatility refers to the fluctuation of financial prices. Figure 3.1 displays the daily logarithmic returns of DJIA between the period 2007 – 2009. There are periods of small fluctuations, for instance from the period I of 2007 to period III of 2008, and there are also periods of large fluctuations, from period III of 2008 to period I of 2009.

This phenomenon is known as volatility clustering and it has been a great concern in financial economics and econometrics. Hence, there exist various methods for evaluating volatility.

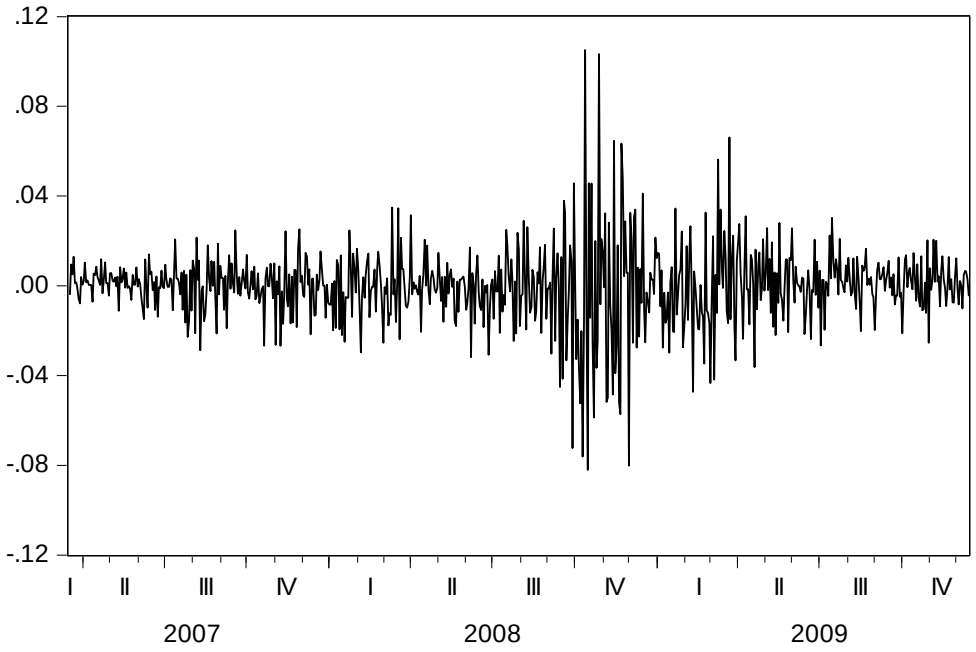

Figure 3.1 : Daily logarithmic returns of DJIA between the period 2007 - 2009.

The least squares model suggests that the expected value of all error squared terms is identical at any assumed point. However, Engle (2001) mentions that the data, in which the error terms are non-equivalent, suffers from heteroskedasticity. As he also implies, instead of considering this as an issue which has to be corrected, ARCH and GARCH models treat heteroskedasticity as a variance to be modelled. The Autoregressive Conditional Heteroskedastic (ARCH) model that is introduced by Engle (1982) allows the conditional variance to "change over time as a function of past errors" while the unconditional variance remains constant. In the represented ARCH equation,

$$h_t = \omega + \alpha \varepsilon_{t-1}^2 \qquad \textbf{(3.1)}$$

h_t denotes the conditional variance, ω is the constant term, that needs to be positive, ε_{t-1}^2 represents the past errors and α is the coefficient of past error terms, which is non-negative. Bollerslev (1986) extends the ARCH process and introduces the Generalized Autoregressive Conditional Heteroskedastic (GARCH) process that allows both a "much more flexible lag structure" and a longer memory than ARCH does. While in the ARCH process the conditional variance is specified as a linear

function of past sample variances only, the GARCH model lets the lagged conditional variances to be considered as well. The GARCH (1,1) model is as follows:

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1} \quad \textbf{(3.2)}$$

where, $\alpha_0 > 0$, $\alpha_1 \geq 0$ and $\beta_1 \geq 0$. The term α_0 is the constant, α_1 is the reaction parameter and β_1 is the persistence parameter which determines the length of the fluctuation. If β_1 is close to 1, the series is said to have long memories whereas if β_1 is close to 0, the series seems to have short memories.

Many researchers imply that stock returns are negatively correlated with changes in their volatility. Actually, the volatility is in the tendency to rise in reaction to bad news whereas it falls when there is good news. However, the GARCH models only determine the magnitude of excess returns and are inadequate in explaining the positivity or negativity of the returns. Also, the interpretation of the persistence of shocks to conditional variance in GARCH models is another concern.

Regarding the problems associated with the GARCH models, further research conducted by Nelson (1991) proposes an alternative. He introduces the Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model, which is as follows:

$$\log(h_t) = \omega + \alpha \frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}}} + \gamma \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \beta \log(h_{t-1}) \quad \textbf{(3.3)}$$

where ω is the constant term, coefficient α represents the reaction to the magnitude of the shock, coefficient γ represents the reaction to the sign of the shock and β is the persistence parameter that takes a value between 0 and 1. For $\gamma < 0$, "negative shocks have a bigger impact on future volatility than positive shocks of the same magnitude" (Bollerslev, 2008). In consistence, another model established by Glosten et al. (1993) which is GJR-GARCH, enables the conditional variance to react diversely to the positive and negative shocks. They conceive a more general specification of the GARCH-M model, that Engle et al. (1987) studied, in the construction of the GJR process.

There exist various methods in explaining the stock market behavior, with regards to many global events. For instance, Ferraira and Karali (2015) adopt an event study

methodology that is based on regression, to examine how major earthquakes affect the returns and volatility of several stock market indices. They construct a single dummy variable to symbolise all the earthquakes considered and employ a GARCH (1,1) model where the conditional mean and conditional variance equations are set as a function of the earthquake dummy variable. They conclude that the financial markets recover immediately as a response to the shocks that the earthquakes generate. Also, Sita (2017) estimates a stochastic volatility model in order to investigate how sentiment contributes to volatility on FTSE 100 after the Brexit Referendum. Since he assumes that a stochastic volatility model is more flexible than a typical GARCH model in the measurement of the magnitude of volatility, he prefers that method. He then uses sensitivity as a proxy for investor sentiment and implies that the investor sentiment is particularly high on the day of the referendum. However, he also indicates that the sentiment is elusive.

In their study, Corbet et al. (2018) adopt a three-step empirical methodology within a GARCH framework to determine whether and how the terrorist incidents that occurred in Europe influence the domestic stock markets' stability. They employ GARCH, EGARCH and GJR-GARCH models respectively. The EGARCH model they applied is as follows:

$$\log(h_t) = (1 + \lambda_d D_t)\left(\omega + \alpha \frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}}} + \gamma \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \beta \log(h_{t-1})\right) \quad \textbf{(3.4)}$$

D_t is appointed as an event dummy variable which gets a "value of unity" after the establishment of ISIL and zero otherwise. Also, λ_d is assigned in the equation. If the parameter is substantially estimated, an increment in domestic European stock market volatility occurs during the period after the ISIL terrorism campaign began. They indicate that bombings and explosions through Europe lead to stock market volatility within all exchanges. However, events like infrastructure attacks and hijackings seem to not generating widespread volatility effects.

There also exist various studies on how investor sentiment contributes to the stock market reactions. For instance, Verma and Verma (2007) use a two-step method to monitor the investor sentiment effects on the stock market indices of DJIA and S&P 500. They first examine the relative influence of investor sentiment on conditional volatility for individual and institutional investors. Later on, they try to find if "noise"

or "rational risk factors" leads to the sentiment effects on volatility. Consequently, they estimate a multivariate EGARCH model, in order to investigate the asymmetric impacts and use AAII as an investor sentiment proxy. They point out that investor sentiment substantially determines the stock market volatilities.

To express the impact of investor sentiment on the mean-variance tradeoff of the stock market, Yu and Yuan (2011) present various volatility models which include rolling window model, the mixed data sampling approach, GARCH (1,1) and asymmetric GARCH (1,1). They apply a composite sentiment index, which is the first principal component of six measures such as CEFD, NYSE share turnover, number of and the average first-day returns on IPOs, equity share in new issues and dividend premium. They also regress these sentiment gauges on the growth of industrial production, growth of durable consumption, growth of nondurable consumption, growth of service consumption, growth of employment and a dummy variable for National Bureau of Economic Research (NBER) recessions, to control the macroeconomic conditions. They imply that there exists a strong effect of investor sentiment on the mean-variance tradeoff. In consistence, Wang (2018) adopts four approaches, which are rolling window model, GARCH, GJR-GARCH and EGARCH, to determine the role of institutional investor sentiment in the mean-variance relation. They conclude that institutional investors exert impacts on the mean-variance relation and that they are "sentiment traders".

Regarding the literature, in this thesis, the EGARCH model is used since the model helps to overcome the non-negativity constraints and to understand the asymmetric effects efficiently. Specifically, EGARCH (1,1) model is constructed since the analyses are applied depending on the Akaike criterion and according to this criteria, mostly the selected model is preferred. The conditional mean and conditional variance equations are expressed respectively.

$$\mu_t = \theta_0 + \theta_1 Sent_t + \varepsilon_t \tag{3.5}$$

$$\log(h_t) = \gamma_0 + \gamma_1 \frac{|\varepsilon_{t-1}|}{\sqrt{h_{t-1}}} + \gamma_2 \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \gamma_3 \log(h_{t-1}) + \gamma_4 Sent_{t-1} \tag{3.6}$$

$Sent_t$ in the mean equation represents the investor sentiment, which is used to control the macroeconomic shocks. Hence, the coefficient θ_1 indicates the influence of

investor sentiment on the returns. The coefficient γ_2 in the variance equation evaluates the influence of negative shocks on returns, which also determines the leverage effect. The coefficient γ_3 is the persistence parameter whereas the coefficient γ_4 represents the investor sentiment effect on the conditional variance of returns. The selected EGARCH model is applied to all analyses that are constructed through this thesis. Besides, the returns and the investor sentiment indices, every term remains the same in each analysis.

3.2 Data

The main purpose of this research is to determine the investor sentiment effects in the selected countries' stock market indices regarding the global events mentioned in Section 2. As mentioned earlier in the Literature Review part of the thesis, 1997, Asian Financial Crisis is also selected as an incident to be analyzed in terms of investor sentiment. However, due to data insufficiency, this event is replaced with 2001, Turkish Economic Crisis.

With regards to the aim of the thesis, in the very first part, daily trading volume data of stock market indices of the considered countries, where the events took place in, are applied as investor sentiment proxies. However, since the changes in trading volume data not only indicates the investor sentiment effects but also are the indicators of many macroeconomic events, the data are not directly appointed as investor sentiment proxies in this research. In order to generate new investor sentiment indices specific to the events and to capture the sentiment effects substantially, a regression analysis is carried out for each case, where daily trading volume data of the countries are the dependent variables and a group of macroeconomic data are the independent variables. Also, in many cases, consumer confidence indices of the countries are used as dummy variables and added to the regression.

For the second part of the analyses, various stock market indices of different countries are selected considering the geographical closeness, the political and the economic relations among the countries in which the incidents took place in. The approaches taken, the variables used and the indices generated are expressed extensively under all cases.

3.2.1 Investor sentiment effect related to 2001, September 11 terrorist attacks

For the initial part of the analysis, daily trading volume data of Dow Jones Industrial Average (DJIA) is taken for a period of 9 months, between July 2001 and April 2002 and used as an investor sentiment proxy. However, in order to generate a new investor sentiment index specified for 2001, September 11 Terrorist Attacks, a regression analysis is carried out where the daily trading volume data is the dependent variable and a group of macroeconomic data such as Consumer Price Index (CPI), Producer Price Index (PPI), Unemployment Rate, Money Supply, Industrial Production and Treasury Bill Yields are the independent variables. Also, the Michigan Consumer Confidence Index (MCCI) data is considered in this analysis as a dummy variable and added to the regression. Since the macroeconomic data are generally released on a monthly basis, they need to be transformed into a daily frequency. Therefore, the cubic spline interpolation method is applied to change these control variables into a daily frequency. The trading volume and all the macroeconomic data are retrieved from Thomson Reuters whereas MCCI data is retrieved from Fred St. Louis.

For the second part of the study, the daily closing values of US (DJIA), China (SSEC), Japan (Nikkei 225), Pakistan (KSE 100), Saudi Arabia (TASI), Turkey (BIST 100) and the UK (FTSE 100) stock market indices from July 2001 to April 2002, for a period of 9 months, are retrieved from Thomson Reuters. The logarithmic returns of all data are taken and used as dependent variables in the regression.

3.2.2 Investor sentiment effect related to 2001, Turkish economic crisis

For the first part of the research, daily trading volume data of BIST 100 is taken between February 2000 to November 2002, for approximately 3 years period, and appointed as an investor sentiment proxy. Nonetheless, the trading volume data is not applied solely in the analysis and regressed against a group of macroeconomic variables which are Gross Domestic Product (GDP), Consumer Price Index (CPI), Producer Price Index (PPI), Money Supply, Industrial Production and Treasury Bill Yields. Also, the Consumer Confidence Index (CCI) of Turkey is used as a dummy variable in the analysis. A case-specific new investor sentiment index is gained by carrying out this regression. Unemployment Rate cannot be added to the analysis since the data is insufficient in the considered time period. The GDP data is released quarterly and the other macroeconomic data are released monthly. Therefore, the cubic

spline interpolation is used in order to convert them into a daily frequency. The trading volume, GDP, CPI, PPI, Treasury Bill Yields and CCI data are retrieved from Thomson Reuters whereas the Money Supply and Industrial Production data are retrieved from Fred St. Louis.

For the second part of the analysis, the daily closing values of Turkey (BIST 100), Argentina (MERVAL), Brazil (IBOVESPA), Germany (DAX), Japan (Nikkei 225), the UK (FTSE 100) and the US (DJIA) stock market indices from February 2000 to November 2002, for approximately 3 years period, are retrieved from Thomson Reuters. Their logarithmic returns are taken and used as dependent variables in the analysis.

3.2.3 Investor sentiment effect related to 2005, Hurricane Katrina

For the initial part of this study, the daily trading volume data of DJIA, for 9 months period, between June 2005 and March 2006, is used as an investor sentiment proxy. Nevertheless, to carry out a new case-specific investor sentiment index, a regression analysis is carried out where daily trading volume data is the dependent variable and a group of macroeconomic data that are Consumer Price Index (CPI), Producer Price Index (PPI), Unemployment Rate, Money Supply, Industrial Production and Treasury Bill Yields are the independent variables. Also, the Michigan Consumer Confidence Index (MCCI) data is added in the regression and used as a dummy variable. However, the macroeconomic variables are released on a monthly basis. Therefore, the cubic spline interpolation method is applied to transform them into daily frequency. The trading volume and all the macroeconomic data are retrieved from Thomson Reuters whereas MCCI data is retrieved from Fred St. Louis.

For the second part of the research, the daily closing values of US (DJIA, NASDAQ and S&P 500) and Mexico (MXSE IPC) stock market indices from June 2005 to March 2006, for a period of 9 months, are retrieved from Thomson Reuters. The logarithmic returns of all data are taken and used as dependent variables in the regression.

3.2.4 Investor sentiment effect related to 2005, London train bombings

For the first part of this analysis, the daily trading volume data of FTSE 100 is taken for 9 months period, between May 2005 and February 2006, and as an investor sentiment proxy. Though the daily trading volume is regressed against Consumer Price

Index (CPI), Producer Price Index (PPI), Unemployment Rate, Money Supply, Industrial Production and Treasury Bill Yields. Also, the Consumer Confidence Index (CCI) of the UK is used as a dummy variable in the regression analysis. After the regression is carried out, a new investor sentiment index, specified for 2005, London Train Bombings is obtained. However, the macroeconomic data is released on a monthly basis. Therefore, the cubic spline interpolation method is used to convert the control variables to a daily frequency. The trading volume and all the macroeconomic data are retrieved from Thomson Reuters.

