EXCHANGE RATE DETERMINATION:
EFFECT OF TURKISH AND GLOBAL MACROECONOMIC NEWS

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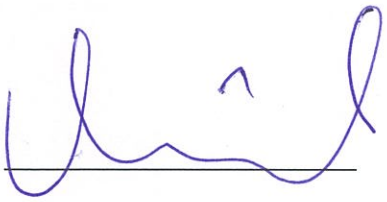

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ABSTRACT

EXCHANGE RATE DETERMINATION: EFFECT OF TURKISH AND GLOBAL MACROECONOMIC NEWS

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This study investigates the effect of the domestic and foreign sourced macro-economic news on the increase of the TL - Dolar exchange rate observed after 2013. The study was carried out, using OLS and GARCH methods for the period between January 1, 2013 and December 31, 2016. The results reveal that surprises related to domestic macro-economic data is more effective than foreign macro-economic surprises and the most important variables that explain the movements in the exchange rate are domestic inflation and monetary policy surprises as well as foreign employment surprises.

Keywords: Exchange rate, GARCH, macroeconomic news

ÖZ

DÖVİZ KURU BELİRLENMESİ: TÜRKİYE VE KÜRESEL MAKROEKONOMİK HABERLERİN ETKİSİ

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Tez Danışmanı: Yrd. Doç. Ünay TAMGAÇ TEZCAN

Bu çalışma 2013 yılından sonra görülen TL- dolar döviz kurundaki yükselişin sebebini yerli ve yabancı kaynaklı makroekonomik duyuruların etkilerini ele alarak araştırmaktadır. Çalışma 01 Ocak 2013 ile 31 Aralık 2016 tarihleri için OLS ve GARCH yöntemi kullanılarak incelenmiştir. Sonuçlar, yerel makroekonomik verilere ilişkin sürprizlerin yabancı makroekonomik sürprizlerden daha etkili olduğunu ve döviz kurunun hareketlerini açıklayan en önemli değişkenlerin yerel enflasyon ve merkez bankası politikası sürprizleriyle yabancı istihdam sürprizleri olduğunu göstermektedir.

Anahtar Kelimeler: Döviz kuru, GARCH, makroekonomik haberler,

To My Family

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ABBREVIATION LIST

API	: American Petroleum Institute
AR	: Autoregressive
ARCH	: Autoregressive Conditional Heteroskedasticity
ARCH-LM	: ARCH- Lagrange multiplier
ARIMA	: Autoregressive Integrated Moving Average
ARMA	: Autoregressive Moving Average
CB	: Conference Board
CBRT	: Central Bank of the Republic of Turkey
CPI	: Consumer Price Index
DEM	: Germany Deutsche Mark
DF-GLS	: Dickey-Fuller Generalized Least Squares
EGARCH	: Exponential Generalized Autoregressive Conditional Heteroscedastic
EIA	: Energy Information Administration
EMH	: Efficient Market Hypothesis
EMU	: Economic and Monetary Union of the European Union
FED	: Board of Governors of the Federal Reserve System
FX	: Foreign exchange
GARCH	: Generalized Autoregressive Conditional Heteroskedasticity
GDP	: Gross Domestic Product
GFC	: Global Financial Crisis
IBD/TIPP	: The Investor's Business Daily/ Technometrica Institute of Policy and Politics
ISM	: The Institute of Supply Management
JPY	: Japanese Yen
KC FED	: Federal Reserve Bank of Kansas City
KPSS test	: Kwiatkowski–Phillips–Schmidt–Shin test
MA	: Moving Average
MoM	: Month-over-Month
N.S.A.	: Non-Seasonal Adjust
NAPM	: The National Association of Purchasing Managers
NFIB	: National Federation of Independent Business'

NY : New York

OLS : Ordinary Least Squares

PCE : Personal Consumption Expenditure

PMI : Purchasing Managers Index

PPI : Producer Price Index

QoQ : Quarter-over-Quarter

ROM : Reserve Option Mechanism

S&P : Standard & Poor's

S&P/CS HPI : The Standard & Poor's Case–Shiller Home Price Indices

S.A. : Seasonal Adjust

SSR : Sum of Squared Residuals

SWARCH : Switching Autoregressive Conditional Heteroskedasticity

TANKAN : Tanki Keizai Kansoku Chousa

TIC : Treasury International Capital

TRY : Turkish Lira

TSI : Turkish Statistical Institute

US : United States

USA : United States of America

USD : United States Dollar

VAR-GARCH: Value at Risk-Generalized Autoregressive Conditional Heteroskedasticity

YoY : Year-over-Year

CHAPTER I

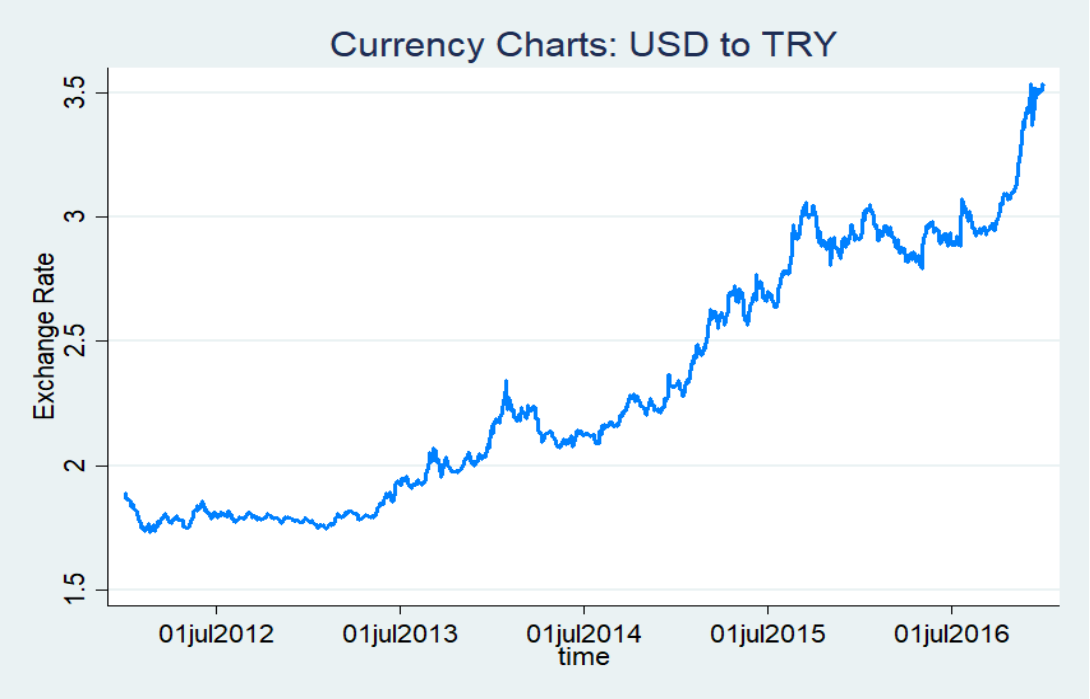
INTRODUCTION

In this study, the effect of news related to macro-economic indicators on the $/TL exchange rate in Turkey is analyzed. The relationship between exchange rates and macro-economic indicators has been widely discussed in the academic literature. Studies conclude that it is difficult to estimate exchange rates using various macro indicators. While many empirical studies that analyzed the relationship between exchange rate and macro indicators have succeeded relatively on explicating long-term movements of exchange rates, they fail to explain the short and mid-term movements. In the academic literature, various approaches have been proposed towards the understanding of the dynamics related to the short and mid-term movement of exchange rates. As Ehrmann and Fratzscher (2005) cited in their studies, news surprises is an important source of information that affect markets and hence market prices. The news surprises are obtained by a comparison of the values of the actual data at the time when the data is released and the market expectations before the release time. Recently, empirical studies using this approach showed that news about various macro indicators have significant impact on the foreign exchange markets.

One important study of this nature is Neely and Dey's (2010) study which studies the effect of news on the USA exchange rates. While there are several research on the relationship between news and exchange rate movements, studies on developing countries are especially rare. This is basically due to the lack of data and that expectation surveys are not regular for macro indicators in developing countries.

In this study, the above mentioned approach that considers the effect of news surprises on foreign exchange markets is adopted for Turkey. Specifically surprises of

real-time macro data obtained through news announcements for Turkey are used to explain the $/TL exchange rate. In Turkey, there are various studies that study the impact of news about monetary policy on financial markets, such as Aktaş et al. (2009), Demiralp and Yılmaz (2010), and Duran et al. (2012). However, these studies focus on the news related to monetary policy, and there is not a comprehensive study that analyses the effect of general macroeconomic news on the exchange rate. Moreover, I also incorporate macroeconomic news announcements from the US into our analysis of the TL/$ exchange rate. Hence, I jointly compare the effect of domestic and foreign news on the exchange rate.



Graph 1.1. Movement of the TL/$ Exchange rate

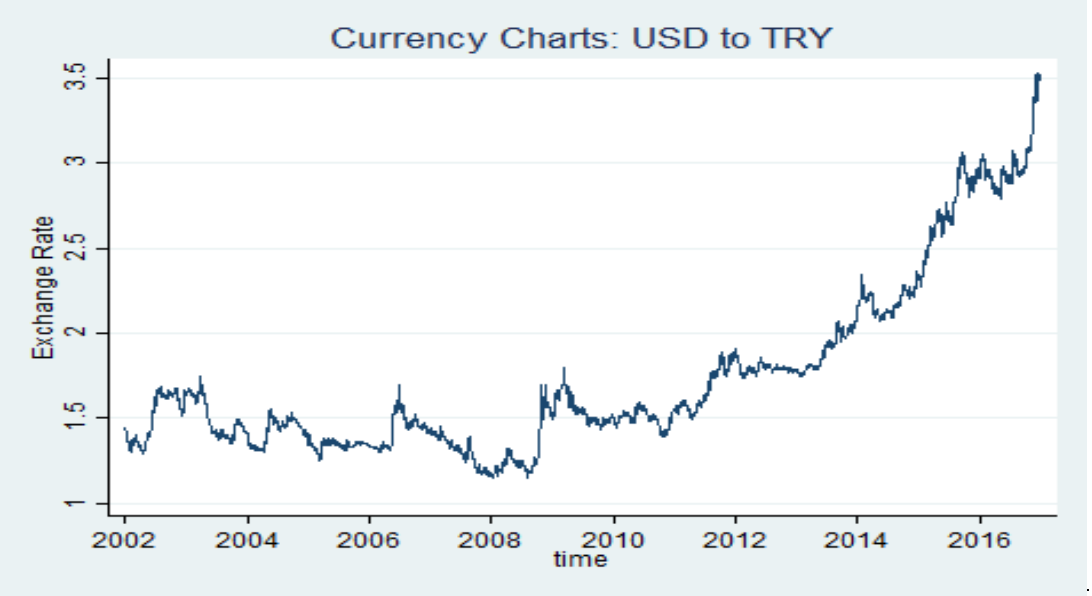
The investigation of exchange rate and news surprises is based on Efficient Market Hypothesis (EMH). The first traditional definition of EMH was done by Eugene Fama in 1975.[1] Thanks to this idea, Fama won Nobel Prize in 2013 along with Lars Peter Hansen and Robert J. Shiller.[2] According to EMH, prices in the market are

[1] Fama, E. F. (2011). My life in finance. Annu. Rev. Financ. Econ., 3(1), 1-15.
[2] For more information: http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2013/fama-facts.html

influenced by all relevant news and expectations. Based on this information, prices are determined according to the laws of supply and demand.