For the second part of the study, the daily closing values of the UK (FTSE 100), Belgium (BEL 20), France (CAC 40), Ireland (ISEQ), Netherlands (AEX) and Spain (IBEX 35) stock market indices from May 2005 to February 2006, for a period of 9 months, are retrieved from Thomson Reuters. Their logarithmic returns are taken and used as dependent variables in the analysis.

3.2.5 Investor sentiment effect related to 2008, Global financial crisis

For the initial part of this research, the daily trading volume data of DJIA, for approximately 3 years period, between March 2007 and December 2009, is appointed as an investor sentiment proxy. However, the daily trading volume data is not applied alone in the study and regressed against a group of macroeconomic variables which are Gross Domestic Product (GDP), Consumer Price Index (CPI), Producer Price Index (PPI), Unemployment Rate, Money Supply, Industrial Production and Treasury Bill Yields in order to acquire a new investor sentiment index exclusively. Also, the Michigan Consumer Confidence Index (MCCI) is added to the regression as a dummy variable. Since the GDP data is released quarterly and the other macroeconomic data are released monthly, the cubic spline interpolation is applied in order to transform them into a daily frequency. The trading volume and all the macroeconomic data are retrieved from Thomson Reuters whereas MCCI data is retrieved from Fred St. Louis.

For the second part of the analysis, the daily closing values of the US (DJIA), China (SSEC), Germany (DAX), Japan (Nikkei 225), Russia (MOEX), Turkey (BIST 100) and the UK (FTSE 100) stock market indices from March 2007 to December 2009, for approximately 3 years period, are retrieved from Thomson Reuters. The logarithmic returns of all data are taken and used as dependent variables in the regression.

3.2.6 Investor sentiment effect related to 2008, Wenchuan earthquake

For the first part of this study, the daily trading volume data of SSEC is taken for 9 months period, between March 2008 and December 2008, and used as an investor sentiment proxy. Nonetheless, the daily trading volume is regressed against Consumer Price Index (CPI), Producer Price Index (PPI), Unemployment Rate, Money Supply, Industrial Production and Treasury Bill Yields, in order to generate a new investor sentiment index specified for 2008, Wenchuan Earthquake. Also, the Consumer Confidence Index (CCI) of China is used as a dummy variable and added to regression analysis. However, the macroeconomic variables are released on a monthly basis. Therefore, the cubic spline interpolation method is used to convert these control variables to a daily frequency. The trading volume and all the macroeconomic data are retrieved from Thomson Reuters.

For the second part of the research, the daily closing values of China (SSEC), Japan (Nikkei 225), South Korea (KOSPI) and Taiwan (TWSE) stock market indices from March 2008 to December 2008, for a period of 9 months, are retrieved from Thomson Reuters. Their logarithmic returns are taken and used as dependent variables in the analysis.

3.2.7 Investor sentiment effect related to 2010, Greek sovereign debt crisis

For the initial part of this analysis, the daily trading volume data of ATG, for 3 years period, between December 2009 and December 2012, is used as an investor sentiment proxy. Nevertheless, a regression analysis is carried out where daily trading volume is the dependent variable and a group of macroeconomic variables such as Gross Domestic Product (GDP), Consumer Price Index (CPI), Producer Price Index (PPI), Unemployment Rate, Money Supply, Industrial Production and Treasury Bill Yields are the independent variables. Also, the Consumer Confidence Index (CCI) of Greece is used as a dummy variable in the regression analysis. The regression analysis mentioned, forms a new case-specific investor sentiment index for 2010, Greek Sovereign Debt Crisis. The GDP data is in quarterly frequency whereas the other macroeconomic variables are on a monthly basis. Therefore, the cubic spline interpolation method is applied to transform these data into a daily frequency. The trading volume and all the macroeconomic data are retrieved from Thomson Reuters.

For the second part of the study, the daily closing values of Greece (ATG), Belgium (BEL 20), Germany (DAX), Italy (FTSE MIB), Poland (WIG), Spain (IBEX 35) and Turkey (BIST 100) stock market indices from December 2009 to December 2012, for a period of 3 years, are retrieved from Thomson Reuters. The logarithmic returns of all data are taken and used as dependent variables in the regression.

3.2.8 Investor sentiment effect related to 2011, Arab spring

For the first part of this research, the daily trading volume data of EGX 30 is taken for 3 years period, between June 2010 and June 2013, and used as an investor sentiment proxy. Though, the daily trading volume is not used solely in the analysis and regressed against Gross Domestic Product (GDP), Unemployment Rate, Consumer Price Index (CPI), Producer Price Index (PPI), Money Supply, Industrial Production and Treasury Bill Yields, in order to obtain a case-specific new investor sentiment index and capture the sentiment effects significantly. Since there exists no consumer confidence index for Egypt, the regression is carried out without this variable. The GDP and the Unemployment Rate data are released quarterly for Egypt and the other macroeconomic variables are on a monthly basis. Hence, the cubic spline interpolation method is used to convert these control variables to a daily frequency. The trading volume and all the macroeconomic data are retrieved from Thomson Reuters.

For the second part of the analysis, the daily closing values of Egypt (EGX 30), France (CAC 40), Israel (TA 35), Jordan (ASE), Lebanon (BLOM), Qatar (QE), Saudi Arabia (TASI), Turkey (BIST 100), United Arab Emirates (ADX) and US (DJIA) stock market indices from June 2010 to June 2013, for a period of 3 years, are retrieved from Thomson Reuters. Their logarithmic returns are taken and used as dependent variables in the analysis.

3.2.9 Investor sentiment effect related to 2011, Japan earthquake and tsunami

For the initial part of this study, the daily trading volume data of Nikkei 225, for 9 months period, between January 2011 and October 2011, is used as an investor sentiment proxy. However, the daily trading volume is regressed against Consumer Price Index (CPI), Producer Price Index (PPI), Unemployment Rate, Money Supply, Industrial Production and Treasury Bill Yields. Also, the Consumer Confidence Index (CCI) of Japan is used in the regression as a dummy variable. With the carried-out regression, a new investor sentiment index is obtained that is specific to 2011, Japan

Earthquake and Tsunami, which helps to capture the sentiment effects substantially. However, the macroeconomic data are on a monthly basis. Therefore, the cubic spline interpolation method is applied to transform these data into daily frequency. The trading volume and all the macroeconomic data are retrieved from Thomson Reuters.

For the second part of the research, the daily closing values of Japan (Nikkei 225), China (SSEC), Hong Kong (HSI), South Korea (KOSPI) and the US (DJIA) stock market indices from January 2011 to October 2011, for a period of 9 months, are retrieved from Thomson Reuters. The logarithmic returns of all data are taken and used as dependent variables in the regression.

3.2.10 Investor sentiment effect related to 2015, Paris terrorist attacks

For the first part of this analysis, the daily trading volume data of CAC 40 is taken between September 2015 and June 2016, for 9 months period, and used as an investor sentiment proxy. Nonetheless, to generate a new investor sentiment index specified for 2015, Paris Terrorist Attacks that provides a better understanding of sentiment effects related to the incident, a regression analysis is carried out where daily trading volume data is the dependent variable and various macroeconomic variables which are Consumer Price Index (CPI), Producer Price Index (PPI), Unemployment Rate, Money Supply, Industrial Production and Treasury Bill Yields are the independent variables. Also, the Consumer Confidence Index (CCI) of France is used as a dummy variable in the regression. However, all the macroeconomic variables are in monthly frequency. Therefore, the cubic spline interpolation method is used to convert macroeconomic data from monthly to a daily frequency. The trading volume and all the macroeconomic data are retrieved from Thomson Reuters.

For the second part of the study, the daily closing values of France (CAC 40), Belgium (BEL 20), Germany (DAX), Morocco (MASI), Portugal (PSI 20), Spain (IBEX 35) and the UK (FTSE 100) stock market indices from September 2015 to June 2016, for a period of 9 months, are retrieved from Thomson Reuters. Their logarithmic returns are taken and used as dependent variables in the analysis.

3.2.11 Investor sentiment effect related to 2016, Brexit referendum

For the initial part of this research, the daily trading volume data of FTSE 100 is taken for a 1-year period, between December 2015 and December 2016, and used as an

investor sentiment proxy. Nevertheless, the daily trading volume is not used alone in the analysis and regressed against Gross Domestic Product (GDP), Consumer Price Index (CPI), Producer Price Index (PPI), Unemployment Rate, Money Supply, Industrial Production and Treasury Bill Yields, in order to capture the sentiment effects significantly and obtain a case-specific new investor sentiment index. Also, the Consumer Confidence Index (CCI) of the UK is used in the regression as a dummy variable. The GDP is on a quarterly basis whereas all the other macroeconomic variables are in monthly frequency. Thus, the cubic spline interpolation method is applied to transform macroeconomic data into daily frequency. The trading volume and all the macroeconomic data are retrieved from Thomson Reuters.

For the second part of the analysis, the daily closing values of the UK (FTSE 100), Belgium (BEL 20), France (CAC 40), Germany (DAX), Ireland (ISEQ), Italy (FTSE MIB), Netherlands (AEX) Spain (IBEX 35), Turkey (BIST 100) and the US (DJIA) stock market indices from December 2015 to December 2016, for a period of 1 year, are retrieved from Thomson Reuters. The logarithmic returns of all data are taken and used as dependent variables in the regression.

3.2.12 Investor sentiment effect related to 2016, US presidential election

For the first part of this study, the daily trading volume data of DJIA, for a 1-year period, between June 2016 and June 2017, is used as an investor sentiment proxy. Though, the daily trading volume is not used solely in the analysis. A regression analysis is carried out where daily trading volume data is the dependent variable and a group of macroeconomic variables such as Gross Domestic Product (GDP), Consumer Price Index (CPI), Producer Price Index (PPI), Unemployment Rate, Money Supply, Industrial Production and Treasury Bill Yields are the independent variables. Also, the Michigan Consumer Confidence Index (MCCI) is used as a dummy variable in the regression. This regression is applied to generate a new investor sentiment which is specified for 2016, US Presidential Election, that captures the sentiment effects substantially. Since the GDP is on a quarterly basis and all the other macroeconomic variables are on a monthly basis, the cubic spline interpolation method is used to convert all data into daily frequency. The trading volume and all the macroeconomic data are retrieved from Thomson Reuters whereas MCCI data is retrieved from Fred St. Louis.

For the second part of the research, the daily closing values of the US (DJIA), China (SSEC), France (CAC 40), Germany (DAX), Japan (Nikkei 225), Mexico (MXSE IPC), South Korea (KOSPI), Turkey (BIST 100) and the UK (FTSE 100) stock market indices from June 2016 to June 2017, for a period of 1 year, are retrieved from Thomson Reuters. Their logarithmic returns are taken and used as dependent variables in the analysis.

4. RESULTS

4.1 Investor Sentiment Effect Related to 2001, September 11 Terrorist Attacks

For the first step of the analysis, a regression analysis is applied where daily trading volume (TRADE_VOLUME_t) data of DJIA, for the period between July 2001 and April 2002, is the dependent variable and various macroeconomic variables that are Consumer Price Index (CPI_t), Producer Price Index (PPI_t), Unemployment Rate (UNEMP_t), Money Supply (M2_t), Industrial Production (IND_PROD_t) and Treasury Bill Yields (T_BILL_t) are the independent variables. Also, the Michigan Consumer Confidence Index data is added to the regression as a dummy variable and named as DUMMY_MCCI_t in the analysis. The macroeconomic variables are on a monthly basis, therefore, the cubic spline interpolation method is used to convert them into a daily frequency. The initial model that is constructed to generate an investor sentiment index is as follows:

$$\begin{aligned}\text{TRADE\_VOLUME}_t &= \theta_0 + \theta_1\text{CPI}_t + \theta_2\text{PPI}_t + \theta_3\text{UNEMP}_t + \theta_4\text{M2}_t \\ &+ \theta_5\text{IND\_PROD}_t + \theta_6\text{T\_BILL}_t + \theta_7\text{DUMMY\_MCCI}_t\end{aligned} \quad \textbf{(4.1)}$$

Table 4.1 : Regression analysis carried out to generate the investor sentiment index for September 11 terrorist attacks.

Variable	Coeff.	Std. Error	t-Statistic	Prob.
C	8,5238	1,0156	8,3927	0,0000
R2_CPI	-79,620	15,472	-5,1461	0,0000
R2_PPI	1,3283	3,8366	3,4621	0,0007
LOG_IP_TRADE_VOLUME(-1)	0,5584	0,0527	10,6015	0,0000
DUMMY_OUTLIER	-1,5607	0,1722	-9,0647	0,0000
R-squared	0,6726	Mean dep. var.		19,243
Adj. R-squared	0,6656	S.D. dep. var.		0,2925
S.E. of regression	0,1692	Akaike info crit.		-0,6906
Sum squared resid	5,4079	Schwarz crit.		-0,6064
Log likelihood	71,986	Hannan-Quinn crit.		-0,6565
F-statistic	97,059	Durbin-Watson stat.		2,0408
Prob. (F-statistic)	0,0000			

Since UNEMP, M2, IND_PROD, T_BILL and DUMMY_MCCI data are insignificant, they are removed from the equation. Therefore, the final equation that helps to acquire

the investor sentiment effect related to 2001, September 11 Terrorist Attacks event is demonstrated in Table 4.1. The DUMMY_OUTLIER variable is composed in order to control the macroeconomic shocks that the outliers originate. The residuals of this regression are appointed as the investor sentiment index in the following analyses, that capture the investor sentiment effects, as $Sent_t$.

To examine the effects of investor sentiment related to 2001, September 11 Terrorist Attacks, daily stock market index returns of the US (DJIA), Turkey (BIST), the UK, (FTSE), Pakistan (KSE), Japan (NIK), China (SSEC) and Saudi Arabia (TASI), for the period between July 2001 and April 2002, are used as dependent variables in the EGARCH models. The outcomes of the EGARCH models are shown in Table 4.2. In order to achieve convergence, EViews Legacy optimization method is applied in the analysis of DJIA.

Table 4.2 : EGARCH results related to the September 11 terrorist attacks incident.

Coefficients	BIST	DJIA	FTSE	KSE	NIK	SSEC	TASI
θ_0	0,0019	-0,0011	-0,0009	0,0022	0,0002	-0,0010	0,0011
	(0,3439)	(0,0817)	(0,2019)	(0,0641)	(0,8981)	(0,3749)	(0,0005)
θ_1	0,0028	0,0004	0,0008	-0,0023	0,0061	-0,0089	0,0020
	(0,8048)	(0,9337)	(0,8446)	(0,7372)	(0,3776)	(0,1029)	(0,1680)
γ_0	-6,7195	-0,2547	-0,2957	-15,521	-9,5052	-1,1912	-1,9291
	(0,0103)	(0,0275)	(0,1273)	(0,0000)	(0,0001)	(0,0001)	(0,0000)
γ_1	0,2067	-0,0708	0,0860	0,2742	-0,0552	0,3470	0,6584
	(0,3262)	(0,2547)	(0,3467)	(0,0000)	(0,7123)	(0,0006)	(0,0000)
γ_2	-0,0900	-0,1253	-0,2734	-0,0372	0,1996	-0,2608	-0,0872
	(0,4986)	(0,0098)	(0,0000)	(0,3811)	(0,0329)	(0,0000)	(0,2411)
γ_3	0,0974	0,9642	0,9743	-0,8458	-0,1803	0,8897	0,8636
	(0,7860)	(0,0000)	(0,0000)	(0,0000)	(0,5435)	(0,0000)	(0,0000)
γ_4	1,2893	-0,2095	-0,7325	0,6793	0,9790	0,4358	-0,2949
	(0,0816)	(0,6079)	(0,1426)	(0,0052)	(0,1934)	(0,3120)	(0,6419)
R-squared	-0,0011	-0,0055	-0,0037	0,0001	0,0045	-0,0027	-0,0039
Adj. R-squared	-0,0063	-0,0108	-0,0089	-0,0051	-0,0008	-0,0080	-0,0091
Akaike info crit.	-4,3489	-6,1460	-6,1722	-5,3673	-5,1807	-5,4184	-7,5775
Schwarz crit.	-4,2306	-6,0277	-6,0539	-5,2490	-5,0624	-5,3001	-7,4591
Hannan-Quinn crit.	-4,3010	-6,0981	-6,1243	-5,3194	-5,1328	-5,3705	-7,5295
Durbin-Watson stat.	1,7173	1,8187	2,0306	2,0240	2,1265	2,0011	1,5713

The initial numbers that are attained, are the coefficients and the numbers in the brackets express the probabilities of the coefficients in the analyses. Coefficient θ_1 is monitored to see the effects of investor sentiment on returns. θ_1 is insignificant for all the markets, which presents that the market returns are not influenced by the investor sentiment related to 2001, September 11 Terrorist Attacks event.

Coefficient γ_2 is controlled to determine the asymmetric volatility in the model. Therewith, γ_2 is significant and negative for DJIA, FTSE and SSEC, which remarks

that the negative shocks exert a higher impact on each h_t than the positive shocks do. Coefficient γ_3 measures the persistence in conditional volatility. If γ_3 is large, volatility is said to take a long time to fade away following 2001, September 11 Terrorist Attacks incident in the market. Since γ_3 is significant, positive and high for the stock market indices such as DJIA, FTSE, SSEC and TASI, they seem to show high persistence. Besides, coefficient γ_4 is evaluated to explore the investor sentiment effects on the conditional volatility. Though, γ_4 is statistically significant and positive only for BIST and KSE.

4.2 Investor Sentiment Effect Related to 2001, Turkish Economic Crisis

In the initial part of the analysis, a regression analysis is carried out where daily trading volume ($\mathrm{TRADE\_VOLUME}_t$) data of BIST 100, for the period between February 2000 and November 2002, is the dependent variable and a group of macroeconomic variables such as Gross Domestic Product (GDP_t), Consumer Price Index (CPI_t), Producer Price Index (PPI_t), Unemployment Rate (UNEMP_t), Money Supply ($\mathrm{M2}_t$), Industrial Production ($\mathrm{IND\_PROD}_t$) and Treasury Bill Yields ($\mathrm{T\_BILL}_t$) are the independent variables. Also, the Consumer Confidence Index data of Turkey is added to the regression as a dummy variable and indicated as $\mathrm{DUMMY\_CCI}_t$ in the analysis. Since GDP is in quarterly frequency and the other macroeconomic data are on a monthly basis, the cubic spline interpolation method is used to convert them into a daily frequency. The initial model that is presented to originate an investor sentiment index is as follows:

$$\begin{aligned}\mathrm{TRADE\_VOLUME}_t &= \theta_0 + \theta_1\mathrm{GDP}_t + \theta_2\mathrm{CPI}_t + \theta_3\mathrm{PPI}_t + \theta_4\mathrm{UNEMP}_t \\ &+ \theta_5\mathrm{M2}_t + \theta_6\mathrm{IND\_PROD}_t + \theta_7\mathrm{T\_BILL}_t \\ &+ \theta_8\mathrm{DUMMY\_CCI}_t\end{aligned} \tag{4.2}$$

Since CPI, PPI, UNEMP, M2, T_BILL and DUMMY_CCI data are insignificant, they are removed from the equation. Therefore, the final equation that helps to comprehend the influence of investor sentiment on 2001, Turkish Economic Crisis incident is shown in Table 4.3. The DUMMY_OUTLIER variable is constituted in order to control the macroeconomic shocks that the outliers generate. The residuals of this regression are

assigned as the investor sentiment index in the following analyses, that capture the impacts of investor sentiment, as $Sent_t$.

Table 4.3 : Regression analysis carried out to generate the investor sentiment index for Turkish economic crisis.

Variable	Coeff.	Std. Error	t-Statistic	Prob.
C	3,9120	0,6045	6,4717	0,0000
RL_GDP	-6,4492	3,8658	-1,6683	0,0957
RL_GDP^2	-3682,61	2161,90	-1,7034	0,0889
R_IND_PROD	-0,2153	0,1287	-1,6739	0,0946
LOG_IP_TRADE_VOLUME(-1)	0,5561	0,0351	15,8528	0,0000
LOG_IP_TRADE_VOLUME(-2)	0,0644	0,0364	1,7715	0,0769
LOG_IP_TRADE_VOLUME(-4)	0,0629	0,0363	1,7295	0,0842
LOG_IP_TRADE_VOLUME(-5)	0,1144	0,0349	3,2785	0,0011
DUMMY_OUTLIER	-1,2851	0,1302	-9,8702	0,0000
R-squared	0,5897	Mean dep. var.		19,247
Adj. R-squared	0,5850	S.D. dep. var.		0,2841
S.E. of regression	0,1830	Akaike info crit.		-0,5458
Sum squared resid	23,619	Schwarz crit.		-0,4881
Log likelihood	203,84	Hannan-Quinn crit.		-0,5235
F-statistic	126,65	Durbin-Watson stat.		2,0265
Prob(F-statistic)	0,0000			

To determine the effects of investor sentiment associated with 2001, Turkish Economic Crisis, daily stock market index returns of Turkey (BIST), Germany (DAX), US (DJIA), UK (FTSE), Brazil (IBOV), Argentina (MERV) and Japan (NIK), for the period between February 2000 and November 2002, are appointed as dependent variables in the EGARCH models. The outcomes of the EGARCH models are presented in Table 4.4. The first numbers that are procured, are the coefficients and the numbers in the brackets indicate the probabilities of the coefficients in the analyses. Coefficient θ_1 is evaluated to determine the impacts of investor sentiment on returns. θ_1 is significant for DAX and FTSE, which represents that the returns of these stock market indices are affected by the investor sentiment associated with 2001, Turkish Economic Crisis incident.

Coefficient γ_2, which is explored to ascertain the asymmetric volatility in the model, is significant and negative for all the stock market indices, except for NIK. This demonstrates that the negative shocks generate a greater influence on each h_t than the positive shocks do. Coefficient γ_3 is the measure of persistence in conditional volatility. If γ_3 is large, volatility takes a long time to vanish following 2001, Turkish Economic Crisis incident in the market. Since γ_3 is significant, positive and high for all the stock market indices, except for NIK, they exert a high persistence. Likewise, coefficient γ_4 is checked to examine the impacts of investor sentiment on conditional

volatility. Herewith, γ_4 is statistically significant and positive for all the stock market indices, except for FTSE and MERV.

Table 4.4 : EGARCH results associated with Turkish economic crisis event.

Coefficients	BIST	DAX	DJIA	FTSE	IBOV	MERV	NIK
θ_0	-0,0010	-0,0020	-0,0007	-0,0012	-0,0010	-0,0013	-0,0011
	(0,3565)	(0,0001)	(0,1181)	(0,0013)	(0,2039)	(0,1406)	(0,0629)
θ_1	-0,0041	-0,0058	-0,0034	-0,0073	0,0016	0,0036	-0,0049
	(0,4170)	(0,0350)	(0,1067)	(0,0001)	(0,6173)	(0,2137)	(0,1011)
γ_0	-1,8747	-0,1393	-0,2164	-0,1363	-0,7744	-0,1814	-12,8855
	(0,0000)	(0,0010)	(0,0010)	(0,0007)	(0,0052)	(0,0000)	(0,0000)
γ_1	0,4766	0,0374	0,0534	0,0345	0,0941	0,1364	-0,0193
	(0,0000)	(0,2080)	(0,0180)	(0,1378)	(0,0216)	(0,0000)	(0,6916)
γ_2	-0,0634	-0,1380	-0,1229	-0,1754	-0,0783	-0,0375	0,1375
	(0,0234)	(0,0000)	(0,0000)	(0,0000)	(0,0014)	(0,0001)	(0,0002)
γ_3	0,7828	0,9861	0,9801	0,9873	0,9107	0,9887	-0,5524
	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0003)
γ_4	0,5363	0,1832	0,2034	0,0052	0,4032	0,0761	0,3630
	(0,0048)	(0,0462)	(0,0602)	(0,9489)	(0,0289)	(0,3543)	(0,0670)
R-squared	-0,0009	0,0050	0,0035	0,0126	-0,0006	-0,0006	0,0018
Adj. R-squared	-0,0023	0,0036	0,0021	0,0113	-0,0020	-0,0020	0,0004
Akaike info crit.	-4,1086	-5,3888	-5,9242	-5,9984	-4,9939	-4,6147	-5,4517
Schwarz crit.	-4,0637	-5,3440	-5,8794	-5,9535	-4,9490	-4,5698	-5,4069
Hannan-Quinn crit.	-4,0913	-5,3715	-5,9069	-5,9811	-4,9765	-4,5973	-5,4344
Durbin-Watson stat.	1,9959	2,0672	1,9689	2,0880	1,9129	1,7228	2,0338

4.3 Investor Sentiment Effect Related to 2005, Hurricane Katrina

For the first step of the analysis, a regression analysis is applied where daily trading volume (TRADE_VOLUME_t) data of DJIA, for the period between June 2005 and March 2006, is the dependent variable and several macroeconomic variables which are Consumer Price Index (CPI_t), Producer Price Index (PPI_t), Unemployment Rate (UNEMP_t), Money Supply (M2_t), Industrial Production (IND_PROD_t) and Treasury Bill Yields (T_BILL_t) are the independent variables. Also, the Michigan Consumer Confidence Index data is added to the regression as a dummy variable and named as DUMMY_MCCI_t in the analysis. The macroeconomic variables are on a monthly basis, therefore, the cubic spline interpolation method is used to convert them into a daily frequency. The initial model that is constructed to generate an investor sentiment index is as follows:

$$\begin{aligned}\text{TRADE\_VOLUME}_t &= \theta_0 + \theta_1\text{CPI}_t + \theta_2\text{PPI}_t + \theta_3\text{UNEMP}_t + \theta_4\text{M2}_t \\ &+ \theta_5\text{IND\_PROD}_t + \theta_6\text{T\_BILL}_t + \theta_7\text{DUMMY\_MCCI}_t\end{aligned} \quad \textbf{(4.3)}$$

Since CPI, UNEMP, IND_PROD and DUMMY_MCCI data are insignificant, they are removed from the equation. Therefore, the final equation that helps to acquire the influence of investor sentiment in 2005, Hurricane Katrina event is demonstrated in Table 4.5. The DUMMY_OUTLIER variable is created in order to control the macroeconomic shocks that the outliers originate. The residuals of this regression are appointed as the investor sentiment index in the following analyses, that capture the influences of investor sentiment, as $Sent_t$.

Table 4.5 : Regression analysis carried out to generate the investor sentiment index for Hurricane Katrina.

Variable	Coeff.	Std. Error	t-Statistic	Prob.
C	11,5182	1,2067	9,5449	0,0000
R_PPI	-0,5039	0,1259	-4,0034	0,0001
R2L_M2	-7769,42	2968,76	-2,6171	0,0096
R2_T_BILL	94,7873	38,2865	2,4757	0,0142
LOG_IP_TRADE_VOLUME(-1)	0,4056	0,0622	6,5168	0,0000
DUMMY_OUTLIER	0,8654	0,1657	5,2229	0,0000
R-squared	0,4594	Mean dep. var.		19,362
Adj. R-squared	0,4450	S.D. dep. var.		0,2168
S.E. of regression	0,1615	Akaike info crit.		-0,7785
Sum squared resid	4,9022	Schwarz crit.		-0,6774
Log likelihood	81,510	Hannan-Quinn crit.		-0,7375
F-statistic	31,954	Durbin-Watson stat.		1,8641
Prob(F-statistic)	0,0000			

To examine the effects of investor sentiment related to 2005, Hurricane Katrina, daily stock market index returns of US (DJIA, NASDAQ, S&P) and Mexico (MXSE), for the period between June 2005 and March 2006, are used as dependent variables in the EGARCH models. The outcomes of the EGARCH models are shown in Table 4.6. In order to achieve convergence, EViews Legacy optimization method is applied in the analysis of S&P 500. However, in the models for DJIA and MXSE, convergence cannot be achieved. Therefore, they are not analyzed in terms of investor sentiment related to the incident.

The initial numbers that are attained, are the coefficients and the numbers in the brackets express the probabilities of the coefficients in the analyses. Coefficient θ_1 is monitored to see the impacts of investor sentiment on returns. θ_1 is insignificant for both markets, which presents that the market returns are not influenced by the investor sentiment related to 2005, Hurricane Katrina event.

Coefficient γ_2 is controlled to determine the asymmetric volatility in the model. Therewith, γ_2 is significant and negative for S&P, which remarks that the negative

shocks exert a higher impact on h_t than the positive shocks. Coefficient γ_3 measures the persistence in conditional volatility. If γ_3 is large, volatility is said to take a long time to disappear following 2005, Hurricane Katrina event in the market. Since γ_3 is high, positive and significant for S&P, it seems to show high persistence. Besides, coefficient γ_4 is evaluated to explore the investor sentiment effects on the conditional volatility. Though, γ_4 is neither statistically significant nor positive for any of the selected stock market indices.

Table 4.6 : EGARCH results related to Hurricane Katrina incident.

Coefficients	NASDAQ	S&P
θ_0	0,0005	0,0002
	(0,4482)	(0,6767)
θ_1	-0,0008	-0,0006
	(0,8586)	(0,8308)
γ_0	-7,1592	-0,3205
	(0,2746)	(0,1226)
γ_1	-0,0997	-0,0905
	(0,6727)	(0,1598)
γ_2	-0,0916	-0,1307
	(0,4780)	(0,0064)
γ_3	0,2497	0,9617
	(0,7149)	(0,0000)
γ_4	0,8660	-0,2514
	(0,2988)	(0,4753)
R-squared	0,0001	-0,0004
Adj. R-squared	-0,0051	-0,0056
Akaike info crit.	-6,7370	-7,4413
Schwarz crit.	-6,6187	-7,3230
Hannan-Quinn crit.	-6,6891	-7,3934
Durbin-Watson stat.	1,9061	2,1034

4.4 Investor Sentiment Effect Related to 2005, London Train Bombings

In the initial part of the analysis, a regression analysis is carried out where daily trading volume (TRADE_VOLUME_t) data of FTSE 100, for the period between May 2005 and February 2006, is the dependent variable and multiple macroeconomic variables that are Consumer Price Index (CPI_t), Producer Price Index (PPI_t), Unemployment Rate (UNEMP_t), Money Supply (M2_t), Industrial Production (IND_PROD_t) and Treasury Bill Yields (T_BILL_t) are the independent variables. Also, the Consumer Confidence Index data of the UK is added to the regression as a dummy variable and indicated as DUMMY_CCI_t in the analysis. The macroeconomic variables are on a monthly basis, therefore, the cubic spline interpolation method is used to convert them into a daily

frequency. The initial model that is presented to originate an investor sentiment index is as follows:

$$\begin{aligned}\text{TRADE\_VOLUME}_t &= \theta_0 + \theta_1 \text{CPI}_t + \theta_2 \text{PPI}_t + \theta_3 \text{UNEMP}_t + \theta_4 \text{M2}_t \\ &+ \theta_5 \text{IND\_PROD}_t + \theta_6 \text{T\_BILL}_t + \theta_7 \text{DUMMY\_CCI}_t\end{aligned} \quad \textbf{(4.4)}$$

Table 4.7 : Regression analysis carried out to generate the investor sentiment index for London train bombings.

Variable	Coeff.	Std. Error	t-Statistic	Prob.
C	9,6035	1,2885	7,4531	0,0000
R_CPI	3,6019	1,7204	2,0937	0,0376
R2_PPI	-44,23	16,63	-2,6596	0,0085
R_IND_PROD	1,1445	0,5315	2,1532	0,0326
LOG_IP_TRADE_VOLUME(-1)	0,5452	0,0610	8,9311	0,0000
R-squared	0,4852	Mean dep. var.		21,149
Adj. R-squared	0,4744	S.D. dep. var.		0,3044
S.E. of regression	0,2207	Akaike info crit.		-0,1592
Sum squared resid	9,2996	Schwarz crit.		-0,0756
Log likelihood	20,606	Hannan-Quinn crit.		-0,1254
F-statistic	44,996	Durbin-Watson stat.		1,8888
Prob(F-statistic)	0,0000			

Since UNEMP, M2, T_BILL and DUMMY_CCI data are insignificant, they are removed from the equation. Therefore, the final equation that helps to capture the investor sentiment effect related to 2005, London Train Bombings incident is shown in Table 4.7.