Fama defines efficient market as the market in which all rational investors compete to maximize their interest and knowledge is accessible to all. These assumptions are also valid for the forex market where the exchange rates are determined. In this case, a new information can change the price,

In this study I will examine the impact of the news to explain $/TL exchange rate. I analyze the period between the years 2013 and 2016. This period is quite important for $/TL exchange rate because the exchange rate has experienced large fluctuations and the TL has depreciated after a long period of stability since the 2002 crises. As it can be seen in Graph 1.2, the TL/$ exchange rate which had been fairly stable between the years 2002- 2012, ranging between 1-2 for more than a decade, it has been on a gradual increase since year 2013. While the $/TL exchange rate had reached a maximum level of 1.91 in the 2002-2013 period, it has increased to 3.54 in the 3-year period from 2013 till 2016.



Graph 1.2. Movement of the TL/$ exchange rate (2002-2016)

This study analyses the effects of major macro-economic news so as to find out the determinants for the increase in $/TL exchange rate since 2013. Daily data is used in the time series analysis and the estimations are carried using two different methods, namely OLS and GARCH. After an exploration of the recent literature on exchange rate determination in Chapter II, the methodology used in the study is discussed in Chapter III. Information about the data is provided in Chapter IV and the empirical finding are discussed in Chapter V. Finally, the conclusion is provided in Chapter VI.

CHAPTER II

LITERATURE

Recently, a considerably amount of interest is built on the understanding of how news related to macroeconomic data affect exchange rates. As discussed in Andersen et al. (2003) (ABDV (2003) hereafter) macro-economic news influence both the conditional mean returns and volatilities of exchange rates.

As the efficient market hypothesis explains, all the available information in the market must already be included in the asset prices (EMH, see Fama, 1970). Thus, asset prices must only change by the arrival of new unexpected information. These "surprises" affect the asset prices as they change agents' expectations about the future state of the economy. Basically, they can affect the expectations related to cash flows or the discount factor. Therefore, an unanticipated change in exchange rate today can only be explained by the unexpected information connected with the arrival of new data ("news") between the time agents' expectations are built and the present time.

There are two basic methods in the empirical literature to model "news" to analyze how news affect the exchange rate. In the first method time series innovations in the relevant macroeconomic variables are considered as "news". In the second one, the difference between the actual and expected values of macroeconomic announcements based on survey data is taken as "news". Recently there is a rapidly growing empirical literature that uses news to explain exchange rate behavior. Below the most relevant studies to this study are discussed.

2. 1. Eddelbüttel and McCurdy (1996)

One of the initial studies in this literature is by Eddelbüttel and McCurdy (1996) who analyze the impact of the frequency of general and currency-specific news

headlines on the DEM-USD exchange rate changes. They are using deseasonalized intraday DEM-USD exchange rate changes that starts from October 1992 and ends on September 1993. They use data, named as the 'HFDF93' data, gathered from Olsen & Associates which includes every bid and ask exchange rates between the Japanese Yen, the German Mark, and the US Dollar. The data also includes Reuters news data set together with the relevant interest rate or yield differential. They use a GARCH (1,1) model to estimate the impacts of news headlines on the intraday volatility of the DEM-USD spot exchange rate.

One important finding of this paper is that interest rates do not have much descriptor power at a high frequency; but, that in the conditional variance equation the frequency of news and also the interest rate differential is highly significant. Particularly, more global news increases the conditional volatility of the DEM-USD spot exchange rate.

2. 2. Andersen, Bollerslev, Diebold and Vega (2003)

This paper queried whether exchange rate has a connection with news about fundamentals of the economy or not. Their study is focused on the connection among forex movements, news and order flow. They show that news effects are important for the exchange rate behavior and that there are asymmetric response patterns. They confirm that the main system is increasing the impact of bad news in good times and that – increased state uncertainty – operates in the data. Moreover, they also investigate how the stock, bond and foreign exchange markets react to real-time news surprises.

First, they have a focus on foreign exchange markets rather than a sole focus on stock or bond markets. They refer to the central issue in the exchange rate economy and the link between exchange rates and fundamentals.

Moreover, they primarily concentrate on exchange rate conditional means rather than conditional variances. They do not try to find out exchange rate volatility but the rate of the exchange rate itself, since without modeling the conditional mean sufficiently high-frequency discrete-time volatility cannot be extracted.

Thirdly, they use a renewed date set spanning a relatively longer time period. In addition, it involves a broad set of exchange rates and macroeconomic indicators.

2. 3. Galati and Ho (2003)

This paper investigates the impact of macroeconomic news on the daily movements of the euro/dollar exchange rate in the Euro Area and the United States during the first two years of EMU. Their daily data covers the period of January 1, 1999 to December 31, 2000.

They also query if the agents reacted to news differently or not depending on the following cases: whether it was European or a U.S. centered news, whether the news was bad or good. Also, they search if the traders' response changes as time passes.

Their finding is that the daily change of the euro/dollar ratio is highly correlated with macroeconomic news. Nevertheless, a notable time variation is displayed in this relationship. They also show that the market reacts to bad news coming from the Euro area and that good news do not play a major role.

2. 4. Cai, Joo, Zhang (2009)

This paper investigates how macroeconomic news in the domestic economy and in the US affects exchange rates for nine developing markets. In order to achieve this, it uses a unique high-frequency data for nine emerging countries, namely Czech

Republic, Hungary, Indonesia, Korea, Mexico, Poland, South Africa, Thailand, and Turkey. Data from Bloomberg on market expectations on macroeconomic news and the actual announcement, and data from Consensus Forecasts on market expectations for the exchange rates is used. Using data from January 2, 2000 to the end at December 31, 2006 GARCH (1,1) model is employed in the study.

The study shows that the returns and volatilities of developing market exchange rates is highly responsive to major US macroeconomic news. In contrast, domestic news does not have much effect; and recently, the US news has become more effective on developing market currencies. The study also shows that these currencies can regularly be more reactive to market sentiment. Good news become more notable when optimism prevails in the market, and bad news become more notable while pessimism prevails. Hence, they show that macroeconomic news is statistically significant at a varying degree with market uncertainty, and the significance differs by news and currency.

2. 5. Özlü and Ünalmış (2012)

This paper considers the effect of economic fundamentals on exchange rates in Turkey. The paper uses GARCH (1, 1) model with the daily data obtained from Reuters, the Turkish Central Bank and Turkish Statistics Institute for the period from March 2004 until July 18, 2012.

In this study, the effects of announcements related to several macroeconomic variables namely the GDP, industrial production index, inflation, current account deficit, balance of trade and monetary policy on the TL/$ exchange rate is investigated using real time data for Turkey. Examination of how the exchange rates react after the announcements are made is important for the policy makers. The reaction of the

exchange rate to macroeconomic indicators basically reflects changes in expectations about current and future macro indicators. Their findings show that the value of the Turkish Lira is particularly sensitive to the surprises about the current account deficit and monetary policy.

2. 6. Birz and Lott (2013)

This paper considers newspaper coverage of real sector macro news and analyzes how it affects the stock returns on the S&P 500. News coverage of four macroeconomic series, namely GDP, durable goods, retail sales and unemployment, collected from the Money Market Survey is used in the study. The empirical analysis is based on daily data over the period from January, 1991 to April, 2004 and returns on the S&P 500 data are gathered from Wharton Research Data Services.

They try to find out if there is a link between stock returns and real sector economic news. The literature published before has pointed out that statistical releases determine the price of stocks by affecting agents' expectations and decisions. And by anecdotal evidence it is said that these two are correlated however this argument lacks strong empirical evidence. Thus, as a new approach, they use newspaper coverage as representative for agents' interpretation after macro news.

The paper shows that stock returns are highly affected by news about unemployment and GDP growth. The connection between retail sales and durable goods news and stock prices is seem to be weak, though they end up with the expected sign. Their explanation is that the variables are not directly an indicator for upcoming economic circumstances, or durable goods and retail sales may not have enough statistical strength because of insufficient report stories.

The paper points to a possible causation problem because newspaper articles are written after stock market's closing on the day of the economic releases. To avoid

this problem, as another measure of economic news they use Associated Press stories, which are written earlier than stock market closure.

This paper claims that the results can be helpful to understand how real economic news affects stock market. However, since the articles are generally transmitted after economic releases it does not seem possible to make trading strategies using news articles' information.

2. 7. Ermişoğlu, Oduncu and Akçelik (2013)

This paper analyzes how the Reserve Options Mechanism (ROM) affects the basket exchange rate calculated as an average of the dollar and euro in a period of volatile short term capital flows and in terms of macroeconomic and financial stability.

Following the global financial crisis, academics and policy makers have started to discuss a central banking framework that can contribute to financial stability as well as price stability. The ROM, which is one of such innovative policy instruments recently put into practice by the Central Bank of the Republic of Turkey. It is mainly used to reduce the adverse effects of extreme volatility in capital movements for macroeconomic and financial stability.

The paper by Ermişoğlu et al. (2013) empirically analyzes the effect of ROM on exchange rate volatility using a VAR-GARCH (1, 1) model with the daily data. The analysis period starts from October 15, 2010 which is the time the Central bank stopped to pay interest rate for the required reserves, and ends at October 15, 2012.

The paper shows that the ROM has a significant effect in decreasing exchange rate volatility during the study period. Hence their finding is that ROM is an effective policy tool for reducing exchange rate volatility caused by volatility in capital flows.

2. 8. Caporale, Spagnolo and Spagnol (2016)

This paper examines how exchange rates are affected by macroeconomic news coverages. In order to examine the interaction between exchange rates and macroeconomic news, this paper uses a VAR-GARCH (1, 1) model. For this model, they compare several developing country currencies and the US dollar. These developing countries are Turkey, Czech Republic, South Africa, Hungary, Korea, Indonesia, Mexico, Poland and Thailand. The equations are estimated with daily data over the sample period from January 2, 2000 to December 31, 2006. The data for the News Indices are obtained from Bloomberg. They use news coverage of four macroeconomic series, which are GDP, durable goods, retail sales and unemployment as in Birz and Lott (2013) and the number of story headlines is counted as news coverage.

This paper estimates the following equation

$$x_t = \alpha + \beta x_{t-1} + \delta f_{t-1} + u_t \quad (1)$$

where x_t is the vector of variables contains exchange rate, domestic news index and USA (Eurozone) news index. x_{t-1} is the corresponding vector of lagged variables. f_{t-1} is similarly a vector and contains interest rate differential, and domestic stock. For interest rate differential the 90-day Treasury bill rate differential (vis-a-vis the US) is used. Domestic stock returns are used as proxies for monetary policy and domestic financial shocks.

This paper makes five notable contributions to the existing literature. First, it takes daily newspaper coverage of macro news (newspaper headlines) into account as a form of news that drive investors' decisions. Second, a useful econometric framework is adopted in explaining both mean and volatility spillovers. Thirdly, they use vast amount of developing markets data. Fourth, they search the potential impact

of the recent global financial crises. Finally, they check for external financial shocks and domestic monetary policy shocks.