To determine the effects of investor sentiment associated with 2005, London Train Bombings, daily stock market index returns of UK (FTSE), Netherlands (AEX), Belgium (BEL), France (CAC), Spain (IBEX) and Ireland (ISEQ), for the period between May 2005 and February 2006, are appointed as dependent variables in the EGARCH models. The outcomes of the EGARCH models are presented in Table 4.8.

The first numbers which are procured, are the coefficients and the numbers in the brackets indicate the probabilities of the coefficients in the analyses. Coefficient θ_1 is evaluated to see the impacts of investor sentiment on returns. θ_1 is significant for AEX, CAC and IBEX stock market indices, at 10% level. However, the coefficients are also positive for these stock market returns. So, this indicates that these stock market returns are positively influenced by the investor sentiment associated with 2005, London Train Bombings incident.

Table 4.8 : EGARCH results associated with London train bombings event.

Coefficients	AEX	BEL	CAC	FTSE	IBEX	ISEQ
θ_0	0,0013	0,0010	0,0006	0,0006	0,0009	0,0012
	(0,0081)	(0,0100)	(0,2199)	(0,1071)	(0,0269)	(0,0050)
θ_1	0,0034	0,0019	0,0042	0,0006	0,0032	0,0002
	(0,0751)	(0,3114)	(0,0636)	(0,7305)	(0,0578)	(0,9165)
γ_0	-8,7452	-2,2838	-0,7996	-7,2641	-2,1352	-1,1633
	(0,0041)	(0,1936)	(0,0462)	(0,0002)	(0,0379)	(0,0492)
γ_1	0,0162	-0,1268	-0,0047	0,2530	0,0769	0,0082
	(0,9181)	(0,3205)	(0,9532)	(0,2896)	(0,5776)	(0,9274)
γ_2	-0,1834	-0,1715	-0,2110	-0,3156	-0,1994	-0,1525
	(0,0675)	(0,0772)	(0,0013)	(0,0053)	(0,0103)	(0,0151)
γ_3	0,1353	0,7738	0,9182	0,3215	0,7978	0,8884
	(0,6529)	(0,0000)	(0,0000)	(0,0756)	(0,0000)	(0,0000)
γ_4	1,2419	0,0621	0,0924	0,9789	0,9876	0,3590
	(0,0243)	(0,8505)	(0,6797)	(0,0751)	(0,0706)	(0,2932)
R-squared	0,0070	0,0052	0,0070	-0,0022	-0,0083	-0,0006
Adj. R-squared	0,0018	0,0001	0,0018	-0,0074	-0,0135	-0,0057
Akaike info crit.	-7,1901	-7,6656	-7,0618	-7,5100	-7,3670	-7,4811
Schwarz crit.	-7,0726	-7,5481	-6,9443	-7,3925	-7,2495	-7,3636
Hannan-Quinn crit.	-7,1425	-7,6180	-7,0142	-7,4625	-7,3194	-7,4336
Durbin-Watson stat.	2,0868	2,0330	2,1380	2,1655	2,1082	1,9651

Coefficient γ_2, which is explored to ascertain the asymmetric volatility in the model, is significant and negative for all the stock market indices, at 10% level. This demonstrates that the negative shocks generate a higher impact on h_t than the positive shocks do. Coefficient γ_3 is the measure of persistence in conditional volatility. If γ_3 is large, volatility takes a long time to fade away following 2005, London Train Bombings incident in the market. Since γ_3 is high, positive and significant for BEL, CAC, IBEX and ISEQ, they exert a high persistence. Likewise, coefficient γ_4 is checked to examine the impacts of investor sentiment on conditional volatility. Herewith, γ_4 is statistically significant and positive for AEX, FTSE and IBEX.

4.5 Investor Sentiment Effect Related to 2008, Global Financial Crisis

For the first step of the analysis, a regression analysisi is applied where daily trading volume (TRADE_VOLUME_t) data of DJIA, for the period between March 2007 and December 2009, is the dependent variable and a group of macroeconomic variables such as Gross Domestic Product (GDP_t), Consumer Price Index (CPI_t), Producer Price Index (PPI_t), Unemployment Rate (UNEMP_t), Money Supply (M2_t), Industrial Production (IND_PROD_t) and Treasury Bill Yields (T_BILL_t) are the independent variables. Also, the Michigan Consumer Confidence Index data is added to the regression as a dummy variable and named as DUMMY_MCCI_t in the analysis. Since GDP is in quarterly frequency and the rest of the macroeconomic variables are on a

monthly basis, the cubic spline interpolation method is used to convert them into a daily frequency. The initial model that is constructed to generate an investor sentiment index is as follows:

$$\begin{aligned}\text{TRADE\_VOLUME}_t &= \theta_0 + \theta_1 \text{GDP}_t + \theta_2 \text{CPI}_t + \theta_3 \text{PPI}_t + \theta_4 \text{UNEMP}_t \\ &+ \theta_5 \text{M2}_t + \theta_6 \text{IND\_PROD}_t + \theta_7 \text{T\_BILL}_t \\ &+ \theta_8 \text{DUMMY\_MCCI}_t\end{aligned} \quad \textbf{(4.5)}$$

Since CPI, UNEMP, M2, IND_PROD, T_BILL and DUMMY_MCCI data are insignificant, they are removed from the equation. Therefore, the final equation that helps to acquire the impact of investor sentiment on 2008, Global Financial Crisis event is demonstrated in Table 4.9. The DUMMY_OUTLIER variable is constituted in order to control the macroeconomic shocks that the outliers originate. The residuals of this regression are appointed as the investor sentiment index in the following analyses, that capture the impacts of investor sentiment, as $Sent_t$.

Table 4.9 : Regression analysis carried out to generate the investor sentiment index for Global financial crisis.

Variable	Coeff.	Std. Error	t-Statistic	Prob.
C	5,1869	0,6783	7,6466	0,0000
RL_GDP	-212,18	63,903	-3,3203	0,0009
IPOLATED_PPI	-0,0014	0,0009	-1,6363	0,1022
LOG_IP_TRADE_VOLUME(-1)	0,4873	0,0374	13,045	0,0000
LOG_IP_TRADE_VOLUME(-2)	0,1841	0,0408	4,5094	0,0000
LOG_IP_TRADE_VOLUME(-3)	0,0738	0,0372	1,9816	0,0479
R-squared	0,5272	Mean dep. var.		19,353
Adj. R-squared	0,5238	S.D. dep. var.		0,3333
S.E. of regression	0,2300	Akaike info crit.		-0,0930
Sum squared resid	37,565	Schwarz crit.		-0,0546
Log likelihood	39,282	Hannan-Quinn crit.		-0,0782
F-statistic	158,31	Durbin-Watson stat.		2,0120
Prob(F-statistic)	0,0000			

To examine the effects of investor sentiment related to 2008, Global Financial Crisis, daily stock market index returns of the US (DJIA), Turkey (BIST), Germany (DAX), the UK (FTSE), Russia (MOEX), Japan (NIK) and China (SSEC), for the period between March 2007 and December 2009, are used as dependent variables in the EGARCH models. The outcomes of the EGARCH models are shown in Table 4.10.

The initial numbers that are represented, are the coefficients and the numbers in the brackets express the probabilities of the coefficients in the analyses. Coefficient θ_1 is

monitored to see the impacts of investor sentiment on returns. θ_1 is significant for DJIA and FTSE, which remarks that the market returns are influenced by the investor sentiment related to 2008, Global Financial Crisis event.

Table 4.10 : EGARCH results related to Global financial crisis incident.

Coefficients	BIST	DAX	DJIA	FTSE	MOEX	NIK	SSEC
θ_0	0,0014	-4,8E-05	0,0001	-0,0001	-0,0006	-0,0011	0,0011
	(0,0625)	(0,9272)	(0,7435)	(0,8240)	(0,4578)	(0,0301)	(0,1513)
θ_1	-0,0021	-0,0027	-0,0039	-0,0038	-0,0025	-0,0042	-0,0043
	(0,5227)	(0,2184)	(0,0377)	(0,0590)	(0,3942)	(0,1016)	(0,2147)
γ_0	-0,6658	-0,3155	-0,2437	-0,2439	-0,2058	-0,2347	-1,0894
	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)
γ_1	0,1866	0,1325	0,0842	0,0805	0,1401	0,0997	0,2068
	(0,0000)	(0,0001)	(0,0009)	(0,0004)	(0,0000)	(0,0004)	(0,0000)
γ_2	-0,0678	-0,1344	-0,1472	-0,1383	-0,0931	-0,1244	-0,1242
	(0,0069)	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)
γ_3	0,9338	0,9747	0,9797	0,9788	0,9862	0,9809	0,8791
	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)
γ_4	0,2572	0,1410	0,0907	0,0727	0,2614	0,1873	0,3401
	(0,0158)	(0,0265)	(0,1409)	(0,1808)	(0,0001)	(0,0007)	(0,0121)
R-squared	0,0010	0,0064	0,0014	0,0105	0,0013	0,0116	0,0023
Adj. R-squared	-0,0004	0,0050	0,0000	0,0091	-0,0001	0,0102	0,0009
Akaike info crit.	-5,0110	-5,5704	-5,8233	-5,7076	-4,6318	-5,4645	-4,8495
Schwarz crit.	-4,9663	-5,5256	-5,7786	-5,6628	-4,5870	-5,4197	-4,8048
Hannan-Quinn crit.	-4,9937	-5,5531	-5,8060	-5,6903	-4,6145	-5,4472	-4,8322
Durbin-Watson stat.	1,8696	2,0822	2,2683	2,1730	1,9465	2,0298	1,9912

Coefficient γ_2 is controlled to determine the asymmetric volatility in the model. Therewith, γ_2 is significant and negative for all stock market indices, which asserts that the negative shocks exert a higher impact on h_t than the positive shocks do. Coefficient γ_3 measures the persistence in conditional volatility. If γ_3 is large, volatility is said to take a long time to vanish following 2008, Global Financial Crisis event in the market. Since γ_3 is significant, positive and high for all the stock market indices, they seem to show high persistence. Besides, coefficient γ_4 is evaluated to investigate the investor sentiment effects on the conditional volatility. Thereby, γ_4 is statistically significant and positive for the stock market indices which are BIST, DAX, MOEX, NIK and SSEC.

4.6 Investor Sentiment Effect Related to 2008, Wenchuan Earthquake

In the initial part of the analysis, a regression analysis is carried out where daily trading volume (TRADE_VOLUME_t) data of SSEC, for the period between March 2008 and December 2008, is the dependent variable and various macroeconomic variables which are Consumer Price Index (CPI_t), Producer Price Index (PPI_t), Unemployment

Rate (UNEMP_t), Money Supply ($\mathrm{M2}_t$), Industrial Production ($\mathrm{IND\_PROD}_t$) and Treasury Bill Yields ($\mathrm{T\_BILL}_t$) are the independent variables. Also, the Consumer Confidence Index data of China is added to the regression as a dummy variable and indicated as $\mathrm{DUMMY\_CCI}_t$ in the analysis. The macroeconomic variables are on a monthly basis, therefore, the cubic spline interpolation method is used to convert them into a daily frequency. The initial model that is presented to originate an investor sentiment index is as follows:

$$\begin{aligned}\mathrm{TRADE\_VOLUME}_t &= \theta_0 + \theta_1 \mathrm{CPI}_t + \theta_2 \mathrm{PPI}_t + \theta_3 \mathrm{UNEMP}_t + \theta_4 \mathrm{M2}_t \\ &+ \theta_5 \mathrm{IND\_PROD}_t + \theta_6 \mathrm{T\_BILL}_t + \theta_7 \mathrm{DUMMY\_CCI}_t\end{aligned} \quad \textbf{(4.6)}$$

Since CPI, PPI, UNEMP, M2 and IND_PROD data are insignificant, they are removed from the equation. Therefore, the final equation that helps to capture the influence of investor sentiment on 2008, Wenchuan Earthquake incident is shown in Table 4.11. The DUMMY_OUTLIER variable is created in order to control the macroeconomic shocks that the outliers generate. The residuals of this regression are assigned as the investor sentiment index in the following analyses, that capture the influences of investor sentiment, as $Sent_t$.

Table 4.11 : Regression analysis carried out to generate the investor sentiment index for Wenchuan earthquake.

Variable	Coeff.	Std. Error	t-Statistic	Prob.
C	5,0560	1,0278	4,9191	0,0000
R2_T_BILL	-30,691	11,7862	-2,6040	0,0100
DUMMY_CCI	-0,0803	0,0355	-2,2592	0,0250
LOG_IP_TRADE_VOLUME(-1)	0,6249	0,0663	9,4307	0,0000
LOG_IP_TRADE_VOLUME(-2)	0,1526	0,0658	2,3194	0,0214
DUMMY_OUTLIER	0,8744	0,1469	5,9512	0,0000
R-squared	0,7233	Mean dep. var.		22,519
Adj. R-squared	0,7159	S.D. dep. var.		0,3866
S.E. of regression	0,2060	Akaike info crit.		-0,2912
Sum squared resid	7,9798	Schwarz crit.		-0,1901
Log likelihood	34,248	Hannan-Quinn crit.		-0,2503
F-statistic	98,284	Durbin-Watson stat.		2,1100
Prob(F-statistic)	0,0000			

To determine the effects of investor sentiment associated with 2008, Wenchuan Earthquake, daily stock market index returns of China (SSEC), South Korea (KOSPI), Japan (NIK) and Taiwan (TWSE), for the period between March 2008 and December 2008, are appointed as dependent variables in the EGARCH models. The outcomes of the EGARCH models are presented in Table 4.12.

The first numbers which are procured, are the coefficients and the numbers in the brackets indicate the probabilities of the coefficients in the analyses. Coefficient θ_1 is evaluated to see the impacts of investor sentiment on returns. θ_1 is significant only for SSEC stock market index. However, the coefficient is also positive for this stock market. So, this implies that the stock returns of SSEC are positively influenced by the investor sentiment associated with 2008, Wenchuan Earthquake incident.

Coefficient γ_2, that is explored to ascertain the asymmetric volatility in the model, is negative and significant for KOSPI and NIK. This demonstrates that the negative shocks generate a higher influence on h_t than the positive shocks do. Coefficient γ_3 is the measure of persistence in conditional volatility. If γ_3 is large, volatility takes a long time to disappear following 2008, Wenchuan Earthquake incident in the market. Since γ_3 is high, positive and significant for KOSPI and NIK, they exert a high persistence. Likewise, coefficient γ_4 is checked to determine the impacts of investor sentiment on conditional volatility. However, γ_4 is insignificant for the selected stock market indices.

Table 4.12 : EGARCH results associated with Wenchuan earthquake event.

Coefficients	KOSPI	NIK	SSEC	TWSE
θ_0	-0,0009 (0,3960)	-0,0018 (0,1436)	-0,0048 (0,0295)	-0,0032 (0,0403)
θ_1	0,0028 (0,6270)	0,0027 (0,6915)	0,0477 (0,0000)	-0,0047 (0,5193)
γ_0	-0,2227 (0,0347)	-0,3654 (0,0095)	-8,0456 (0,0578)	-11,3436 (0,0057)
γ_1	0,1141 (0,0175)	0,2104 (0,0108)	0,3552 (0,1486)	-0,1110 (0,3373)
γ_2	-0,1057 (0,0052)	-0,1600 (0,0034)	-0,0407 (0,7545)	-0,0038 (0,9628)
γ_3	0,9820 (0,0000)	0,9734 (0,0000)	-0,0641 (0,9127)	-0,4798 (0,3649)
γ_4	-0,0669 (0,7790)	0,0729 (0,8348)	-0,2650 (0,6307)	0,5352 (0,3347)
R-squared	0,0007	0,0019	0,1270	0,0031
Adj. R-squared	-0,0046	-0,0034	0,1224	-0,0021
Akaike info crit.	-5,0571	-4,8145	-4,3875	-4,8134
Schwarz crit.	-4,9387	-4,6962	-4,2692	-4,6951
Hannan-Quinn crit.	-5,0091	-4,7666	-4,3396	-4,7655
Durbin-Watson stat.	1,9067	1,9653	2,3643	1,8953

4.7 Investor Sentiment Effect Related to 2010, Greek Sovereign Debt Crisis

For the first step of the analysis, a regression analysis is applied where daily trading volume (TRADE_VOLUME_t) data of ATG, for the period between December 2009 and

December 2012, is the dependent variable and a group of macroeconomic variables that are Gross Domestic Product (GDP_t), Consumer Price Index (CPI_t), Producer Price Index (PPI_t), Unemployment Rate (UNEMP_t), Money Supply ($\mathrm{M2}_t$), Industrial Production ($\mathrm{IND\_PROD}_t$) and Treasury Bill Yields ($\mathrm{T\_BILL}_t$) are the independent variables. Also, the Consumer Confidence Index data of Greece is added to the regression as a dummy variable and named as $\mathrm{DUMMY\_CCI}_t$ in the analysis. Since GDP is in quarterly frequency and the macroeconomic variables are on a monthly basis, the cubic spline interpolation method is used to convert them into a daily frequency. The initial model that is constructed to generate an investor sentiment index is as follows:

$$\begin{aligned}\mathrm{TRADE\_VOLUME}_t &= \theta_0 + \theta_1 \mathrm{GDP}_t + \theta_2 \mathrm{CPI}_t + \theta_3 \mathrm{PPI}_t + \theta_4 \mathrm{UNEMP}_t \\ &+ \theta_5 \mathrm{M2}_t + \theta_6 \mathrm{IND\_PROD}_t + \theta_7 \mathrm{T\_BILL}_t \\ &+ \theta_8 \mathrm{DUMMY\_CCI}_t\end{aligned} \quad \textbf{(4.7)}$$

Table 4.13 : Regression analysis carried out to generate the investor sentiment index for Greek sovereign debt crisis.

Variable	Coeff.	Std. Error	t-Statistic	Prob.
C	3,4187	0,4833	7,0734	0,0000
R2L_GDP	938,233	2335,746	0,4017	0,6880
R2L_GDP^2	-7,97E+08	3,24E+08	-2,4644	0,0139
R2_UNEMP	0,6712	9,8593	0,0681	0,9457
R2_UNEMP^2	8748,22	4335,40	2,0179	0,0440
LOG_IP_TRADE_VOLUME(-1)	0,5074	0,0351	14,452	0,0000
LOG_IP_TRADE_VOLUME(-2)	0,1308	0,0360	3,6304	0,0003
LOG_IP_TRADE_VOLUME(-5)	0,1599	0,0282	5,6696	0,0000
DUMMY_CCI	0,0449	0,0271	1,6547	0,0984
R-squared	0,5994	Mean dep. var.		17,015
Adj. R-squared	0,5952	S.D. dep. var.		0,5261
S.E. of regression	0,3347	Akaike info crit.		0,6605
Sum squared resid	86,385	Schwarz crit.		0,7142
Log likelihood	-248,58	Hannan-Quinn crit.		0,6812
F-statistic	144,19	Durbin-Watson stat.		2,0115
Prob(F-statistic)	0,0000			

Since UNEMP, M2, IND_PROD, T_BILL and DUMMY_MCCI data are insignificant, they are removed from the equation. Therefore, the final equation that helps to acquire the investor sentiment effect related to 2010, Greek Sovereign Debt Crisis event is demonstrated in Table 4.13. The residuals of this regression are appointed as the investor sentiment index in the following analyses, that capture the investor sentiment effects, as $Sent_t$.

To examine the effects of investor sentiment related to 2010, Greek Sovereign Debt Crisis, daily stock market index returns of Greece (ATG), Belgium (BEL), Turkey (BIST), Germany (DAX), Italy (MIB), Spain (IBEX) and Poland (WIG), for the period between December 2009 and December 2012, are used as dependent variables in the EGARCH models. The outcomes of the EGARCH models are demonstrated in Table 4.14.

The initial numbers are the coefficients themselves and the numbers in the brackets express the probabilities of the coefficients in the analyses. Coefficient θ_1 is investigated to observe the impacts of investor sentiment on returns. θ_1 is significant for all the stock market indices, except for BIST and DAX. However, the coefficients are also positive for these stock market returns. So, this indicates that these market returns are positively affected by the investor sentiment related to 2010, Greek Sovereign Debt Crisis event.

Table 4.14 : EGARCH results related to Greek sovereign debt crisis incident.

Coefficients	ATG	BEL	BIST	DAX	MIB	IBEX	WIG
θ_0	-0,0010 (0,2414)	-0,0002 (0,6994)	0,0008 (0,0888)	0,0002 (0,6369)	-0,0005 (0,2802)	-0,0011 (0,0155)	0,0004 (0,2208)
θ_1	0,0082 (0,0000)	0,0014 (0,0553)	0,0018 (0,1193)	0,0007 (0,4626)	0,0025 (0,0240)	0,0035 (0,0006)	0,0017 (0,0154)
γ_0	-0,8175 (0,0000)	-0,5784 (0,0000)	-0,7568 (0,0000)	-0,6549 (0,0000)	-0,3963 (0,0000)	-0,3472 (0,0000)	-0,3581 (0,0000)
γ_1	0,1655 (0,0000)	0,1361 (0,0000)	0,2002 (0,0000)	0,1770 (0,0000)	0,1359 (0,0000)	0,1496 (0,0000)	0,1298 (0,0001)
γ_2	-0,0307 (0,0952)	-0,1873 (0,0000)	-0,1161 (0,0000)	-0,2088 (0,0000)	-0,1338 (0,0000)	-0,1628 (0,0000)	-0,1139 (0,0000)
γ_3	0,9090 (0,0000)	0,9470 (0,0000)	0,9310 (0,0000)	0,9410 (0,0000)	0,9647 (0,0000)	0,9716 (0,0000)	0,9723 (0,0000)
γ_4	0,0182 (0,8121)	0,0381 (0,5263)	0,1160 (0,1401)	0,0088 (0,9059)	0,0109 (0,8635)	-0,0387 (0,4942)	0,0379 (0,4458)
R-squared	0,0242	0,0040	0,0031	0,0018	0,0071	0,0069	0,0037
Adj. R-squared	0,0230	0,0027	0,0018	0,0005	0,0058	0,0056	0,0025
Akaike info crit.	-4,7949	-6,0981	-5,8615	-5,9879	-5,4252	-5,4593	-6,4489
Schwarz crit.	-4,7530	-6,0563	-5,8197	-5,9460	-5,3833	-5,4175	-6,4071
Hannan-Quinn crit.	-4,7788	-6,0820	-5,8454	-5,9718	-5,4091	-5,4432	-6,4328
Durbin-Watson stat.	1,9013	1,9300	1,9657	1,7989	1,9250	1,8219	1,8271

Coefficient γ_2 is controlled to determine the asymmetric volatility in the model. Therewith, γ_2 is significant and negative for all stock market indices, at 10% level, which represents that the negative shocks exert a higher impact on h_t than the positive shocks do. Coefficient γ_3 measures the persistence in conditional volatility. If γ_3 is large, volatility is said to take a long time to die out following 2010, Greek Sovereign Debt Crisis event in the market. Since γ_3 is significant, positive and high for all the

stock market indices, they seem to show high persistence. Besides, coefficient γ_4 is evaluated to explore the investor sentiment effects on the conditional volatility. Though, γ_4 is statistically insignificant for all the selected stock market indices.

4.8 Investor Sentiment Effect Related to 2011, Arab Spring

In the initial part of the analysis, a regression analysis is carried out where daily trading volume (TRADE_VOLUME_t) data of EGX 30, for the period between June 2010 and June 2013, is the dependent variable and a group of macroeconomic variables such as Gross Domestic Product (GDP_t), Consumer Price Index (CPI_t), Producer Price Index (PPI_t), Unemployment Rate (UNEMP_t), Money Supply (M2_t), Industrial Production (IND_PROD_t) and Treasury Bill Yields (T_BILL_t) are the independent variables. Since GDP is in quarterly frequency and the macroeconomic variables are on a monthly basis, the cubic spline interpolation method is used to convert them into a daily frequency. The initial model that is presented to originate an investor sentiment index is as follows:

$$\begin{aligned}\text{TRADE\_VOLUME}_t &= \theta_0 + \theta_1\text{GDP}_t + \theta_2\text{CPI}_t + \theta_3\text{PPI}_t + \theta_4\text{UNEMP}_t \\ &+ \theta_5\text{M2}_t + \theta_6\text{IND\_PROD}_t + \theta_7\text{T\_BILL}_t\end{aligned} \quad \textbf{(4.8)}$$

Since CPI, PPI, UNEMP, M2, T_BILL and DUMMY_CCI data are insignificant, they are removed from the equation. Therefore, the final equation that helps to comprehend the influence of investor sentiment on 2011, Arab Spring incident is shown in Table 4.15. The residuals of this regression are assigned as the investor sentiment index in the following analyses, that capture the impacts of investor sentiment, as $Sent_t$.

To determine the effects of investor sentiment associated with 2011, Arab Spring, daily stock market index returns of Egypt (EGX), France (CAC), Israel (TA), Jordan (ASE), Lebanon (BLOM), Qatar (QE), Saudi Arabia (TASI), Turkey (BIST), United Arab Emirates (ADX) and US (DJIA) for the period between June 2010 and June 2013, are appointed as dependent variables in the EGARCH models. However, the outcomes of the analyses are not found adequate to model the investor sentiment effects through the stock markets. Therefore, the influence of investor sentiment associated with 2011, Arab Spring incident is not studied extensively through this thesis.

Table 4.15 : Regression analysis carried out to generate the investor sentiment index for Arab spring.

Variable	Coeff.	Std. Error	t-Statistic	Prob.
C	2,5318	0,4557	5,5558	0,0000
RL_GDP	-35,9574	23,0950	-1,5569	0,1199
RL_GDP^2	-79448,7	30697,7	-2,5881	0,0098
R_PPI	0,2681	0,1045	2,5660	0,0105
RL_M2	71,1723	34,8191	2,0441	0,0413
LOG_IP_TRADE_VOLUME(-1)	0,4647	0,0355	13,106	0,0000
LOG_IP_TRADE_VOLUME(-2)	0,1828	0,0373	4,9007	0,0000
LOG_IP_TRADE_VOLUME(-4)	0,0851	0,0373	2,2803	0,0229
LOG_IP_TRADE_VOLUME(-5)	0,1260	0,0351	3,5891	0,0004
R-squared	0,7037	Mean dep. var.		18,014
Adj. R-squared	0,7006	S.D. dep. var.		0,5554
S.E. of regression	0,3039	Akaike info crit.		0,4673
Sum squared resid	71,116	Schwarz crit.		0,5211
Log likelihood	-173,01	Hannan-Quinn crit.		0,4880
F-statistic	228,60	Durbin-Watson stat.		2,0057
Prob(F-statistic)	0,0000			

4.9 Investor Sentiment Effect Related to 2011, Japan Earthquake and Tsunami

For the first step of the analysis, a regression analysis is applied where daily trading volume ($\mathrm{TRADE\_VOLUME}_t$) data of Nikkei 225, for the period between January 2011 and October 2011, is the dependent variable and several macroeconomic variables which are Consumer Price Index (CPI_t), Producer Price Index (PPI_t), Unemployment Rate (UNEMP_t), Money Supply ($\mathrm{M2}_t$), Industrial Production ($\mathrm{IND\_PROD}_t$) and Treasury Bill Yields ($\mathrm{T\_BILL}_t$) are the dependent variables.

Also, the Consumer Confidence Index data of Japan is added to the regression as a dummy variable and named as $\mathrm{DUMMY\_CCI}_t$ in the analysis. The macroeconomic variables are on a monthly basis. Therefore, the cubic spline interpolation method is used to convert them into a daily frequency. The initial model that is constructed to generate an investor sentiment index is as follows:

$$\begin{aligned}\mathrm{TRADE\_VOLUME}_t &= \theta_0 + \theta_1 \mathrm{CPI}_t + \theta_2 \mathrm{PPI}_t + \theta_3 \mathrm{UNEMP}_t + \theta_4 \mathrm{M2}_t \\ &+ \theta_5 \mathrm{IND\_PROD}_t + \theta_6 \mathrm{T\_BILL}_t + \theta_7 \mathrm{DUMMY\_CCI}_t\end{aligned} \quad \textbf{(4.9)}$$

Since CPI, M2 and T_BILL data are insignificant, they are removed from the equation. Therefore, the final equation that helps to acquire the influence of investor sentiment on 2011, Japan Earthquake and Tsunami event is demonstrated in Table 4.16. The

residuals of this regression are appointed as the investor sentiment index in the following analyses, that capture the influences of investor sentiment, as $Sent_t$.

Table 4.16 : Regression analysis carried out to generate the investor sentiment index for Japan earthquake and tsunami.

Variable	Coeff.	Std. Error	t-Statistic	Prob.
C	-2898,29	1269,91	-2,2823	0,0236
R2_PPI	63,802	14,500	4,4001	0,0000
R_UNEMP	4,1623	4,2071	0,9893	0,3238
R_UNEMP^2	1231,71	661,223	1,8628	0,0641
R_UNEMP^3	-60202,6	24529,4	-2,4543	0,0151
R_UNEMP^4	-6888393	2783133	-2,4751	0,0142
IPOLATED_IND_PROD	123,198	53,125	2,3190	0,0215
IPOLATED_IND_PROD^2	-1,9477	0,8316	-2,3420	0,0203
IPOLATED_IND_PROD^3	0,0136	0,0058	2,3621	0,0192
IPOLATED_IND_PROD^4	0,0000	0,0000	-2,3795	0,0184
LOG_IP_TRADE_VOLUME(-1)	0,3522	0,0683	5,1562	0,0000
DUMMY_CCI	0,0568	0,0298	1,9093	0,0578
R-squared	0,6500	Mean dep. var.		21,083
Adj. R-squared	0,6288	S.D. dep. var.		0,2437
S.E. of regression	0,1485	Akaike info crit.		-0,9171
Sum squared resid	4,0117	Schwarz crit.		-0,7149
Log likelihood	100,96	Hannan-Quinn crit.		-0,8352
F-statistic	30,725	Durbin-Watson stat.		2,0737
Prob(F-statistic)	0,0000			

To examine the effects of investor sentiment related to 2011, Japan Earthquake and Tsunami, daily stock market index returns of Japan (NIK), US (DJIA), Hong Kong (HSI), South Korea (KOSPI) and China (SSEC), for the period between January 2011 and October 2011, are used as dependent variables in the EGARCH models. The outcomes of the EGARCH models are shown in Table 4.17. In order to achieve convergence, EViews Legacy optimization method is applied in the analysis of HSI and SSEC.

The initial numbers that are attained, are the coefficients and the numbers in the brackets express the probabilities of the coefficients in the analyses. Coefficient θ_1 is monitored to evaluate the impacts of investor sentiment on returns. θ_1 is significant only for KOSPI, which remarks that the market returns are influenced by the investor sentiment related to 2011, Japan Earthquake and Tsunami event.

Coefficient γ_2 is controlled to determine the asymmetric volatility in the model. Therewith, γ_2 is significant and negative for all stock market indices, which states that the negative shocks exert a higher impact on h_t than the positive shocks do. Coefficient γ_3 measures the persistence in conditional volatility. If γ_3 is large, volatility is said to take a long time to fade away following 2011, Japan Earthquake and Tsunami event

in the market. Since γ_3 is significant, positive and high for all the stock market indices, they seem to show high persistence. Besides, coefficient γ_4 is evaluated to investigate the investor sentiment effects on the conditional volatility. Though, γ_4 is statistically insignificant for all the selected stock market indices.

Table 4.17 : EGARCH results related to Japan earthquake and tsunami incident.