Findings of this paper show that there is a weak dynamic connection between the first moments and that only for some cases, foreign news has a negative and domestic news has a positive impact. Likewise, the 2008 financial crisis, in most cases, does not seem to be effective on mean spillovers. On the contrary, they find evidence for causality invariance, and that the volatility spillover parameters have changed due to the recent financial crisis. They also find evidence on the connection between the second moments. In many cases, they observed a sizeable downward shift has been observed. At last, they find a limited role of the two proxies (for monetary policy and domestic financial shocks) in the model. As a result, they confirm that macro news has key importance in driving FX markets for developing economies.

2. 9. Akar and Çiçek (2016)

This paper investigates the effect of new policy instruments which are the interest rate corridor, required reserve ratio and reserve option mechanism (ROM) on the volatilities of US dollar, euro, British pound and basket rate for the Turkish economy. Their empirical analysis is based on daily data over the sample period from January 2, 2002 to December 9, 2014. They use ARMA-GARCH, ARMAEGARCH and SWARCH models in their analysis.

This study shows that there is asymmetric volatility impact and that negative shocks lead to smaller exchange rate volatility than positive ones. The main reason behind this asymmetry might be the circumspection motive of economic agents. Since the amount of capital flows have increased in Turkey in the recent decade, the costs of

Turkish Lira credits have been more expensive than the costs of foreign loans. Private sector chooses to invest in foreign exchange to prevent insolvency situation, when a positive shock hits the exchange rate. When the economy has less volatility, economic agents may choose to buy alternative assets like stocks or treasury bonds which can procure higher returns. But when the exchange rate is affected by a positive shock, these investors may immediately change their assets with foreign exchange, so that they can put a limit to their losses arising from the depreciation.

They also provide some evidence that the ROM could decrease the volatilities of exchange rates, especially of US dollar and basket rate. However, they could not reach enough evidence in favor of the other two instruments.

2. 10. Cheung, Fatum and Yamamoto (2017)

In a recent study Cheung, Fatum and Yamamoto (2017) investigate whether the effect of macro news on the exchange rate is state- and time-dependent. In order to achieve this, they analyze how the JPY/USD rate is affected by Japanese and US macroeconomic news. Their empirical analysis is based on daily data over the sample period from January 1, 1999 to August 31, 2016. They carry out their analysis for 3 sub-periods around the Global Financial Crisis (GFC): pre-GFC, the GFC and post-GFC periods. They use OLS estimation with heteroscedasticity and autocorrelation consistent (HAC) standard errors using daily data.

They study news coverage of 23 American and 17 Japanese macroeconomic data series. US news variables are consumer spending, personal income, industrial production, consumer credit, capacity utilization, retail sales, GDP second estimate, GDP third estimate, GDP advanced estimate, non-farm payrolls, durable goods orders, business inventories, new home sales, personal spending, factory orders, NAPM index,

index of leading indicators, consumer price index, producer price index, consumer confidence index, housing starts, target federal funds rate and trade balance. Japanese news variables are industrial production, department and super sales value, GDP final, GDP preliminary, capacity utilization, construction orders, current account, machinery orders, overall spending, trade balance, producer price index, consumer confidence index, consumer price index, retail trade, leading economic index, TANKAN non-manufacturing index and TANKAN large manufacturing index.

The news surprise for news q at time t, $S_{q,t}$ is calculated as $(A_{q,t} - E_{q,t})/\hat{\sigma}_{q,t}$ where $A_{q,t}$ shows the actual value of a given macroeconomic fundamental q, at announced time t, $E_{q,t}$ shows the expectation value of a given macroeconomic fundamental q, at announced time t and $\hat{\sigma}_{q,t}$ shows the sample standard deviation of all surprise values $(A_{q,t} - E_{q,t})$ with fundamental q.

Three equations to analyze exchange rates and macroeconomic news. The first equation is used:

$$R_t = \beta_0 + \sum_{i=1}^{j} \beta_j R_{t-j} + \sum_{q=1}^{Q} \sum_{k=0}^{K} \Upsilon_{q,k}\ S_{q,t-k} + \epsilon_t \qquad (2)$$

where R_t is the five-minute exchange rate return and $S_{q,\,t-k}$ is the standardized shock of the q^{th} macro news. J determines the lag order of exchange rate returns and Q determines macroeconomic news.

The second equation is:

$$R_t = \beta_0 + \sum_{i=1}^{j} \beta_j R_{t-j} + \sum_{q=1}^{Q} \sum_{k=0}^{K} \Upsilon^{+}_{q,k}\ S^{+}_{q,t-k} + \sum_{q=1}^{Q} \sum_{k=0}^{K} \Upsilon^{-}_{q,k}\ S^{-}_{q,t-k} + \epsilon_t \quad (3)$$

$$\text{where } S^{-}_{q,t-k} = \mathrm{I}(S_{q,t-k} < 0) S_{q,t-k} \qquad (4)$$

$$S^{+}_{q,t-k} = \mathrm{I}(S_{q,t-k} \geq 0) S_{q,t-k} \qquad (5)$$

Defining I $(\cdot)$ as an indicator function that captures the surprising news' sign.

Finally, the paper estimates the following equation to measure news-by-news effect as in Andersen et al. (2003).

$$R_t = \alpha_q + \beta_q S_{qt} + \epsilon_t \quad (6)$$

More than half of the US news are found to be influential across the whole sample. Moreover, US news is found influential for all periods: before, during, and after the GFC periods. Also, it is reported that the influence of US news is remarkably larger than that of Japanese news. They show that, although the number and composition of influential US news has almost been stable over the three mentioned sub-periods, the average effect of the significant US news has notably increased in the latter periods. The average effect of the significant US news has doubled in the post-GFC period compared to the pre-GFC period. Their results support the view that the effect of the effective US macro news on the exchange rate is remarkably time-dependent. Specifically, US news have become more important recently after the crisis.

Their results about Japanese news differ than that about US news and most surprisingly Japanese news seem to be losing its impact rapidly after the GFC and has become non-influential.

CHAPTER III

METHODOLOGY

In this section I will discuss some estimation methodologies used to analyze time series variables such as daily exchange rate. To provide a better understanding of the serial correlation that exits within a time series variable in the following sections I will first discuss the three types of models, the Autoregressive (AR) model of order *p*, the Moving Average (MA) model of order *q* and the mixed Autoregressive Moving Average (ARMA) model of order *p, q*.

A common characteristic of financial time series is the existence of *volatility clustering* which occurs when the volatility of the variable changes over time. This behavior is technically named *conditional heteroskedasticity*. AR, MA and ARMA models do not regard volatility clustering, because they are not conditionally heteroskedastic. So, a more sophisticated model is needed for our predictions. Autoregressive Integrated Moving Average (ARIMA), Autoregressive Conditional Heteroskedastic (ARCH) and Generalized Autoregressive Conditional Heteroskedastic (GARCH) are some examples of advanced models.

In the financial time series analysis of this study GARCH models will be used for predicting exchange rate changes. Even tough AR, MA and ARMA are more basic time series models, they can be considered as the basis for more advanced models. Therefore, more sophisticated models will be discussed after a basic introduction on the more basic models.

3. 1. Salient Financial Time Series Models

Before introducing the time series models, it will be useful to go over the concept of stationarity and the technique of differencing.

3. 1. a. Stationary and Differencing

A time series is called *stationary* if its properties (such as the mean and variance) are independent of the time in which series are observed. Time series having trend or seasonality are not stationary, inasmuch as trend and seasonality will affect the values of the series in respect to the time change.

It should be noted that a time series with cyclic behavior (but not trend or seasonality) can be stationary, because length of the cycles is not constant, so where the peaks and troughs cannot be known before observing the series.

Briefly, the patterns of a stationary time series are unpredictable in the long-term. Time plots will show the series to be roughly horizontal (although some cyclic behavior is possible) with constant variance.

The *differenced series* of a time series variable x_t, consists of the change between consecutive observations of the original series and is stated as:

$$x'_t = x_t - x_{t-1} \tag{7}$$

Sometimes the differenced data might not be stationary and it may be necessary to difference the data once again to have a stationary series:

$$x''_t = x'_t - x'_{t-1} \tag{8}$$

$$x''_t = x_t - x_{t-1} - (x_{t-1} - x_{t-2}) \tag{9}$$

$$x''_t = x_t - 2x_{t-1} + x_{t-1} - x_{t-2} \tag{10}$$

3. 1. b. Random Walk

On important basic model in time series analysis is the *random walk* which is a time series model in which consecutive observations are equal with a random step up or down. A random walk is a time series model x_t where

$$x_t = x_{t-1} + e_t \tag{11}$$

in which e_t is the error term. The error term is a *white noise*, which is a normal variable whose mean is zero and variance is one.

It has to be noted that from a process of this type that the change $(x_t - x_{t-1})$ for next period cannot be predicted. Namely, the change is absolutely random. Notice that a random walk process has a constant mean, but its variance is not constant. Consequently, a random walk process is nonstationary, and its variance increases with time *t*.

3. 1. c. Autoregressive Models

In *multiple regression models* a linear combination of predictors are used to forecast the variable of interest. In *autoregression models*, a linear combination of past values of the variable is used to forecast the variable of interest. Hence the term autoregression denotes that it is a regression of the variable against itself.

An autoregressive model of order *p* is represented as:

$$x_t = c + \phi_1 x_{t-1} + \phi_2 x_{t-2} + \cdots + \phi_p x_{t-p} + e_t \qquad (12)$$

where e_t is white noise, and *c* is the constant term. This equation is quite similar to a multiple regression except the lagged values of x_t are the predictors. This model is referred to as the "AR (*p*) model". Autoregressive models are fairly flexible in handling a wide range of different time series patterns.

For an AR (1) model:

if $\phi_1 = 0$, x_t is equivalent to white noise.

if $\phi_1 = 0 \; and \; c = 0$, x_t is equivalent to a random walk.

if $\phi_1 = 0 \; and \; c \neq 0$, x_t is equivalent to a random walk with drift.

if $\phi_1 < 0$, x_t has the tendency of to swaying between positive and negative values.

Normally, autoregressive models are restricted to stationary data, and then it is necessary to put some constraints on the values of the parameters.

For an AR (1) model: $-1 < \phi_1 < 1$

For an AR (2) model: $-1 < \phi_2 < 1,\ \phi_1 + \phi_2 < 1,\ \phi_2 - \phi_1 < 1$

If $p \geq 3$, the restrictions become more complex.

3. 1. d. Moving Average Models

Moving average does not use past values of the forecast variable in a regression, instead it uses the past forecast errors in a regression-like model. A moving average model of order *p* is represented as:

$$x_t = c + e_t + \mu_1 e_{t-1} + \mu_2 e_{t-2} + \cdots + \mu_q e_{t-q} \qquad (13)$$

Where e_t indicates white noise. This model is referred to as the MA (q) model. Since the values of e_t are not observed, it is not really a regression in the usual sense.

It is important that all values of x_t can be considered as weighted moving average of the past few forecast errors. Nevertheless, moving average smoothing and moving average models should not be confused. Moving average smoothing is used in order to figure the trend-cycle of past values, on the other hand moving average models are used to forecast future values.