Coefficients	DJIA	HSI	KOSPI	NIK	SSEC
θ_0	-0,0004	-0,0025	-0,0005	-0,0009	-0,0015
	(0,4811)	(0,0000)	(0,5453)	(0,2677)	(0,0034)
θ_1	-0,0014	-0,0037	-0,0143	0,0003	0,0023
	(0,7678)	(0,5181)	(0,0357)	(0,9643)	(0,5484)
γ_0	-0,4833	-0,0981	-0,4780	-1,7112	-1,0309
	(0,0015)	(0,5113)	(0,0182)	(0,0025)	(0,0000)
γ_1	0,0812	-0,0578	0,1186	0,1975	-0,4048
	(0,3433)	(0,3070)	(0,3288)	(0,2531)	(0,0000)
γ_2	-0,2500	-0,1814	-0,1830	-0,3573	-0,1372
	(0,0000)	(0,0000)	(0,0046)	(0,0003)	(0,0004)
γ_3	0,9532	0,9816	0,9551	0,8248	0,8537
	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)
γ_4	-0,3396	-0,0503	-0,5198	-0,7910	0,2201
	(0,4593)	(0,9216)	(0,4047)	(0,2098)	(0,5252)
R-squared	-0,0022	0,0047	0,0348	-0,0008	-0,0058
Adj. R-squared	-0,0074	-0,0005	0,0297	-0,0061	-0,0111
Akaike info crit.	-6,2725	-5,8441	-5,7082	-5,9713	-6,2961
Schwarz crit.	-6,1542	-5,7258	-5,5899	-5,8530	-6,1777
Hannan-Quinn crit.	-6,2246	-5,7962	-5,6603	-5,9234	-6,2481
Durbin-Watson stat.	2,2190	1,7476	1,6669	1,8525	1,9544

4.10 Investor Sentiment Effect Related to 2015, Paris Terrorist Attacks

In the initial part of the analysis, a regression analysis is carried out where daily trading volume (TRADE_VOLUME_t) data of CAC 40, for the period between September 2015 and June 2016, is the dependent variable and multiple macroeconomic variables that are Consumer Price Index (CPI_t), Producer Price Index (PPI_t), Unemployment Rate (UNEMP_t), Money Supply (M2_t), Industrial Production (IND_PROD_t) and Treasury Bill Yields (T_BILL_t) are the independent variables. Also, the Consumer Confidence Index data of France is added to the regression as a dummy variable and indicated as DUMMY_CCI_t in the analysis. The macroeconomic variables are on a monthly basis. Therefore, the cubic spline interpolation method is used to convert them into a daily frequency. The initial model that is presented to originate an investor sentiment index is as follows:

$$\text{TRADE\_VOLUME}_t = \theta_0 + \theta_1 \text{CPI}_t + \theta_2 \text{PPI}_t + \theta_3 \text{UNEMP}_t + \theta_4 \text{M2}_t + \theta_5 \text{IND\_PROD}_t + \theta_6 \text{T\_BILL}_t + \theta_7 \text{DUMMY\_CCI}_t \quad \textbf{(4.10)}$$

Table 4.18 : Regression analysis carried out to generate the investor sentiment index for Paris terrorist attacks.

Variable	Coeff.	Std. Error	t-Statistic	Prob.
C	11,050	0,9362	11,803	0,0000
R2_CPI	44,350	23,1820	1,9131	0,0572
IPOLATED_T_BILL	0,3920	0,0990	3,9608	0,0001
DUMMY_CCI	-0,1517	0,0396	-3,8260	0,0002
LOG_IP_TRADE_VOLUME(-1)	0,3917	0,0509	7,6981	0,0000
DUMMY_OUTLIER	-1,7043	0,1632	-10,441	0,0000
R-squared	0,5688	Mean dep. var.		18,587
Adj. R-squared	0,5574	S.D. dep. var.		0,3385
S.E. of regression	0,2252	Akaike info crit.		-0,1135
Sum squared resid	9,5834	Schwarz crit.		-0,0128
Log likelihood	17,071	Hannan-Quinn crit.		-0,0728
F-statistic	49,865	Durbin-Watson stat.		2,2089
Prob(F-statistic)	0,0000			

Since UNEMP, M2, IND_PROD, T_BILL and DUMMY_MCCI data are insignificant, they are removed from the equation. Therefore, the final equation that helps to capture the investor sentiment effect related to 2015, Paris Terrorist Attacks incident is shown in Table 4.18. The DUMMY_OUTLIER variable is composed in order to control the macroeconomic shocks that the outliers generate. The residuals of this regression are assigned as the investor sentiment index in the following analyses, that capture the investor sentiment effects, as $Sent_t$.

To determine the effects of investor sentiment associated with 2015, Paris Terrorist Attacks, daily stock market index returns of France (CAC), Belgium (BEL), Germany (DAX), UK (FTSE), Spain (IBEX), Morocco (MASI) and Portugal (PSI), for the period between September 2015 and June 2016, are appointed as dependent variables in the EGARCH models. The outcomes of the EGARCH models are presented in Table 4.19. In order to achieve convergence, EViews Legacy optimization method is used in the analysis of BEL, CAC, DAX, FTSE and IBEX.

The first numbers which are procured, are the coefficients and the numbers in the brackets indicate the probabilities of the coefficients in the analyses. Coefficient θ_1 is evaluated to see the impacts of investor sentiment on returns. θ_1 is significant only for BEL and DAX, which represents that the returns of these stock market indices are affected by the investor sentiment associated with 2015, Paris Terrorist Attacks.

Coefficient γ_2, which is explored to ascertain the asymmetric volatility in the model, is significant and negative for all the stock market indices, except for MASI. This demonstrates that the negative shocks generate a higher effect through each h_t than the positive shocks do. Coefficient γ_3 is the measure of persistence in conditional volatility. If γ_3 is large, volatility takes a long time to die out following 2015, Paris Terrorist Attacks incident in the market. Since γ_3 is significant, positive and high for all the stock market indices, they exert a high persistence. Likewise, coefficient γ_4 is checked to examine the impacts of investor sentiment on conditional volatility. However, γ_4 is statistically significant for only the stock market indices which are BEL and PSI.

Table 4.19 : EGARCH results associated with Paris terrorist attacks event.

Coefficients	BEL	CAC	DAX	FTSE	IBEX	MASI	PSI
θ_0	-0,0009	-0,0009	-0,0014	-0,0015	-0,0021	0,0003	-0,0015
	(0,2158)	(0,3678)	(0,1702)	(0,0407)	(0,0391)	(0,4109)	(0,0861)
θ_1	-0,0059	-0,0038	-0,0109	-0,0041	-0,0080	0,0008	-0,0043
	(0,0719)	(0,4535)	(0,0239)	(0,2637)	(0,1211)	(0,5221)	(0,3229)
γ_0	-1,1561	-0,6362	-0,4027	-0,2959	-0,1462	-1,9161	-0,8941
	(0,0002)	(0,0242)	(0,2287)	(0,1324)	(0,3490)	(0,0033)	(0,0854)
γ_1	-0,1309	-0,0496	-0,0973	0,0007	-0,0151	0,4638	-0,0226
	(0,0674)	(0,3937)	(0,1620)	(0,9890)	(0,8664)	(0,0000)	(0,7887)
γ_2	-0,3419	-0,2349	-0,1515	-0,2573	-0,1650	0,0285	-0,1889
	(0,0001)	(0,0001)	(0,0018)	(0,0001)	(0,0000)	(0,5906)	(0,0004)
γ_3	0,8603	0,9220	0,9430	0,9655	0,9803	0,8531	0,8939
	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)
γ_4	0,5455	0,2359	0,1761	-0,0396	-0,0607	-0,3113	1,0146
	(0,0462)	(0,3697)	(0,6091)	(0,8579)	(0,6694)	(0,2807)	(0,0072)
R-squared	0,0242	0,0123	0,0295	0,0033	0,0072	-0,0035	-0,0019
Adj. R-squared	0,0191	0,0071	0,0244	-0,0019	0,0021	-0,0087	-0,0071
Akaike info crit.	-6,2354	-5,7751	-5,6942	-6,2620	-5,6065	-7,7122	-5,8160
Schwarz crit.	-6,1175	-5,6572	-5,5763	-6,1441	-5,4886	-7,5943	-5,6981
Hannan-Quinn crit.	-6,1877	-5,7274	-5,6465	-6,2143	-5,5588	-7,6645	-5,7682
Durbin-Watson stat.	1,9625	2,0571	1,9901	2,0301	1,9363	1,5201	1,6722

4.11 Investor Sentiment Effect Related to 2016, Brexit Referendum

For the first step of the analysis, a regression analysis is applied where daily trading volume (TRADE_VOLUME_t) data of FTSE 100, for the period between December 2015 and December 2016, is the dependent variable and a group of macroeconomic variables such as Gross Domestic Product (GDP_t), Consumer Price Index (CPI_t), Producer Price Index (PPI_t), Unemployment Rate (UNEMP_t), Money Supply (M2_t), Industrial Production (IND_PROD_t) and Treasury Bill Yields (T_BILL_t) are the independent variables. Also, the Consumer Confidence Index data of the UK is added

to the regression as a dummy variable and named as $\mathrm{DUMMY\_CCI}_t$ in the analysis. Since GDP is in quarterly frequency and the macroeconomic variables are on a monthly basis, the cubic spline interpolation method is used to convert them into a daily frequency. The initial model that is constructed to generate an investor sentiment index is as follows:

$$\begin{aligned}\mathrm{TRADE\_VOLUME}_t &= \theta_0 + \theta_1 \mathrm{GDP}_t + \theta_2 \mathrm{CPI}_t + \theta_3 \mathrm{PPI}_t + \theta_4 \mathrm{UNEMP}_t \\ &+ \theta_5 \mathrm{M2}_t + \theta_6 \mathrm{IND\_PROD}_t + \theta_7 \mathrm{T\_BILL}_t \\ &+ \theta_8 \mathrm{DUMMY\_CCI}_t\end{aligned} \quad \textbf{(4.11)}$$

Since GDP and M2 data are insignificant, they are removed from the equation. Therefore, the final equation that helps to acquire the impact of investor sentiment on 2016, Brexit Referendum event is demonstrated in Table 4.20. The DUMMY_OUTLIER variable is constituted in order to control the macroeconomic shocks that the outliers originate. The residuals of this regression are appointed as the investor sentiment index in the following analyses, that capture the impacts of investor sentiment, as $Sent_t$.

Table 4.20 : Regression analysis carried out to generate the investor sentiment index for Brexit referendum.

Variable	Coeff.	Std. Error	t-Statistic	Prob.
C	7,1118	1,1605	6,1282	0,0000
R_CPI	2,0562	1,2662	1,6240	0,1056
R_PPI	5,7962	2,2354	2,5930	0,0101
IPOLATED_UNEMP	0,5492	0,1927	2,8498	0,0047
R2_IND_PROD	-6,1067	3,4106	-1,7905	0,0746
R2_T_BILL	-126,10	44,216	-2,8519	0,0047
DUMMY_CCI	0,1730	0,0530	3,2661	0,0012
LOG_IP_TRADE_VOLUME(-1)	0,5152	0,0491	10,488	0,0000
DUMMY_OUTLIER	-1,6938	0,2336	-7,2511	0,0000
R-squared	0,5221	Mean dep. var.		20,522
Adj. R-squared	0,5069	S.D. dep. var.		0,3234
S.E. of regression	0,2271	Akaike info crit.		-0,0929
Sum squared resid	12,997	Schwarz crit.		0,0300
Log likelihood	21,129	Hannan-Quinn crit.		-0,0435
F-statistic	34,416	Durbin-Watson stat.		2,0332
Prob(F-statistic)	0,0000			

To examine the effects of investor sentiment related to 2016, Brexit Referendum, daily stock market index returns of UK (FTSE), Netherlands (AEX), Belgium (BEL), Turkey (BIST), France (CAC), Germany (DAX), US (DJIA), Italy (MIB), Spain (IBEX) and Ireland (ISEQ) for the period between December 2015 and December 2016, are used as dependent variables in the EGARCH models. The outcomes of the

EGARCH models are shown in Table 4.21 and Table 4.22. In order to achieve convergence, EViews Legacy optimization method is applied in the analysis of AEX, CAC, DAX, DJIA, FTSE and MIB. The initial numbers that are presented, are the coefficients and the numbers in the brackets express the probabilities of the coefficients.

Table 4.21 : EGARCH results related to Brexit referendum incident.

Coefficients	AEX	BEL	BIST	CAC	DAX
θ_0	-0,0010	-0,0004	0,0012	-0,0003	-0,0003
	(0,0000)	(0,4874)	(0,1302)	(0,6782)	(0,5198)
θ_1	-0,0057	-0,0077	-0,0058	-0,0059	-0,0060
	(0,0479)	(0,0033)	(0,0175)	(0,0911)	(0,0897)
γ_0	-0,1357	-0,7249	-13,8430	-0,4780	-0,1227
	(0,0000)	(0,0661)	(0,0000)	(0,1425)	(0,0260)
γ_1	-0,0559	0,1729	-0,3138	0,1918	-0,0393
	(0,0128)	(0,0470)	(0,0005)	(0,0101)	(0,1862)
γ_2	-0,2274	-0,1418	-0,3316	-0,1015	-0,1586
	(0,0000)	(0,1690)	(0,0000)	(0,0654)	(0,0002)
γ_3	0,9785	0,9351	-0,5991	0,9623	0,9825
	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0000)
γ_4	-0,2231	0,0640	0,3088	-0,0601	-0,2819
	(0,0842)	(0,7926)	(0,4094)	(0,8019)	(0,0888)
R-squared	0,0148	0,0368	0,0022	0,0270	0,0276
Adj. R-squared	0,0109	0,0331	-0,0016	0,0232	0,0239
Akaike info crit.	-6,2138	-6,2577	-5,8973	-5,9384	-5,9937
Schwarz crit.	-6,1180	-6,1618	-5,8014	-5,8426	-5,8978
Hannan-Quinn crit.	-6,1753	-6,2192	-5,8588	-5,8999	-5,9552
Durbin-Watson stat.	1,7553	1,7797	1,8210	1,8838	1,8545

Table 4.22 : EGARCH results related to Brexit referendum incident (continued).

Coefficients	DJIA	FTSE	MIB	IBEX	ISEQ
θ_0	0,0003	-0,0006	-0,0002	1,72E-06	-8,77E-05
	(0,4102)	(0,0000)	(0,8309)	(0,9986)	(0,8895)
θ_1	-0,0033	-0,0042	-0,0079	-0,0074	-0,0025
	(0,0284)	(0,0246)	(0,0711)	(0,0309)	(0,1971)
γ_0	-0,1728	-0,1884	-0,8559	-5,5811	-1,0666
	(0,0007)	(0,0000)	(0,0196)	(0,0000)	(0,0019)
γ_1	-0,0531	-0,0648	0,3922	0,8235	0,3423
	(0,0013)	(0,0379)	(0,0000)	(0,0000)	(0,0035)
γ_2	-0,1490	-0,2329	-0,0512	0,3039	-0,0694
	(0,0000)	(0,0000)	(0,3453)	(0,0019)	(0,1338)
γ_3	0,9790	0,9729	0,9315	0,4110	0,9100
	(0,0000)	(0,0000)	(0,0000)	(0,0015)	(0,0000)
γ_4	-0,1835	0,3444	-0,3759	0,4686	0,5238
	(0,0868)	(0,0018)	(0,2401)	(0,1937)	(0,1030)
R-squared	0,0168	0,0003	0,0280	0,0378	0,0150
Adj. R-squared	0,0130	-0,0036	0,0242	0,0340	0,0112
Akaike info crit.	-7,0717	-6,5090	-5,2720	-5,5358	-6,1221
Schwarz crit.	-6,9758	-6,4131	-5,1761	-5,4400	-6,0262
Hannan-Quinn crit.	-7,0332	-6,4704	-5,2334	-5,4973	-6,0835
Durbin-Watson stat.	2,1483	1,8474	2,0662	1,8874	1,6475

Coefficient θ_1 is monitored to see the effects of investor sentiment on returns. θ_1 is significant for all the stock market indices at 10% level, except for ISEQ, which implies that the market returns are influenced by the investor sentiment related to 2016, Brexit Referendum event.

Coefficient γ_2 is controlled to determine the asymmetric volatility in the model. Therewith, γ_2 is significant and negative for all stock market indices, except for BEL, MIB, IBEX and ISEQ, which states that the negative shocks exert a higher impact on h_t than the positive shocks do. Coefficient γ_3 measures the persistence in conditional volatility. If γ_3 is large, volatility is said to take a long time to vanish following 2016, Brexit Referendum event in the market. Since γ_3 is significant, positive and high for all the stock market indices, except for BIST and IBEX, they seem to show high persistence.

Besides, coefficient γ_4 is evaluated to comprehend the investor sentiment effects on the conditional volatility. Thereby, γ_4 is statistically significant and positive for only FTSE. Also, the coefficients for AEX, DAX and DJIA are statistically significant. However, the coefficients are also negative for the conditional volatility of these stock returns. Therefore, it is concluded that conditional volatility of stock returns for FTSE is positively affected whereas conditional volatility of stock returns for AEX, DAX and DJIA are negatively influenced by the investor sentiment related to the Brexit referendum.

4.12 Investor Sentiment Effect Related to 2016, US Presidential Election

In the initial part of the analysis, a regression analysis is carried out where daily trading volume ($\mathrm{TRADE\_VOLUME}_t$) data of DJIA, for the period between June 2016 and June 2017, is the dependent variable and several macroeconomic variables which are Gross Domestic Product (GDP_t), Consumer Price Index (CPI_t), Producer Price Index (PPI_t), Unemployment Rate (UNEMP_t), Money Supply ($\mathrm{M2}_t$), Industrial Production ($\mathrm{IND\_PROD}_t$) and Treasury Bill Yields ($\mathrm{T\_BILL}_t$) are the independent variables. Also, the Michigan Consumer Confidence Index data is added to the regression as a dummy variable and indicated as $\mathrm{DUMMY\_MCCI}_t$ in the analysis. Since GDP is in quarterly frequency and the macroeconomic variables are on a monthly basis, the cubic spline

interpolation method is used to convert them into a daily frequency. The initial model that is presented to originate an investor sentiment index is as follows:

$$\begin{aligned}\text{TRADE\_VOLUME}_t &= \theta_0 + \theta_1 \text{GDP}_t + \theta_2 \text{CPI}_t + \theta_3 \text{PPI}_t + \theta_4 \text{UNEMP}_t \\ &+ \theta_5 \text{M2}_t + \theta_6 \text{IND\_PROD}_t + \theta_7 \text{T\_BILL}_t \\ &+ \theta_8 \text{DUMMY\_MCCI}_t\end{aligned} \quad \textbf{(4.12)}$$

Since CPI and M2 data are insignificant, they are removed from the equation. Therefore, the final equation that helps to capture the influence of investor sentiment in 2016, US Presidential Election incident is shown in Table 4.23. The DUMMY_OUTLIER variable is created in order to control the macroeconomic shocks that the outliers generate. The residuals of this regression are assigned as the investor sentiment index in the following analyses that capture the influences of investor sentiment, as $Sent_t$.

Table 4.23 : Regression analysis carried out to generate the investor sentiment index for the US presidential election.

Variable	Coeff.	Std. Error	t-Statistic	Prob.
C	7,5442	1,3579	5,5558	0,0000
R2L_GDP	132505	58093	2,2809	0,0234
R2_PPI	-17,240	6,8824	-2,5049	0,0129
IPOLATED_UNEMP	-0,2827	0,1255	-2,2527	0,0251
R_IND_PROD	-2,6309	0,8244	-3,1912	0,0016
R2_T_BILL	-131,67	56,090	-2,3474	0,0197
DUMMY_MCCI	0,2093	0,0593	3,5298	0,0005
LOG_IP_TRADE_VOLUME(-1)	0,4655	0,0548	8,5006	0,0000
LOG_IP_TRADE_VOLUME(-2)	0,1993	0,0547	3,6427	0,0003
DUMMY_OUTLIER	1,0371	0,1206	8,6018	0,0000
R-squared	0,9056	Mean dep. var.		18,956
Adj. R-squared	0,9022	S.D. dep. var.		0,6488
S.E. of regression	0,2029	Akaike info crit.		-0,3142
Sum squared resid	10,296	Schwarz crit.		-0,1772
Log likelihood	50,843	Hannan-Quinn crit.		-0,2591
F-statistic	266,33	Durbin-Watson stat.		1,8891
Prob(F-statistic)	0,0000			

To determine the effects of investor sentiment associated with 2016, US Presidential Election, daily stock market index returns of US (DJIA), Turkey (BIST), France (CAC), Germany (DAX), UK (FTSE), South Korea (KOSPI), Mexico (MXSE), Japan (NIK) and China (SSEC), for the period between June 2016 and June 2017, are appointed as dependent variables in the EGARCH models. The outcomes of the EGARCH models are presented in Table 4.24 and Table 4.25. In order to achieve convergence, EViews Legacy optimization method is used in the analysis of FTSE.

The first numbers that are presented, are the coefficients and the numbers in the brackets indicate the probabilities of the coefficients in the analyses.

Table 4.24 : EGARCH results associated with US presidential election event.

Coefficients	BIST	CAC	DAX	DJIA	FTSE
θ_0	0,0012	0,0010	0,0005	0,0009	0,0003
	(0,0599)	(0,0490)	(0,4125)	(0,0151)	(0,4866)
θ_1	-0,0016	-0,0028	-0,0046	-0,0017	-0,0031
	(0,4803)	(0,2249)	(0,0800)	(0,3267)	(0,1294)
γ_0	-10,2550	-4,9211	-4,9592	-7,2367	-0,3398
	(0,0000)	(0,0000)	(0,0000)	(0,0000)	(0,0420)
γ_1	-0,3272	0,7015	0,5335	0,5642	-0,0009
	(0,0110)	(0,0000)	(0,0000)	(0,0000)	(0,9855)
γ_2	-0,2656	0,1813	0,1216	0,0734	-0,1344
	(0,0010)	(0,0647)	(0,2116)	(0,3267)	(0,0000)
γ_3	-0,1574	0,5401	0,5219	0,3507	0,9671
	(0,2440)	(0,0000)	(0,0000)	(0,0111)	(0,0000)
γ_4	2,1424	0,8184	0,9752	0,4779	-0,1270
	(0,0000)	(0,0552)	(0,0045)	(0,2012)	(0,5460)
R-squared	0,0017	0,0158	0,0138	0,0044	0,0149
Adj. R-squared	-0,0022	0,0120	0,0100	0,0005	0,0110
Akaike info crit.	-6,1752	-6,6560	-6,6499	-7,6364	-7,3040
Schwarz crit.	-6,0791	-6,5598	-6,5538	-7,5403	-7,2079
Hannan-Quinn crit.	-6,1366	-6,6173	-6,6112	-7,5977	-7,2654
Durbin-Watson stat.	1,9715	1,7714	1,7368	2,0042	1,6156

Table 4.25 : EGARCH results associated with US presidential election event (continued).

Coefficients	KOSPI	MXSE	NIK	SSEC
θ_0	0,0007	0,0003	0,0003	0,0002
	(0,0648)	(0,5265)	(0,6388)	(0,5449)
θ_1	-0,0051	-0,0090	-0,0105	-0,0034
	(0,0000)	(0,0000)	(0,0014)	(0,0399)
γ_0	-9,9416	-8,9452	-5,8956	-15,4290
	(0,0001)	(0,0000)	(0,0000)	(0,0000)
γ_1	-0,0384	0,2387	0,4772	0,1657
	(0,7779)	(0,0735)	(0,0002)	(0,0800)
γ_2	-0,1914	0,1304	0,0344	0,1467
	(0,0356)	(0,1766)	(0,6842)	(0,0092)
γ_3	0,0268	0,1088	0,3938	-0,4993
	(0,9147)	(0,5492)	(0,0008)	(0,0300)
γ_4	1,4352	1,6772	1,4096	0,5405
	(0,0006)	(0,0000)	(0,0009)	(0,0409)
R-squared	0,0216	0,0636	0,0274	0,0145
Adj. R-squared	0,0178	0,0600	0,0236	0,0107
Akaike info crit.	-7,3529	-6,9319	-6,2623	-7,3166
Schwarz crit.	-7,2568	-6,8358	-6,1662	-7,2204
Hannan-Quinn crit.	-7,3143	-6,8933	-6,2236	-7,2779
Durbin-Watson stat.	2,1219	1,5930	2,2869	1,9930

Coefficient θ_1 is evaluated to see the effects of investor sentiment on returns. θ_1 is significant for DAX, KOSPI, MXSE, NIK and SSEC, at 10% level, which represents

that the returns of the stock market indices are affected by the investor sentiment associated with 2016, US Presidential Election incident.

Coefficient γ_2, which is explored to ascertain the asymmetric volatility in the model, is significant and negative for BIST, FTSE and KOSPI. This demonstrates that the negative shocks generate a higher impact on each h_t than the positive shocks do. Coefficient γ_3 is the measure of persistence in conditional volatility. If γ_3 is large, volatility takes a long time to fade away following 2016, US Presidential Election incident in the market. Since γ_3 is high, positive and significant for FTSE stock market index, it exerts a high persistence. Likewise, coefficient γ_4 is checked to examine the impacts of investor sentiment on conditional volatility. Herewith, γ_4 is statistically significant and positive for all the stock market indices, except DJIA and FTSE.

5. CONCLUSION

Through the analyses in this study, it is concluded that there exist an investor sentiment effect on a significant number of the selected stock markets associated with the incidents which are 2001, September 11 Terrorist Attacks, 2001, Turkish Economic Crisis, 2005, London Train Bombings, 2008, Global Financial Crisis, 2008, Wenchuan Earthquake, 2010, Greek Sovereign Debt Crisis, 2011, Japan Earthquake and Tsunami, 2015, Paris Terrorist Attacks, 2016, Brexit Referendum and 2016, US Presidential Election. Although the hypotheses also indicate that investor sentiment exerts impacts on the selected stock markets regarding 2005, Hurricane Katrina, however, there is no sign of investor sentiment effect associated with this incident.

The crises that are analyzed through the thesis are the Turkish Economic Crisis that occurred in the period between 2001 and 2003, the Global Financial Crisis that happened in the period between 2007 and 2009, and the Greek Sovereign Debt Crisis which took place in the period between 2010 and 2012. The results exert significant evidence that the investor sentiment associated with 2001, Turkish Economic Crisis constitutes substantial impacts in Turkey, Brazil, Germany, Japan, the UK and the US. Also, the shocks that occurred by the incident take a long time to disappear in Turkey, Brazil, Germany, the UK, the US and mostly in Argentina.

As the literature suggests, the investor sentiment related to 2008, Global Financial Crisis generates intense effects in the US, China, Germany, Japan, Russia, Turkey and the UK. Also, the shocks that occurred by the incident take a long time to disappear in the US, China, Germany, Japan, Turkey, the UK and mostly in Russia. Also, associated with the analysis conducted on the Greek Sovereign Debt Crisis, there exists a positive effect of investor sentiment through the stock market returns of Greece, Belgium, Italy, Spain and Poland. Besides, this study shows that the shocks that are constituted by the crisis are long-lived for Greece, Belgium, Germany, Italy, Spain, Poland and Turkey.

The natural disasters that are evaluated through the thesis are 2005, Hurricane Katrina, 2008, Wenchuan Earthquake and 2011, Japan Earthquake and Tsunami incidents. The results indicate that the investor sentiment associated with 2005, Hurricane Katrina

event does not generate any impact since neither the selected stock market returns nor the conditional volatility of the returns responds to investor sentiment. Thus, the shocks that are constituted by the disaster are long-lived for the S&P 500 stock market. Besides, through the analysis conducted on the Wenchuan Earthquake, it is observed that there exist positive impacts of investor sentiment on the stock returns of SSEC, which is the stock market index of China. Moreover, the shocks generated by the incident remain high during the period of the disaster for the stock market indices of South Korea and Japan.

In contrast to the previous studies conducted by Ferreira and Karali (2015) and Fakhry et al. (2018), which suggest that "financial markets are resilient to earthquake shocks", the shocks that are constituted by 2011, Japan Earthquake are long-lived for the considered stock market indices. However, the outcomes present that the investor sentiment associated with the event does not generate greater impacts, since only the stock market returns of KOSPI, which is the stock market index of South Korea, is influenced by investor sentiment.

The political events that are determined through the thesis are the Arab Spring incident that occurred in the period between 2010 and 2013, the Brexit Referendum and the US Presidential election events that both happened in 2016. However, the results of the analysis are found inadequate in modelling the influence of investor sentiment through the stock markets, associated with the Arab Spring incident. On the other hand, the investor sentiment related to 2016, Brexit Referendum generates intense effects in the UK, Belgium, France, Germany, Italy, Netherlands, Spain, Turkey and the US. Also, the shocks that occurred by the incident take a long time to disappear in the UK, Belgium, France, Ireland, Italy, Netherlands, the US and mostly in Germany while the impact of the referendum event is short-lived in Spain.

As the results of the analysis suggest, the investor sentiment associated with 2016, US Presidential Election constitutes considerable impacts in China, France, Germany, Japan, Mexico, South Korea and Turkey since the conditional volatility of these stock market returns is influenced by investor sentiment. Meanwhile, the shocks that occurred by the incident take a long time to disappear in the UK. Besides, the effect of election event is short-lived in France, Germany, Japan and the US.

The terrorist events that are examined through the thesis are 2001, September 11 Terrorist Attacks, 2005, London Train Bombings and 2015, Paris Terrorist Attacks incidents. As the results suggest, investor sentiment related to 2001, September 11 Terrorist Attacks generate significant effects in Turkey and Pakistan. Also, the shocks that occurred by the incident take a long time to vanish in the US, China, Saudi Arabia and mostly in the UK. In consistence, the investor sentiment associated with 2005, London Train Bombings constitutes considerable impacts in the UK, France, Netherlands and Spain. Moreover, the shocks that occurred by the incident take a long time to die out in Belgium, Ireland, Spain and mostly in France, while the impact of the train bombings event is short-lived in the UK. As the results indicate, the investor sentiment associated with 2015, Paris Terrorist Attacks constitutes considerable impacts in Belgium, Germany and Portugal. Meanwhile, the shocks that occurred by the incident take a long time to fade away in Belgium, France, Germany, Morocco, Portugal, the UK and mostly in Spain.

Through all types of event groups, which are crises, natural disasters, political events and terrorist activities, the most influence of investor sentiment is observed through political events, excluding the Arab Spring event. There exists an impact of investor sentiment also through all crises and terrorist activities considered in the study. However, there is no greater influence of investor sentiment on natural disasters. The outcomes of the analyses also present significant evidence that the impacts of investor sentiment with regards to the crises, political events and terror activities exert greater influences through the international stock markets as well as the local markets. However, in contrast, the effects of investor sentiment associated with the Wenchuan Earthquake happen to be local.

Most of the selected incidents such as September 11 Terrorist Attacks, Hurricane Katrina, Global Financial Crisis and the 2016 US Presidential Election took place in the US. The UK follows with two incidents which are London Train Bombings and the Brexit Referendum. Excluding the Hurricane Katrina incident, all of these events gerenate a substantial investor sentiment impact among the stock market indices. Therefore, it can be concluded that the US and the UK events exert signficant impacts through various countries among the world. Moreover, regardless of the geographical location, the political structure or the economic power of the countries, considerable influences of investor sentiment are determined through the global events. Also, the

stock market indices of several developed countries such as France (CAC 40), Germany (DAX), the US (DJIA), the UK (FTSE 100) and Japan (Nikkei 225), and the stock market indices of various developing countries which are Turkey (BIST 100) and China (SSEC) happen to have significant investor sentiment effects associated with the selected incidents.

For further study, the contagion among the selected stock markets, considering the selected events, might be studied to model the long-term impacts of investor sentiment. Hence, the multi GARCH models might be presented to constitute a compound model to investigate the investor sentiment effects through the stock markets. For investor sentiment, panel data might be applied and other types of investor sentiment proxies might be added to the analysis to comprehend the impacts of investor sentiment significantly. Also, in the stock market indices that have long-lived effects through the global events, high persistence may lead to a problem. Thus, to model the long-term variance of these stock market indices, an alternative method such as component GARCH might be developed.