It should be noted that any stationary AR (p) model can be written as an MA (∞) model. If some constrains are applied on the MA parameters, the reverse –that an MA (q) model can be written as a stationary AR (∞) model–also hold. Then the MA is called "invertible" which means that any invertible MA (q) process can be represented as an AR (∞) process.

Invertible models are not simply to enable us to convert from MA models to AR models. There are some mathematical properties that make them easier in practical usage.

The stationarity constrains and invertibility constrains are alike.

For an MA (1) model: $-1 < \mu_1 < 1$

For an MA (2) model: $-1 < \mu_2 < 1, 1 < \mu_1 + \mu_2,\ \mu_1 - \mu_2 < 1$

If $q \geq 3$, more elaborate conditions will hold.

3. 1. e. ARMA Models

The ARMA (p, q) model can be considered as a combination of both moving average models and autoregressive models. An ARMA (p, q) model can be represented as:

$$x_t = c + \phi_1 x_{t-1} + \phi_2 x_{t-2} + \cdots + \phi_p x_{t-p} + e_t + \mu_1 e_{t-1} + \mu_2 e_{t-2} + \cdots + \mu_q e_{t-q} \quad (14)$$

In brief;

$$x_t = \mathrm{c} + \sum_{i=1}^{p} \phi_i x_{t-\mathrm{i}} + e_t + \sum_{i=1}^{q} \mu_i x_{t-\mathrm{i}} \quad (15)$$

There should not be any common factors between the AR and MA polynomials; otherwise the order (p, q) of the model can be reduced.

3. 1. f. ARIMA Models

A non-seasonal ARIMA model can be formed by fusing differencing with autoregression and a moving average model. ARIMA is a word composed of the first letters Autoregressive Integrated Moving Average model ("integration" indicates the opposite of differencing). The full ARIMA (p, d, q) model can be represented as:

$$x_t^{(d)} = c + \phi_1 x_{t-1}^{(d)} + \phi_2 x_{t-2}^{(d)} + \cdots + \phi_p x_{t-p}^{(d)} + e_t + \mu_1 e_{t-1} + \mu_2 e_{t-2} \ldots + \\ + \mu_{\mathrm{q}} \mathrm{e}_{\mathrm{t-q}} \quad (16)$$

where $x_t^{(d)}$ represents the differenced series (which may have been differenced more than once). Note that there are lagged values of x_t and lagged errors in the "predictors" on the right-hand side. In this model,

p = order of the autoregressive part;

d = degree of first differencing involved;

q = order of the moving average part.

Some of the model mentioned before are special cases of ARIMA such that:

White noise : ARIMA (0,0,0)

Random walk : ARIMA (0,1,0) with no constant

Random walk with drift : ARIMA (0,1,0) with a constant

Autoregression : ARIMA (p,0,0)

Moving average : ARIMA (0,0,q)

3. 2. ARCH Models

In 1982 Engle presented a basic ARCH model, the first tool allowing the variance to evolve over time. ARCH models do not take heteroskedasticity as a problem to be solved, but as a feature to be modeled. ARCH model has proved to be very good in catching the volatility clustering effect, where large (small) price changes tend to be followed by other large (small) price changes, yet of unpredictable sign. This feature is called the *ARCH effect*. Bollerslev (1987) explained why volatility tends to cumulate in clusters. The reason is that the intelligence reaches to economic agents in clusters, therefore volatility clustering is observed when that information is incorporated into prices.

The ARCH (q) model can be represented as:

$$Mean\ equation: y_t = x_t b + e_t \tag{17}$$

$$variance\ equation: h_t = a_0 + \sum_{i=1}^{q} a_i e_{t-q}^2 \tag{18}$$

$$e_t = v_t\sqrt{h_t};\quad v_t \sim N(0,1) \tag{19}$$

where e_{t-q}^2 is the past squared errors and v_t is the standarlized residual.

There are two equations in the ARCH (q) one for the mean and other for the variance. The equation for mean is similar to classical OLS equation having the vector of coefficients b and the error term ε_t, dependent variable y_t, the vector of independent

variables x_t. The variance equation stands for the variance which is symbolized by h_t with intercept a_0 and q lags of past squared errors. These squared errors are called *ARCH terms*. The v_t residuals are calibrated for estimated volatility and that is why they are called *standardized residuals*.

3. 3. GARCH Models

The GARCH model, introduced by Bollersev, is an important extension of the ARCH model. The GARCH is acronym form of Generalized Autoregressive Conditional Heteroskedasticity model. In addition to getting along with much more flexible lag structure, the GARCH model allows for a longer memory process, which is the main advantage. The GARCH (*p, q*) model is represented as:

$$Mean\ equation: y_t = x_t b + e_t \tag{17}$$

$$variance\ equation: h_t = a_0 + \sum_{i=1}^{q} a_i e_{t-q}^2 + \sum_{j=1}^{p} \beta_j h_{t-p} \tag{20}$$

$$e_t = v_t\sqrt{h_t}; \quad v_t \sim N(0,1) \tag{19}$$

There extra *p* lags of conditional variance h_t in variance equation, and this is the only difference which tolerates much more parsimonious description of process. This can be considered as an ARMA analogy, in this analogy the GARCH terms substitute for the AR terms, and ARCH terms substitute for the MA terms. The GARCH model becomes the basic ARCH model if *p* takes the value zero. The ability to capture most of volatility dynamics makes GARCH (1,1) more popular than other version of GARCH (*p, q*) model in practical terms.

It is easy to see that GARCH (1,1) corresponds ARCH (∞) the GARCH term in the right-hand side of the variance equation is rewritten in an iterative way as follows:

$$h_t = a_0 + a_1 e_{t-1}^2 + \beta_1 h_{t-1} \tag{21}$$

$$h_t = a_0 + a_1 e_{t-1}^2 + \beta_1 (a_0 + a_1 e_{t-2}^2 + \beta_1 h_{t-2}\ ) \tag{22}$$

$$h_t = a_0 + \beta_1 a_0 + a_1 e_{t-1}^2 + \beta_1 a_1 e_{t-2}^2 \quad + \beta_1 \beta_1 h_{t-2} \ ) \tag{23}$$

and hence

$$h_t = a_0(1 + \beta_1 + \beta_1^2 + \cdots) + a_1(e_{t-1}^2 + \beta_1 e_{t-2}^2 + \beta_1^2 e_{t-3}^2 + \cdots \ ) \tag{24}$$

If $-1 < \beta_1 < 1$, then I reach;

$$h_t = \frac{a_0}{(1-\beta_1)} + a_1 \sum_{i=1}^{\infty} \beta_1^{i-1} e_{t-i}^2 \tag{25}$$

$$h_t = \lambda_0 + a_1 \sum_{i=1}^{\infty} \lambda_i e_{t-i}^2 \tag{26}$$

It cannot be said that the GARCH model is a novel idea, since it has the infinite order ARCH model. On the other hand, it allows much easier and parsimonious description of the process. If the sum of ARCH and GARCH coefficients is lower than one, a GARCH process satisfies the only required condition to be stationary. With this condition, it is certain that the effect of past shocks disappears step by step.

3.4. Tests

In this section some theoretical background for the time series tests that will be use in our analysis is provided. These are the Dickey-Fuller and the ARCH-LM tests.

3. 4. a. Dickey-Fuller Test

Before running the GARCH model estimations we have to make certain that all our variables are stationary. Since regressing two trending variables means a potential spurious regression, it causes high coefficient of determination and even higher significance of independent variables although there is not any relation between these variables. Standard assumptions for asymptotic analysis will be void, when the stationarity assumption is not satisfied. In addition, *t* and *F* statistics do not follow their own distributions anymore (Brooks, 2008).

Let's presuppose the following process:

$$x_t = c + \phi \, x_{t-1} + e_t \tag{27}$$

If ϕ is bigger than one, the stationarity will not be satisfied. The process will be explosive. This situation is not a typical one for financial time series.

If ϕ=1, I will have a unit root in our process. This case is more interesting, which is much more common for financial time series. The existence of unit roots in our data can bring about some misleading conclusions.

Dickey and Fuller (1979) introduced a test procedure to investigate the presence of a unit root. Once I subtract x_t from the above equation Ψ=0 can be tested. As in equations below Ψ=0 is equivalent to ϕ=1.

$$x_t = \mathrm{c} + \phi\, x_{t-1} + e_t \tag{27}$$

$$\Delta x_t = \mathrm{c} + \Psi\, x_{t-1} + e_t \tag{28}$$

$$H_0: \Psi = 0; \;\; H_A: \Psi < 0 \tag{29}$$

This test statistics does not follow the usual *t* distribution. Thus, it has different critical values. In 1979, Dickey and Fuller attained the critical values using simulation technique. The absolute value of them is much greater then when there is *t* distribution. So, stronger evidence is required for rejecting the null hypothesis. This test is valid only when the error term e_t is a white noise. Erroneously, the rejection of the null hypothesis mistake is made more often when e_t follows autocorrelation patterns. An augmented version of the Dickey Fuller test can be helpful for such problems. This test has *p* autoregressive lags in our testing regression, so it can clear potential autocorrelation of e_t

$$\Delta x_t = \mathrm{c} + \Psi\, x_{t-1} + \sum_{i=1}^{q} a_i \Delta x_{t-\mathrm{i}} + e_t \tag{30}$$

$$H_0: \Psi = 0; \;\; H_A: \Psi < 0 \tag{29}$$

The information criteria help us to determine the optimal number of lags. The null will be rejected, if test statistic is more negative than the corresponding critical

value. If the unit root is not rejected, the variables must be scaled to guarantee their stationarity. Mostly it is enough to difference them only once.

3. 4. b. ARCH-LM Test

Before applying any GARCH Model, it is convenient to assure ourselves that the ARCH effect is present in our data and this class of models is thus appropriate. In 1982, a procedure to test presence of ARCH effects was proposed by Engle. The residuals can be saved by running an OLS regression of our mean equation. Then, squared residuals are regressed on an intercept (a_0) and q autoregressive lags. The null hypothesis rejects the presence of ARCH effect, which means that all lag coefficients have to be zero. The number of observations will be represented by TR^2 is the coefficient of determination from the regression with squared residuals. I have product of them TR^2 for the test statistics. The test statistic is distributed in chi-squared with q degrees of freedom. The procedure can briefly be stated by the following equations:

$$y_t = x_t b + e_t \tag{17}$$

$$\hat{e}_t^2 = a_0 + \sum_{i=1}^{q} a_i \hat{e}_{t-q}^2 + \pi_t \tag{30}$$

$$H_0: a_j = 0; H_A: at\ least\ a_j \neq 0, j \in 1,2, \dots, q;\ TR^2 \sim \chi^2(q) \tag{31}$$

CHAPTER IV

DATA

This chapter presents the data used in the analysis. Specifically, the dependent and independent variables in the study, the data sources and the required data conversions before the estimations are presented below.

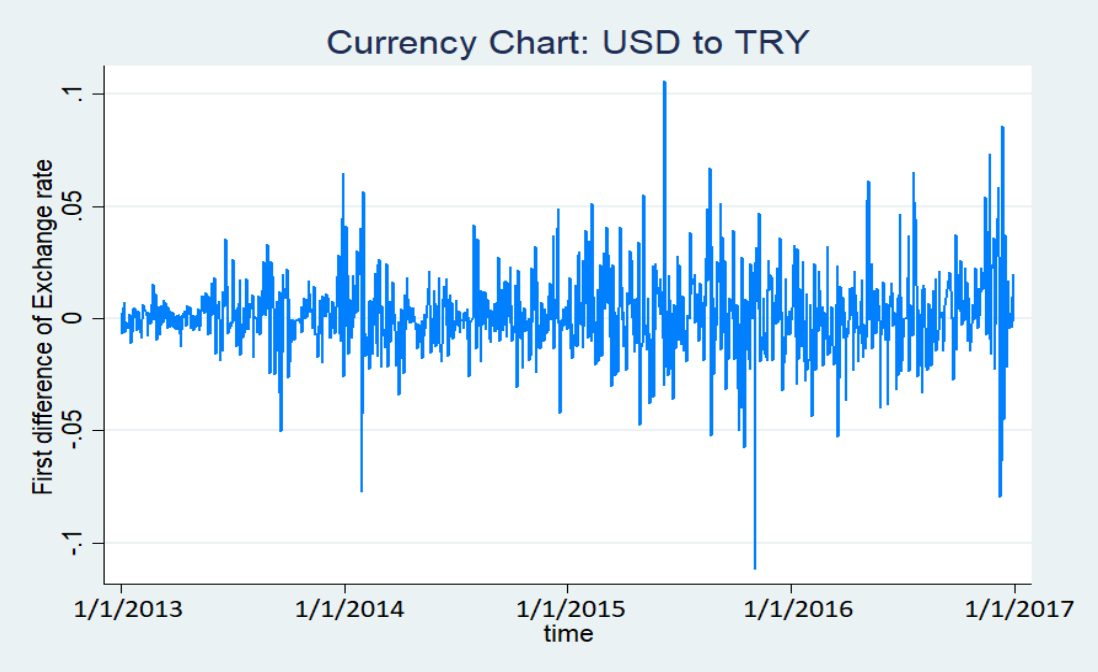
The data is basically obtained from two sources: the Central Bank of the Republic of Turkey (CBRT) and an online investing portal called investing.com. CBRT provides a wide set of publicly available data on its website at www.tcmb.gov.tr. Investing.com is an online platform that provides many investment related data on exchange rates, stock markets as well news that affect investment decisions. This platform is used to obtain the domestic and foreign macroeconomic news data used in the analyses of this study.

The full sample period is from January 2, 2013 to December 30, 2016, covering 1004 days. Exchange rate data for only business days is considered in the analysis. Therefore, the non-business days are not included in the dataset. Hence, Saturday and Sunday's and then the national holidays and religious holidays in Turkey are excluded from the dataset.

Specifically, the excluded non-business days are public holidays which are the New Year's Day (January 1), national sovereignty and children's day (April 23), labor and solidarity day (May1), commemoration of Atatürk youth and sports day (May 19), victory day (August 30), republic day (October 29), and religious holidays which are Eid al-Fitr and Eid Adha. The non-missing dates that are not included in the study are presented in Appendix 3. The analysis is carried out using this intra-day exchange rate data. Some of data used in the analysis has a weekly, monthly, or quarterly frequency. This data is converted into daily frequency.

4. 1. USD/TRY Exchange Rate

I study the daily movements of the dollar against the Turkish Lira from January 2013 till December 2016, therefore my dependent variable is the $/TL exchange rate. The $/TL exchange rate is obtained from the web page of CBRT, quoted in Turkish Lira per Us Dollar terms. The $/TL exchange rate enters the regressions in daily log differences and the log differenced series of the exchange rate is presented in Graph 4.1. The $/TL exchange rate shows the value of Turkish Lira vis-à-vis one US dollar. An increase of the $/TL exchange rate is the depreciation of the Turkish Lira (appreciation of the US dollar) and a decrease of the $/TL exchange rate is the appreciation of the Turkish Lira (depreciation of the US dollar).



Graph 4.3. Movement of the first difference of the $/TL exchange rate

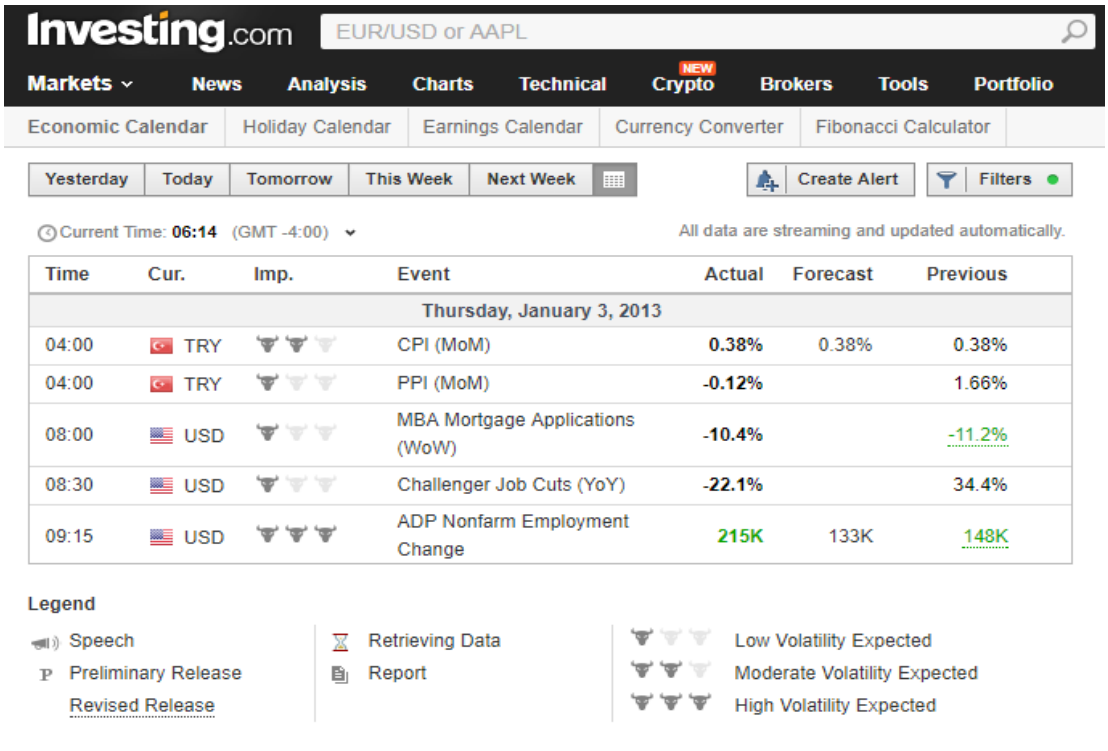
4. 2. Macroeconomic News Variables

News data were obtained from the website called investing.com. The site which has been in service since 2007 is a global finance portal to acquire any economy related information for major economies. The website provides technical data, news, streaming quotes, analysis, financial tools and charts about both Turkey and other

major global economies. Data on interest rates, exchange rates, bonds, stocks, commodities, futures and options and other relevant economic variables can easily be reached from this website which provides data on 97 countries and offers service in 21 languages.

Data were obtained from the economic calendar of the site. From this calendar it is possible to obtain information about the time at which data about each variable were released, as day and hour. Also, the expected volatility level of the variable, its explained value, its forecast value beforehand the data release and the previous explained value are provided on the site (see Figure 4.1.) I gathered all data related to Turkey and the US between January 1, 2013 to December 31, 2016. Since we are interested in the surprise component of the news (which is based on the difference between the actual data and its expectation) only news data that has both the actual and forecasted values is included. These news data are the independent variables in our analysis.

Figure 4. 4. The Website View of the Economic Calendar on Investing.Com



The formation of the independent variables, i.e. the domestic and foreign macroeconomic news variables, whose effect on $/TL exchange rate will be analyzed in our study are explained in the following two subsections.

4. 2. a. Domestic Macroeconomic News Variables

News about sixteen variables about the Turkish economy are used in the analysis as the first set of independent variables that will affect the exchange rate. These variables are the one-week repo rate, capacity utilization rate, current account, consumer price index(CPI) (MoM), CPI (YoY), 3-month jobless average, gross domestic product(GDP), overnight borrowing rate, overnight lending rate, manufacturing confidence, manufacturing purchasing managers index (PMI), producer price index (PPI) (MoM), PPI (YoY), industrial production, trade balance, consumer confidence. More information about these variables is provided in Appendix 1.

The web site provides a grouping of these variables based on their expected volatility level and another grouping based on their category. The variables were grouped into three based on their expected volatility level and into six based on their category.

4. 2. b. Foreign Macroeconomic News Variables

News related with one-hundred and nine various variables related to the US economy were used in the analysis as the second set of independent variables that will affect the exchange rate. These major variables are the FED interest rate, current account, federal budget balance, trade balance, personal income, trade balance on goods, consumer credit, capacity utilization rate, durable goods orders, GDP, industrial production, personal spending, real consumer spending, real personal consumption,

average hourly earnings, average weekly hours, real earnings, unemployment rate, unit labor costs, consumer price index and producer price index.

Information on all the 125 foreign variables (109 domestic and 16 foreign) is provided in Appendix 2. Similar to domestic variables the web site provides grouping based on the expected volatility level and category of the foreign variables also. The foreign news is also grouped into three based on their expected volatility level and into seven based on their category.

4. 3. News Index

The news variables do not enter the estimations directly, but I create a news *surprise index* for each variable and use those as the independent variables. It is essential to create such an index using the actual and forecast values of the variables in order to estimate news surprises. Some variables such as the overnight lending rate, one-week repo rate are reported in a percentage unit, the current account in billion USD's or the consumer confidence as an index. For this reason, a common indexation for these variables that are measured in different units is required.