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APPENDICES

APPENDIX A: Descriptive statistics of the selected stock market indices regarding the global events

APPENDIX A

Table A.1 : Descriptive statistics of selected stock market indices associated with September 11 terrorist attacks.

	BIST	DJIA	FTSE	KSE	NIK	SSEC	TASI
Mean	0,0017	-0,0002	-0,0003	0,0018	-0,0005	-0,0014	0,0005
Median	0,0007	-3,5E-05	0,0002	0,0013	3,8E-05	-0,0016	0,0006
Maximum	0,0755	0,0437	0,0398	0,0645	0,0574	0,0940	0,0218
Minimum	-0,0644	-0,0447	-0,0589	-0,0594	-0,0686	-0,0654	-0,0361
Std. Dev.	0,0274	0,0116	0,0129	0,0167	0,0179	0,0180	0,0071
Skewness	0,1988	-0,0353	-0,3696	0,0868	0,0346	0,6755	-0,5684
Kurtosis	2,8977	4,1267	5,2375	5,4606	3,9823	8,4317	7,6145
Jarque-Bera	1,3700	10,355	45,115	49,438	7,8788	254,55	183,51
Probability	0,5041	0,0056	0,0000	0,0000	0,0195	0,0000	0,0000
Sum	0,3281	-0,0368	-0,0589	0,3596	-0,1028	-0,2632	0,0963
Sum Sq. Dev.	0,1454	0,0261	0,0322	0,0541	0,0625	0,0631	0,0097

Table A.2 : Descriptive statistics of selected stock market indices related to Turkish economic crisis.

	BIST	DAX	DJIA	FTSE	IBOV	MERV	NIK
Mean	-0,0002	-0,0012	-0,0003	-0,0005	-0,0008	-0,0005	-0,0011
Median	-0,0019	-0,0013	-0,0003	-0,0003	-0,0010	-0,0017	-0,0018
Maximum	0,1777	0,0755	0,0615	0,0493	0,0734	0,1612	0,0574
Minimum	-0,1998	-0,0887	-0,0582	-0,0589	-0,0963	-0,1129	-0,0723
Std. Dev.	0,0337	0,0194	0,0137	0,0142	0,0203	0,0263	0,0158
Skewness	0,2269	0,0025	0,1881	-0,2013	-0,1488	0,5279	-0,0846
Kurtosis	7,4344	4,7819	4,7544	4,8091	3,9239	7,3929	4,2461
Jarque-Bera	594,43	94,994	96,311	102,759	28,148	610,66	47,314
Probability	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
Sum	-0,1539	-0,8404	-0,2226	-0,3837	-0,5950	-0,3330	-0,8231
Sum Sq. Dev.	0,8161	0,2696	0,1352	0,1455	0,2937	0,4945	0,1797

Table A.3 : Descriptive statistics of selected stock market indices associated with Hurricane Katrina.

	DJIA	MXSE	NASDAQ	S&P
Mean	0,0003	0,0018	0,0005	0,0004
Median	0,0004	0,0023	0,0007	0,0008
Maximum	0,0168	0,0316	0,0201	0,0166
Minimum	-0,0198	-0,0305	-0,0314	-0,0185
Std. Dev.	0,0059	0,0104	0,0081	0,0059
Skewness	-0,1709	-0,1921	-0,2181	-0,1261
Kurtosis	3,4287	3,2951	3,5987	3,2601
Jarque-Bera	2,4418	1,9071	4,4583	1,0666
Probability	0,2950	0,3854	0,1076	0,5867
Sum	0,0591	0,3416	0,1024	0,0769
Sum Sq. Dev.	0,0067	0,0211	0,0127	0,0068

Table A.4 : Descriptive statistics of selected stock market indices related to London train bombings.

	AEX	BEL	CAC	FTSE	IBEX	ISEQ
Mean	0,0013	0,0011	0,0011	0,0009	0,0011	0,0012
Median	0,0014	0,0009	0,0007	0,0013	0,0010	0,0015
Maximum	0,0210	0,0148	0,0250	0,0197	0,0162	0,0171
Minimum	-0,0176	-0,0155	-0,0195	-0,0184	-0,0193	-0,0202
Std. Dev.	0,0066	0,0052	0,0073	0,0057	0,0062	0,0059
Skewness	-0,0176	-0,0383	0,1930	-0,0859	-0,0521	-0,2886
Kurtosis	3,3527	3,0966	3,4138	3,7527	3,1239	3,8056
Jarque-Bera	1,0311	0,1247	2,6280	4,8924	0,2152	8,0614
Probability	0,5972	0,9396	0,2687	0,0866	0,8980	0,0178
Sum	0,2608	0,2189	0,2071	0,1704	0,2105	0,2395
Sum Sq. Dev.	0,0086	0,0053	0,0104	0,0063	0,0076	0,0068

Table A.5 : Descriptive statistics of selected stock market indices associated with global financial crisis.

	BIST	DAX	DJIA	FTSE	MOEX	NIK	SSEC
Mean	0,0003	-0,0002	-0,0002	-0,0002	-0,0003	-0,0007	0,0001
Median	0,0005	0,0010	0,0005	0,0001	0,0010	0,0005	0,0031
Maximum	0,1213	0,1080	0,1051	0,0938	0,2523	0,0949	0,0903
Minimum	-0,0901	-0,0743	-0,0820	-0,0927	-0,2066	-0,1211	-0,0862
Std. Dev.	0,0213	0,0183	0,0174	0,0175	0,0324	0,0201	0,0226
Skewness	-0,0263	0,2544	0,1045	-0,0682	0,0406	-0,7267	-0,2645
Kurtosis	5,9430	9,2113	9,2954	8,3797	15,6289	8,5435	4,5966
Jarque-Bera	259,20	1161,9	1187,0	866,38	4771,56	982,54	84,637
Probability	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
Sum	0,2027	-0,1251	-0,1513	-0,1487	-0,1851	-0,5141	0,1038
Sum Sq. Dev.	0,3242	0,2411	0,2171	0,2193	0,7539	0,2897	0,3672

Table A.6 : Descriptive statistics of selected stock market indices related to Wenchuan earthquake.

	KOSPI	NIK	SSEC	TWSE
Mean	-0,0016	-0,0016	-0,0034	-0,0028
Median	-0,0005	-0,0006	-0,0052	-0,0020
Maximum	0,1128	0,0949	0,0903	0,0610
Minimum	-0,1117	-0,1211	-0,0676	-0,0593
Std. Dev.	0,0258	0,0291	0,0283	0,0212
Skewness	-0,2920	-0,7165	0,4646	0,1535
Kurtosis	7,5695	6,2231	3,7471	3,6766
Jarque-Bera	172,42	101,09	11,550	4,4855
Probability	0,0000	0,0000	0,0031	0,1062
Sum	-0,3070	-0,3078	-0,6651	-0,5511
Sum Sq. Dev.	0,1286	0,1640	0,1557	0,0871

Table A.7 : Descriptive statistics of selected stock market indices associated with Greek sovereign debt crisis.

	ATG	BEL	BIST	DAX	MIB	IBEX	WIG
Mean	-0,0012	0,0000	0,0005	0,0003	-0,0004	-0,0005	0,0002
Median	-0,0016	0,0001	0,0014	0,0009	0,0004	-0,0002	0,0006
Maximum	0,1343	0,0896	0,0690	0,0521	0,1068	0,1348	0,0458
Minimum	-0,0737	-0,0549	-0,0734	-0,0599	-0,0704	-0,0687	-0,0624
Std. Dev.	0,0228	0,0130	0,0139	0,0140	0,0181	0,0177	0,0111
Skewness	0,3872	0,2424	-0,4392	-0,1898	0,0151	0,4454	-0,6775
Kurtosis	5,5431	7,1636	5,7244	5,3377	5,5383	8,1072	7,2749
Jarque-Bera	230,85	573,98	267,66	183,23	210,50	877,98	656,94
Probability	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
Sum	-0,9438	-0,0181	0,4289	0,2690	-0,3458	-0,3782	0,1680
Sum Sq. Dev.	0,4080	0,1321	0,1516	0,1529	0,2556	0,2466	0,0961

Table A.8 : Descriptive statistics of selected stock market indices related to Arab spring.

	ADX	ASE	BIST	BLOM	CAC
Mean	0,0005	-0,0002	0,0004	-0,0004	0,0000
Median	0,0003	0,0001	0,0015	-0,0003	0,0004
Maximum	0,0261	0,0176	0,0498	0,0224	0,0609
Minimum	-0,0375	-0,0230	-0,0652	-0,0327	-0,0563
Std. Dev.	0,0057	0,0047	0,0126	0,0042	0,0132
Skewness	-0,3798	-0,2858	-0,8974	-0,2439	-0,1723
Kurtosis	7,3580	5,0303	7,4475	10,881	5,6885
Jarque-Bera	638,46	145,14	749,46	2031,68	239,39
Probability	0,0000	0,0000	0,0000	0,0000	0,0000
Sum	0,3688	-0,1483	0,3043	-0,2861	0,0366
Sum Sq. Dev.	0,0256	0,0175	0,1244	0,0136	0,1366

Table A.9 : Descriptive statistics of selected stock market indices related to Arab spring (continued).

	DJIA	EGX	QE	TA	TASI
Mean	0,0005	-0,0004	0,0004	0,0001	0,0002
Median	0,0006	-0,0001	0,0004	0,0006	0,0009
Maximum	0,0415	0,0731	0,0421	0,0404	0,0404
Minimum	-0,0474	-0,1112	-0,0363	-0,0724	-0,0702
Std. Dev.	0,0086	0,0149	0,0066	0,0107	0,0076
Skewness	-0,3645	-0,9943	-0,2655	-0,6398	-1,1871
Kurtosis	7,9740	10,380	10,132	7,2635	16,161
Jarque-Bera	823,45	1906,1	1668,9	646,46	5835,1
Probability	0,0000	0,0000	0,0000	0,0000	0,0000
Sum	0,3775	-0,3112	0,3000	0,0990	0,1477
Sum Sq. Dev.	0,0583	0,1741	0,0342	0,0898	0,0457

Table A.10 : Descriptive statistics of selected stock market indices associated with Japan earthquake and tsunami.

	DJIA	HSI	KOSPI	NIK	SSEC
Mean	-0,0002	-0,0013	-0,0006	-0,0009	-0,0005
Median	0,0006	-0,0009	0,0002	0,0006	-0,0003
Maximum	0,0390	0,0407	0,0490	0,0552	0,0300
Minimum	-0,0571	-0,0583	-0,0642	-0,1115	-0,0387
Std. Dev.	0,0129	0,0146	0,0158	0,0152	0,0108
Skewness	-0,8143	-0,6446	-0,4847	-2,1027	-0,3128
Kurtosis	6,3556	4,8731	5,0433	18,1525	4,2414
Jarque-Bera	112,46	42,012	41,557	2009,2	15,700
Probability	0,0000	0,0000	0,0000	0,0000	0,0004
Sum	-0,0380	-0,2468	-0,1185	-0,1679	-0,1036
Sum Sq. Dev.	0,0323	0,0415	0,0487	0,0446	0,0225

Table A.11 : Descriptive statistics of selected stock market indices related to Paris terrorist attacks.

	BEL	CAC	DAX	FTSE	IBEX	MASI	PSI
Mean	-0,0002	-0,0005	-0,0003	-0,0001	-0,0009	0,0002	-0,0006
Median	-1,8E-06	-0,0008	0,0005	4,E-05	0,0001	0,0002	-0,0001
Maximum	0,0292	0,0348	0,0345	0,0304	0,0376	0,0242	0,0341
Minimum	-0,0351	-0,0413	-0,0387	-0,0352	-0,0500	-0,0159	-0,0457
Std. Dev.	0,0117	0,0142	0,0144	0,0116	0,0154	0,0054	0,0140
Skewness	-0,0050	0,0330	-0,0962	0,0549	-0,1540	0,3704	-0,3330
Kurtosis	3,2509	3,3086	2,7990	3,3824	3,3048	5,6243	3,4870
Jarque-Bera	0,5151	0,8132	0,6324	1,2931	1,5334	60,7239	5,5596
Probability	0,7729	0,6659	0,7289	0,5239	0,4645	0,0000	0,0621
Sum	-0,0301	-0,0911	-0,0588	-0,0282	-0,1703	0,0437	-0,1159
Sum Sq. Dev.	0,0267	0,0395	0,0405	0,0261	0,0465	0,0057	0,0383

Table A.12 : Descriptive statistics of selected stock market indices associated with Brexit referendum.

	AEX	BEL	BIST	CAC	DAX
Mean	0,0004	0,0000	0,0003	0,0002	0,0003
Median	0,0005	0,0003	0,0000	-0,0002	0,0012
Maximum	0,0343	0,0292	0,0342	0,0344	0,0345
Minimum	-0,0587	-0,0661	-0,0735	-0,0838	-0,0707
Std. Dev.	0,0121	0,0116	0,0129	0,0133	0,0131
Skewness	-0,3309	-0,8001	-0,8549	-0,9219	-0,6114
Kurtosis	5,1874	7,0918	7,2654	8,8674	5,7953
Jarque-Bera	57,013	210,73	230,52	412,93	101,62
Probability	0,0000	0,0000	0,0000	0,0000	0,0000
Sum	0,0943	-0,0035	0,0737	0,0434	0,0840
Sum Sq. Dev.	0,0381	0,0351	0,0434	0,0459	0,0447

Table A.13 : Descriptive statistics of selected stock market indices associated with Brexit referendum (continued).

	DJIA	FTSE	MIB	IBEX	ISEQ
Mean	0,0005	0,0006	-0,0004	-0,0001	-0,0001
Median	0,0007	0,0005	-0,0002	0,0010	-0,0004
Maximum	0,0244	0,0352	0,0491	0,0363	0,0445
Minimum	-0,0345	-0,0352	-0,1333	-0,1319	-0,1042
Std. Dev.	0,0080	0,0105	0,0191	0,0164	0,0140
Skewness	-0,4720	0,0986	-1,1814	-2,0845	-2,2824
Kurtosis	4,9202	4,1950	11,392	18,046	18,125
Jarque-Bera	49,980	16,013	829,72	2660,9	2724,8
Probability	0,0000	0,0003	0,0000	0,0000	0,0000
Sum	0,1247	0,1510	-0,1133	-0,0389	-0,0282
Sum Sq. Dev.	0,0169	0,0288	0,0956	0,0701	0,0515

Table A.14 : Descriptive statistics of selected stock market indices related to US presidential election.

	BIST	CAC	DAX	DJIA	FTSE
Mean	0,0010	0,0009	0,0011	0,0007	0,0008
Median	0,0001	0,0003	0,0010	0,0002	0,0007
Maximum	0,0407	0,0406	0,0338	0,0205	0,0352
Minimum	-0,0735	-0,0838	-0,0707	-0,0345	-0,0320
Std. Dev.	0,0116	0,0100	0,0095	0,0056	0,0074
Skewness	-1,0828	-1,8563	-1,3194	-0,7957	0,4741
Kurtosis	10,7217	23,1423	15,7026	10,2069	7,2327
Jarque-Bera	699,42	4562,0	1830,5	592,38	204,61
Probability	0,0000	0,0000	0,0000	0,0000	0,0000
Sum	0,2586	0,2236	0,2785	0,1913	0,2179
Sum Sq. Dev.	0,0349	0,0259	0,0235	0,0083	0,0144

Table A.15 : Descriptive statistics of selected stock market indices related to US presidential election (continued).

	KOSPI	MXSE	NIK	SSEC
Mean	0,0007	0,0003	0,0008	0,0003
Median	0,0008	0,0004	0,0007	0,0007
Maximum	0,0223	0,0286	0,0651	0,0241
Minimum	-0,0314	-0,0468	-0,0825	-0,0250
Std. Dev.	0,0063	0,0081	0,0117	0,0062
Skewness	-0,7366	-0,7654	-1,0753	-0,1014
Kurtosis	6,8957	7,5403	17,282	5,0818
Jarque-Bera	188,64	249,66	2268,5	47,581
Probability	0,0000	0,0000	0,0000	0,0000
Sum	0,1819	0,0878	0,2197	0,0815
Sum Sq. Dev.	0,0103	0,0171	0,0354	0,0101

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