To create the news surprise index, I used the methodology by Balduzzi, Elton and Green (2001). The methodology is applied for all the one-hundred twenty-five variables, including sixteen domestic and one-hundred nine foreign variables. At first, the difference between actual and forecast value of each variable is calculated. It is said to be a positive news surprise if the difference is positive; or negative news surprise if it is negative. Next the standard deviation of the calculated difference values is calculated for each variable. Namely, one-hundred twenty five standard deviations are calculated. Finally, the difference value is divided into the corresponding standard deviation to create the index. Briefly, the news surprise index for a variable q at time t can be represented as

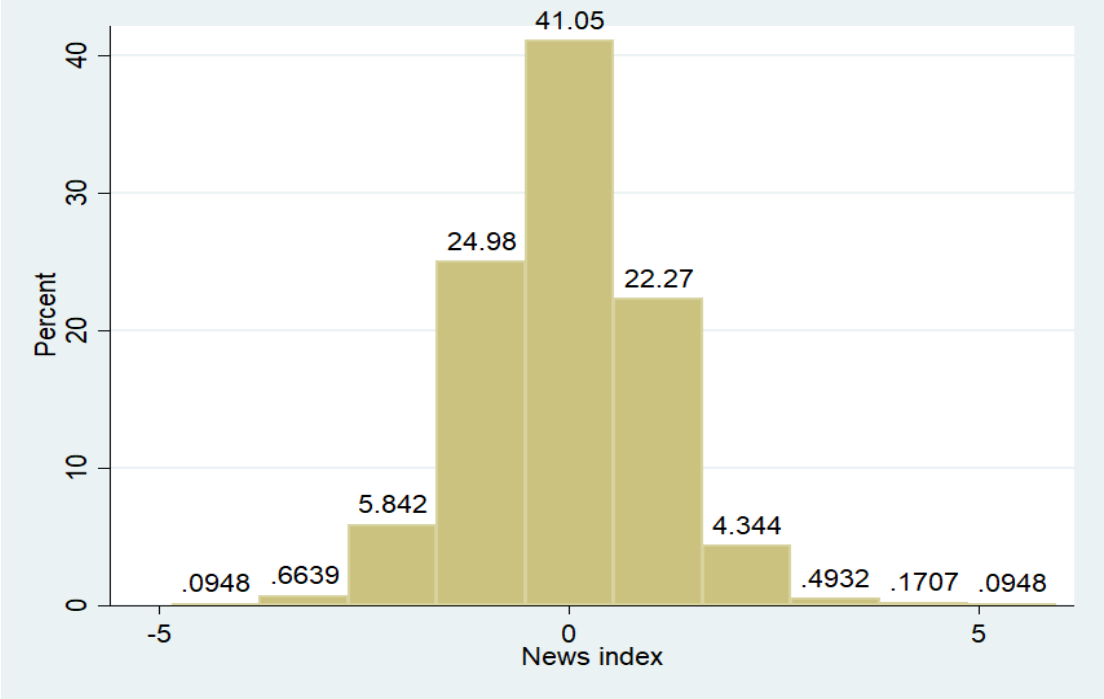
$$S_{q,t} = \frac{A_{q,t} - F_{q,t}}{\hat{\sigma}_q}. \quad (32)$$

where $A_{q,t}$ is the actual value, $E_{q,t}$ the expected value and $\sigma_{q,t}$ the standard deviation of variable q where each news event represents a variable. Summary statistics of the index values are presented in Table 4.1. As it can be seen a total of 5866 non-zero news index variables are created. The index variables have a range of (4.85, 5.95).

Variable	Observation	Mean	Std. Dev.	Min	Max
News index	5866	-0.03539	1.004879	-4.846277	5.950306

Table 4. 1. Summary statistics of the index values

There are 594 news events for which the actual and expected value are equal. Hence these have an index value of 0. Excluding the zero valued indexes, there are 5272 non-zero index variables and the histogram for these non-zero 5272 news indexes is shown below in Graph 4.2.



Graph 4.5. Histogram of news indexes which are not equal to zero

As it can be seen from the graph 4.2., 41.05% of the news indexes are in the range of (-0.5, 0.5) and the remaining 88.3% are in the range of (-1.5, 1.5). 47% of

them are in the range of (-0.5, 0.5) and 89.5% in the range of (-1.5, 1.5) when those whose index values are 0 are also considered. These show that the expectations and actual values for the news events are actually quite close.

4. 3. a. Construction of Aggregate News Indexes

Making the estimations using the one-hundred twenty-five variables has several limitations. The variables in the dataset mostly have a monthly frequency and in a four year period they have forty-eight observations. Hence, there are not sufficient observation when the variables are used alone to attain good results. Thus, it is more reasonable to aggregate news that have a similar feature into common index variables and carry the estimations using those aggregate index variables.

While doing the aggregation, the following method was utilized: If the news events were on different days, the index values created on the event days were used. However, in the case when there are more than one news event on the same day, the index values for those events are summed. As there were more than one news surprise in same day, it is natural to have a more effective news, and hence a larger index was created. As an alternative method, calculating geometric or arithmetic mean could have been used, but these methods would not consider the larger impact of more than one news surprise.

I have used three different aggregating methods, and created three different new indexes based on these different criterions. The criterions are based on having the same news category, same expected volatility level or being related with the same country. for three different categories.

In the first aggregating method based on news category, eleven aggregate news variables were formed, 6 for Turkey and 7 for US. The aggregation of the variables by news category are presented in Table 4.2.

Aggregate Variable	Aggregate Variable Name	Number of news variables	Number of Observations	Code of Aggregated Variables
Aggregation for Turkey News				
tr_1	Balance	2	67	tr01, tr02
tr_2	Monetary Policy	3	110	tr03, tr04, tr05
tr_3	Confidence Index	2	15	tr06, tr07
tr_4	Economic Activity	4	65	tr08, tr09, tr10, tr11
tr_5	Employment	1	35	tr12
tr_6	Inflation	4	118	tr13, tr14, tr15, tr16
Aggregation for US News				
us_1	Balance	12	990	us01, us02, us03, us04, us05, us06, us07, us08, us09, us10, us11, us12
us_2	Monetary Policy	2	71	us13, us14
us_3	Confidence Index	6	336	us15, us16, us17, us18, us19, us20
us_4	Credit	1	48	us21
us_5	Economic Activity	52	2413	us22, us23, us24, us25, us26, us27, us28, us29, us30, us31, us32, us33, us34, us35, us36, us37, us38, us39, us40, us41, us42, us43, us44 us45, us46, us47, us48, us49, us50, us51, us52, us53, us54, us55, us56, us57, us58, us59, us60, us61, us62, us63, us64, us65, us66, us67, us68, us69, us70, us71, us72, us73

us_6	Employment	16	913	us74, us75, us76, us77, us78, us79, us80, us81, us82, us83, us84, us85, us86, us87, us88, us89
us_7	Inflation	20	717	us90, us91, us92, us93, us94, us95, us96, us97, us98, us99, us100, us101, us102, us103, us104, us105, us106, us107, us108, us109

Table 4. 2. Aggregation by news category

The second aggregating method is based on the expected volatility level of the variables. Variables that have the same expected volatility levels are grouped together and this volatility based aggregate variable is represented by stars. Variables that have low expected volatility are represented by 1 star, moderate expected volatility by 2 stars and high expected volatility by 3 stars. We have a total of 6 volatility based aggregate variables 3 for Turkey and 3 for US. Table 4.3. provides the details about how the variables were included in this aggregation.

Aggregate Variable	Aggregate Variable Name	Number of news variables	Number of Observations	Code of Aggregated Variables
Aggregation for Turkey News				
tr_11	1star	8	157	tr01, tr02, tr06, tr07, tr10, tr11, tr15, tr16
tr_12	2star	6	179	tr04, tr08, tr09, tr12, tr13, tr14
tr_13	3star	2	74	tr03, tr05
Aggregation for US News				
us_11	1star	50	2377	us02, us07, us09, us12, us13, us16, us17, us19, us20, us21, us22, us25, us27, us30, us31,

				us32, us33, us35, us36, us42, us43, us50, us51, us53, us56, us57, us65, us66, us67, us69, us70, us71, us73, us76, us77, us79, us82, us84, us87, us92, us95, us96, us98, us100, us102, us103, us105, us106, us108, us109
us_12	2star	39	2015	us01, us03, us05, us06, us08, us10, us11, us18, us23, us26, us34, us38, us39, us41, us44, us45, us46, us48, us52, us54, us55, us59, us60, us61, us63, us72, us75, us78, us80, us81, us86, us89, us91, us93, us94, us97, us99, us101, us104
us_13	3star	19	1048	us04, us14, us15, us24, us28, us29, us37, us40, us47, us49, us58, us62, us64, us68, us74, us83, us85, us88, us90, us107

Table 4. 3. Aggregation by expected volatility level

The final aggregation method is based on the country to which the news is related to. Namely, two aggregate news variables were obtained: one the domestic news and the other the foreign news variable. The domestic news aggregate variable is obtained by aggregating of all the sixteen news variables about Turkey and the foreign news variable is obtained by aggregating all the one-hundred seven news about the US in the study.

CHAPTER V

ESTIMATION

In this chapter, I discuss the estimation results. My dependent variable is the TL/$ exchange rate. I estimate the TL/$ exchange rate and use the news indicators as independent variables.

5. 1. Dependent Variable: USD/TRY Exchange Rate

The summary statistics for the TL/$ exchange rate are displayed in Table 5.1. As can be seen for our study period the exchange rate varies in a range between 1.75 and 3.54, it has a standard deviation of 0.464 and there are a total one-thousand and five observations.

Variable	Observation	Mean	Std. Dev.	Min.	Max.
TL/$ Exchange Rate	1005	2.246328	0.4636481	1.7543	3.5408

Table 5. 4. Summary statistics of the TL/$ exchange rate

Since the exchange rate is a time-series variable, the existence of a unit root has to be checked before the calculations. Phillips-Perron test, DF-GLS test, KPSS test or Dickey-Fuller test may be used for the unit root controls. I used the Dickey-Fuller test to the unit root.

The test results show that the TL/$ exchange rate has a unit root. I compare the absolute value of Test Statistic and absolute value of Critical Value, and if the absolute value of the Test Statistic is higher than the critical value, the null hypothesis that the exchange rate has a unit root will be rejected. In other words, the alternative hypothesis that the exchange rate is stationarity is accepted. Based on the test results, since is 1.842<3.960, I cannot reject the null hypothesis (for more information, see in Table 5.2.). In this situation, the TL/$ exchange rate has a unit root.

Dickey-Fuller test for unit root			Number of observation = 1004	
TL/$ Exchange rate			Interpolated Dickey-Fuller	
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(*t*)	-1.842	-3.960	-3.410	-3.120
MacKinnon approximate p-value for Z(t) = 0.6840				

Table 5. 5. Dickey-Fuller test result of the TL/$ exchange rate

As discussed in the methodology section the most common method to deal with the existence of a unit root is to take a first difference, such that

$$\Delta e_t = e_t - e_{t-1} \tag{33}$$

where e_t denote by TL/$ exchange rate and Δe_t denotes the first difference of TL/$ exchange rate. The problem of a unit root is usually overcome after this calculation. However, the Dickey-Fuller test should be resorted again to make sure that the first difference is stationary. Based on the test result (since 30.142>3.960), the null hypothesis may be rejected and an alternative hypothesis that the first difference of TL/$ exchange rate doesn't have a unit root can be accepted. Since differenced TL/$ exchange rate is stationarity, I can start the estimations.

Dickey-Fuller test for unit root			Number of observation = 1003	
First difference of TL/$ Exchange rate			Interpolated Dickey-Fuller	
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(*t*)	-30.142	-3.960	-3.410	-3.120
MacKinnon approximate *p*-value for *Z*(*t*) = 0.0000				

Table 5. 6. Dickey-Fuller test result of first difference of the TL/$ exchange rate

In order to explain the dependent variable, i.e. the TL/$ exchange rate, through independent news variables I will estimate the following equation

$$R_t = \alpha_q + \beta_q S_{qt} + \epsilon_t \quad (6)$$

where R_t denotes first difference of TL/$ exchange rate and S_{qt} denotes the news index.

5. 2. Effect of News by Event Type

In this part, the effect of each news event is estimated and the relation of that event with the TL/$ exchange rate is measured. In other words, all the variables are included one by one alone into the regression equation as independent variables.

5. 2. a. Result of OLS

For each news event I have formed three different indexes. The first index includes all news surprises related with that variable. Next two other indexes were formed by separating positive and negative news surprises of that event with the objective to measure the asymmetric effect of positive and negative news. This is because positive news surprises (which is when the explained value is higher than the expected value) might not have the same effect as negative news surprises (which is when the explained value is lower than the expected value). Hence positive and negative news surprises are separated to form two different indices for each variable to calculate this asymmetry. The results of the OLS regressions for all events using these three different news indices are given in Appendix 5.

. In some events, the number of observations is not sufficient to carry out the regressions, so the obtained results are not exactly true. For example, for the FED interest rate decision all index values are equal to zero, since the actual and expected values are equal. Hence regression analysis cannot be carried out. To avoid such cases the number of ten is determined as a minimum value criterion for the number of observations. In other words, any variables that has less than 10 observations, even if

the results were significant, isn't included in the results table. The list of news events that have significant coefficients in the OLS regressions carried out with all news is provided in Table 5.4.

Variable	Name	Obs.	Coefficient	R^2	Sign
tr03	Overnight Borrowing Rate	35	-0.0125*** (0.00313)	0.060	Negative
tr04	Overnight Lending Rate	36	-0.0111*** (0.00315)	0.047	Negative
tr05	One-Week Repo Rate	39	-0.0119*** (0.00301)	0.058	Negative
tr09	GDP	15	-0.0158*** (0.00492)	0.039	Negative
tr10	Industrial Production	38	-0.00608* (0.00309)	0.015	Negative
tr15	PPI (MoM)	18	0.0129*** (0.00422)	0.036	Positive
tr16	PPI (YoY)	15	0.0193*** (0.00436)	0.072	Positive
us08	Goods Trade Balance	16	-0.00884* (0.00458)	0.004	Negative
us40	GDP	48	0.00453* (0.00271)	0.003	Positive
us49	ISM Non-Manufacturing Purchasing Managers Index	48	0.00611** (0.00266)	0.006	Positive
us82	ISM Non-Manufacturing Business Activity	25	0.0105*** (0.00369)	0.009	Positive
us83	Jolts Job Openings	41	0.00608** (0.00278)	0.005	Positive

Table 5. 7. OLS result of all news

One-week repo rate, overnight lending rate and overnight borrowing rate are the variables related to the interest rate, and an increase of interest rate causes Turkish Lira to appreciate as the uncovered interest rate parity (UIP) states. Namely, it causes a decrease in TL/$ exchange rate. Thus, these variables have a negative coefficient.

An increase in industrial production, number of job openings, manufacturing and GDP and other domestic events that increase the purchasing power of Turkish lira cause Turkish Lira to appreciate, while the foreign counterpart of these variables cause Turkish Lira to depreciate.

Increases in the PPI, CPI or the other price indices demonstrate an increase in inflation. The increase in inflation also causes the currency to depreciate. When these variables are domestic-sourced, Turkish Lira depreciates (TL/$ exchange rate increases), and if they are foreign-sourced the Turkish Lira appreciates.

the list of events that have significant coefficients in the OLS carried out with positive news is provided in Table 5.5.

Variable	Name	Obs.	Coefficient	R^2	Sign
tr03	Overnight Borrowing Rate	35	-0.00442*** (0.00102)	0.018	Negative
tr04	Overnight Lending Rate	36	-0.00442*** (0.00102)	0.018	Negative
tr05	One-Week Repo Rate	39	-0.00442*** (0.00102)	0.018	Negative
tr09	GDP	15	-0.0119* (0.00651)	0.003	Negative
tr10	Industrial Production	38	-0.00691* (0.00356)	0.004	Negative
us13	Chicago FED National Activity	39	0.0127* (0.00690)	0.003	Positive
us15	CB Consumer Conf.	48	0.00611* (0.00344)	0.003	Positive
us48	ISM Non-Manufacturing Employment	71	0.00223** (0.00110)	0.004	Positive
us82	ISM Non-Manufacturing Business Activity	25	0.00876** (0.00341)	0.007	Positive

Table 5. 8. OLS results of positive news

The values relevant to domestic interest rate and the variables which increase production lead to the appreciating of the Turkish Lira, while those which are foreign-sourced lead the Turkish Lira to depreciate.

There is a list of events having significant coefficients as a result of OLS with negative news in Table 5.6.

Variable	Name	Obs.	Coefficient	R^2	Sign
tr06	Consumer Confidence	12	-0.0204** (0.00831)	0.006	Negative
tr09	GDP	15	-0.0206*** (0.00673)	0.009	Negative
tr13	CPI (MoM)	46	0.00332** (0.00138)	0.006	Positive
tr14	CPI (YoY)	39	0.00368*** (0.00142)	0.007	Positive
tr15	PPI (MoM)	18	0.00681*** (0.00175)	0.009	Positive
tr16	PPI (YoY)	15	0.00191* (0.00106)	0.015	Positive
us01	API Crude Oil Stock	120	-0.00209* (0.00108)	0.004	Negative
us08	Goods Trade Balance	12	-0.0102** (0.00419)	0.006	Negative
us106	PCE Prices	44	0.00223* (0.00124)	0.003	Positive
us107	PPI (MoM)	27	0.00191* (0.00106)	0.003	Positive
us17	IBD/TIPP Economic Optimism	30	0.00414* (0.00234)	0.003	Positive
us49	ISM Non-Manufacturing Purchasing Managers Index	19	0.0128** (0.00521)	0.006	Positive
us64	Philadelphia FED Manufacturing Index	27	0.00191* (0.00106)	0.003	Positive
us70	Richmond Manufacturing Index	36	-0.00257* (0.00135)	0.004	Negative
us71	S&P/CS HPI Composite - 20 N.S.A. (YoY)	42	-0.00292** (0.00129)	0.005	Negative
us72	S&P/CS HPI Composite - 20 N.S.A (MoM)	11	-0.00871*** (0.00319)	0.007	Negative
us97	Core PPI (YoY)	27	0.00191* (0.00106)	0.003	Positive

Table 5. 9. OLS results of negative news

A similar result emerges in here. Variables related to inflation in domestic news led to an increase in TL/$ exchange rate but GDP and consumer confidence led to a decrease in TL/$ exchange rate.

However, the coefficients were calculated in some variables, contrary to expectations. For example, while a coefficient with negative indicator was expected for PPI and Core PPI related to inflation, contrary of that was appeared. For the reason of that, the policy of US economy in recent years may be showed. Because the most important problem for US economy in recent periods was the Zero Lower Bound Problem (ZLBP). This may have caused that the relation between the inflation and TL/$ exchange rate wasn't normal.

A similar unexpected relation was appeared for the API crude oil stock. The increase in crude oil stock wage should cause the dollar to appreciate under normal conditions. Even so, the oil market was acting more differently than expected, due to agreements made by the oil market and organization of petroleum exporting countries (OPEC). That the coefficient is also different as expected may be due to these agreements.

5. 2. b. ARCH-LM Test

ARCH-LM test demonstrates whether the OLS regression has an ARCH effect without resorting to the GARCH model. Thus, it helps to make a more accurate analysis. According to the results of OLS the results of ARCH-LM test, I used the GARCH model, a better method for errors having ARCH effect. As to this test, I researched results of the GARCH model for all significant equations obtained through the OLS method. See in Appendix 4 for the results of ARCH-LM test. In addition to this, I could have resorted Breusch-Pagan LM test to control this operation.

5. 2. c. Result of GARCH

The method of OLS wasn't a great method to attain the right results owing to the ARCH effect. I repeated the calculation for all variables. The results of regression which have significant coefficient made with the method of GARCH (1,1) for all news are shown in table 5.7. See Appendix 6 for all GARCH result.

Variable	Mean		L.arch		L.Garch	
	Coefficient	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
tr04	-0.0122***	(0.00369)	0.201	(0.230)	-4.931	(3.890)
tr05	-0.0119*	(0.00718)	0.0544	(0.186)	-4.659*	(2.410)
tr09	-0.0162***	(0.00301)	0.0421	(0.105)	-5.063**	(2.065)
tr10	-0.00602*	(0.00350)	0.0512	(0.172)	-4.749**	(2.276)
tr15	0.0129***	(0.00209)	0.0549	(0.192)	-4.714*	(2.690)
tr16	0.0193***	(0.00197)	0.0551	(0.200)	-4.638*	(2.814)
us08	-0.0175***	(0.00299)	0.269***	(0.0430)	0.604***	(0.0637)
us11	-0.00391*	(0.00224)	0.252***	(0.0399)	0.578***	(0.0755)
us26	-0.00476*	(0.00251)	0.252***	(0.0402)	0.596***	(0.0719)
us51	0.00930**	(0.00423)	0.249***	(0.0401)	0.615***	(0.0683)
us82	0.00810**	(0.00381)	0.252***	(0.0404)	0.555***	(0.0796)
us83	0.00689***	(0.00134)	0.252***	(0.0416)	0.543***	(0.0825)
us92	0.0137***	(0.00385)	0.263***	(0.0423)	0.560***	(0.0789)
us109	-0.00659**	(0.00308)	0.260***	(0.0405)	0.575***	(0.0729)

Table 5. 10. GARCH result of all news

After estimation made with GARCH (1,1) significant coefficients were calculated for variables of Chicago PMI, KC FED Manufacturing Index, S&P/CS HPI Composite - 20 S.A. and Trade Balance, which didn't have significant coefficients in the previous OLS estimations.

It can be concluded that the coefficients calculated for the overnight borrowing rate which is a domestic news, and the ISM Manufacturing PMI and GDP which are

foreign news, are actually inefficient. The coefficients are the same sign as those found in the OLS results.

The results of regression made with the method of GARCH (1,1) for positive news are shown in table 5.8.

Variable	Mean		L.arch		L.Garch	
	Coefficient	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
tr06	-0.0169***	(0.00378)	0.157***	(0.0169)	0.858***	(0.0137)
tr09	-0.0101**	(0.00484)	0.150***	(0.0158)	0.866***	(0.0120)
us02	-0.00135*	(0.000809)	0.142***	(0.0147)	0.874***	(0.0113)
us13	0.00865**	(0.00426)	0.149***	(0.0159)	0.867***	(0.0120)
us20	0.00354**	(0.00166)	0.151***	(0.0160)	0.866***	(0.0122)
us37	-0.00451*	(0.00243)	0.150***	(0.0159)	0.866***	(0.0121)
us50	-0.00796**	(0.00385)	0.150***	(0.0157)	0.866***	(0.0119)
us75	0.00125*	(0.000662)	0.145***	(0.0156)	0.871***	(0.0119)
us76	0.00125*	(0.000662)	0.145***	(0.0156)	0.871***	(0.0119)
us81	0.00598***	(0.00146)	0.141***	(0.0152)	0.874***	(0.0118)
us82	0.00510**	(0.00214)	0.147***	(0.0154)	0.868***	(0.0118)
us85	0.00125*	(0.000662)	0.145***	(0.0156)	0.871***	(0.0119)
us88	0.00125*	(0.000662)	0.145***	(0.0156)	0.871***	(0.0119)

Table 5. 11. GARCH result of positive news

From to the estimation results of GARCH (1,1) using positive news, it is observed that the coefficient calculated for overnight borrowing rate, overnight lending rate, and one-week repo rate from domestic variables, and for industrial production and CB Consumer from foreign variables are inefficient.

Significant coefficients are obtained using the GARCH (1,1) method for variables of NFIB small business optimism, existing home sales, KC FED Composite Index, Markit Composite PMI, Average Hourly Earnings, Average Weekly Hours, Nonfarm Payrolls, Unemployment Rate, Core CPI Index while insignificant coefficients were obtained for these variables using the OLS method.

Most of the variables that turn out to have significant coefficients have the expected sign. Only inflation and unemployment rate have unexpected signs, which can be due to the Zero Lower Bound Problem (ZLBP).

The results of the regression using the GARCH (1,1) method for negative news are shown in Table 5.9.

Variable	Mean		L.arch		L.Garch	
	Coefficient	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
tr06	-0.0149*	(0.00795)	0.145***	(0.0154)	0.871***	(0.0117)
tr09	-0.0149***	(0.00333)	0.161***	(0.0172)	0.858***	(0.0127)
tr13	0.00134*	(0.000765)	0.144***	(0.0154)	0.871***	(0.0124)
tr14	0.00129*	(0.000771)	0.144***	(0.0154)	0.871***	(0.0124)
tr15	0.00264***	(0.000830)	0.143***	(0.0153)	0.871***	(0.0125)
tr16	0.00449***	(0.000808)	0.141***	(0.0154)	0.872***	(0.0128)
us33	-0.00457***	(0.00119)	0.140***	(0.0150)	0.876***	(0.0116)
us50	0.00124***	(0.000413)	0.147***	(0.0161)	0.869***	(0.0119)
us55	-0.00129**	(0.000632)	0.148***	(0.0157)	0.868***	(0.0119)
us56	-0.00142**	(0.000629)	0.148***	(0.0157)	0.868***	(0.0119)
us73	-0.00153*	(0.000793)	0.146***	(0.0157)	0.870***	(0.0120)
us101	0.00536*	(0.00325)	0.149***	(0.0156)	0.868***	(0.0118)
us104	0.00417*	(0.00244)	0.148***	(0.0155)	0.868***	(0.0119)

Table 5. 12. GARCH result of negative news

Similar results were attained through the GARCH method as with the OLS for domestic news. While the sign of the coefficients remained the same, their sizes have changed. In other words, more efficient coefficients have been obtained through GARCH methodology.

It can be concluded that OLS has given inefficient coefficients for all variables except for the Import Price Index in foreign news. Variables having significant coefficients are the Export Price Index, Domestic Truck Sales, KC FED

Composite Index, Markit Composite PMI, Michigan Consumer Expectations, Michigan Current Conditions and Total Vehicle Sales.

5. 3. Effect of News by Country

In this part, I analyze the effect of domestic and foreign news on TL/$ exchange rate, after aggregating the one-hundred twenty-five various news variables based on the country they are related to. Then I want to look for the effect based on whether it is good news or bad of news. For that I aggregate news on each country with the distinction of good and bad news and make separate calculations for good news and bad news. Good news refers to news which cause a decrease in TL/$ exchange rate (i.e. an appreciation of the TL), while bad news represents news which created increase in TL/$ exchange rate (i.e. an appreciation of the US dollar). The separation is made based on the previous estimation results and economy theory. In addition to this, I separate the news surprises as having positive and negative values and made calculations again in order to estimate of effect of asymmetry.

5. 3. a. Result of OLS

Results received as a result of the estimations made using the regression equation

$$R_t = \alpha_q + \beta_q S_{qt} + \epsilon_t \qquad (6)$$

is shown in Table 5.10. As it can be seen from the results, I have obtained significant results for domestic news when considering all news, and good news; and for foreign news for good news and bad news. As expected in the study, good news related to Turkey have a negative effect on $/TL exchange rate causing an increase in the value of the Turkish Lira (i.e. an appreciation).

	Domestic News		Foreign News	
	Coefficient	R-squared	Coefficient	R-squared
All News	-0.00184*** (0.000669)	0.008	0.000201 (0.000207)	0.001
Good News	-0.00573*** (0.00105)	0.029	-0.00110*** (0.000342)	0.010
Bad News	0.00150 (0.00123)	0.001	0.00113*** (0.000282)	0.016

Table 5. 13. OLS result of news by country

I made an estimation that the main reason of increase at TL/$ exchange rate between 2013 and 2016, before the regression, was originated from domestic bad news. However, that the coefficient is insignificant did not verify my expectation. The reason of that case may be arisen from the equation which I try to calculate or the aggregating operation. I made regression again with significant variable or variables relevant to it for understanding whether it is arisen from equation. But this case may be derived from aggregating operation, in that I decided to differentiate actual and forecast when distinguishing news as good or bad. However, that actual value is lower than forecast value isn't bad news for each value. In this situation, the aggregating operation may have led up that the calculated coefficient became insignificant. Also, bad news having insignificant coefficient, as all news and good news have significant coefficient, is originated from the substantially number of observation. So, all news are forms in which bad and good news were merged.

I obtained similar results when repeating regressions by separating positive and negative news. (Table 5.11.)

I concluded that the effect of news with positive value after estimation made in order to research the asymmetric effect, or that actual value is higher than forecast value is not the same as the effect of news with negative value. Having followed Andersen et. al. (2003), I also concluded that news with negative value is more

effective than news with positive value. The absolute value of coefficients acquired after estimation made news with negative value of news surprises are more effective on TL/$ exchange rate because of the fact that they are larger than absolute value of coefficients acquired after calculations with positive ones.

	Domestic News		Foreign News	
	Coefficient	R^2	Coefficient	R^2
All News	-0.00184*** (0.000669)	0.008	0.000201 (0.000207)	0.001
All News(+)	-0.00342*** (0.000816)	0.017	0.000104 (0.000279)	0.000
All News(-)	0.00127 (0.00114)	0.017	0.000217 (0.000255)	0.001
Good News	-0.00573*** (0.00105)	0.029	-0.00110*** (0.000342)	0.010
Good News(+)	-0.00584*** (0.00121)	0.023	-0.000953** (0.000462)	0.004
Good News(-)	-0.00598*** (0.00223)	0.007	-0.000903** (0.000430)	0.004
Bad News	0.00150 (0.00123)	0.001	0.00113*** (0.000282)	0.016
Bad News(+)	-0.00451** (0.00196)	0.005	0.00100** (0.000415)	0.006
Bad News(-)	0.00515*** (0.00154)	0.011	0.00110*** (0.000365)	0.009

Table 5. 14. OLS result of news by country (symmetric)

5. 3. b. ARCH-LM Test

The ARCH-LM test should be checked before using the method of GARCH, which is a better method for the TL/$ exchange rate. Also, I did this test for all variables having significant coefficients. As a result of the test (Appendix 4), I concluded that I would get a better result with the method of GARCH for all variables.

5. 3. c. Result of GARCH

When the OLS is used method even though the GARCH method should to be used, OLS is consistent but inefficient. I repeated my analyse through the GARCH (1,1) method in order to obtain Efficient and consistent coefficients. GARCH adjusted the coefficients when it has the same result as OLS. New efficient and consistent coefficients calculated by this method are as follows. See Table 5.12. for GARCH result of Turkey news index and see table 5.13. for GARCH result of US news index.

	Mean		L.arch		L.Garch	
	Coef.	Std. Err.	Coef.	Std.Err.	Coef.	Std.Err.
All News	-0.0014***	(0.0004)	0.15***	(0.016)	0.87***	(0.012)
All News(+)	-0.0024***	(0.0006)	0.14***	(0.015)	0.88***	(0.011)
All News(-)	0.0003	(0.0007)	0.15***	(0.015)	0.87***	(0.012)
Good News	-0.0030***	(0.0006)	0.14***	(0.015)	0.88***	(0.012)
G. News(+)	-0.0029***	(0.0007)	0.14***	(0.015)	0.88***	(0.011)
G. News(-)	-0.0038**	(0.0016)	0.15***	(0.016)	0.86***	(0.012)
Bad News	0.0021**	(0.0008)	0.14***	(0.015)	0.87***	(0.012)
Bad News(+)	0.0013	(0.0029)	0.15***	(0.016)	0.87***	(0.012)
Bad News(-)	0.0022**	(0.0008)	0.142***	(0.015)	0.87***	(0.012)

Table 5. 15. GARCH result of Turkey news

It is appeared that good domestic news is more effective than bad domestic news on TL/$ exchange rate, after estimations made by using the method of GARCH. I observed that news with positive value don't have the same effect as news with negative value, or there is an asymmetric effect.

Foreign news is less effective than domestic news on TL/$ exchange rate. It is said that this effect wasn't seen for Turkey and Thailand in Cai et. al.'s (2009) study although this situation looks like contradicting with their study.

	Mean		L.arch		L.Garch	
	Coef.	Std. Err.	Coef.	Std.Err.	Coef.	Std.Err.
All News	0.0001	(0.0001)	0.15***	(0.015)	0.87***	(0.012)
All News (+)	1.52e-05	(0.0002)	0.15***	(0.016)	0.87***	(0.012)
All News (-)	0.0002	(0.0002)	0.15***	(0.015)	0.87***	(0.012)
Good News	-0.0006**	(0.0003)	0.15***	(0.016)	0.87***	(0.012)
G. News (+)	-0.0006*	(0.0004)	0.15***	(0.015)	0.87***	(0.012)
G. News (-)	-0.0004	(0.0003)	0.15***	(0.016)	0.87***	(0.012)
Bad News	0.0007***	(0.0002)	0.14***	(0.015)	0.88***	(0.011)
Bad News (+)	0.0006*	(0.0004)	0.14***	(0.015)	0.88***	(0.011)
Bad News (-)	0.0006**	(0.0003)	0.15***	(0.015)	0.87***	(0.012)

Table 5. 16. GARCH result of US news

5. 4. Effect of News by Volatility Expected

News should have a similar effect for reducing all news in country index, or a single index through the aggregating method, while calculating volatility expected.

However, the news of unemployment rate and the news of Truck Sales don't affect equally on economy. To solve this situation, I separate data in volatility expected level of them and keep on my analyses like this.

5. 4. a. Result of OLS

As the volatility expected level of data, news is divided in three different categories. The results of OLS obtained by evaluating the volatility expected level are showed in Table 5.14. Since there wasn't bad news which were in high volatility expected level in domestic events, a calculation couldn't be made for these values.

As remembered from table 4.3., final value of variables shows volatility expected. I tried to explicit the effect of volatility expected levels on TL/$ exchange rate according to estimation results. According to estimation results, domestic news has a greater significant level than foreign news. Also, it is appeared that domestic

news has larger coefficients than foreign news, for absolute value, if examining the size of calculated coefficients.

Variable	Good News		Bad News		All News	
	Coefficient	R^2	Coefficient	R^2	Coefficient	R^2
tr_11	-0.00470** (0.00189)	0.006	0.00230*** (0.00076)	0.017	0.00157 (0.00134)	0.001
tr_11(+)	-0.00393 (0.00244)	0.003	-0.00029 0.00124	0.001	-0.00193 (0.00211)	0.001
tr_11(-)	-0.00609** (0.00305)	0.004	0.00301*** (0.00085)	0.017	0.00394** (0.00173)	0.005
tr_12	-0.00792*** (0.00182)	0.019	0.00182 (0.00197)	0.001	-0.00244** (0.00114)	0.005
tr_12(+)	-0.00928*** (0.00225)	0.017	0.00123 (0.00338)	0.000	-0.00433*** (0.00159)	0.007
tr_12(-)	-0.00563* (0.00322)	0.003	0.00221 (0.00247)	0.001	-0.000505 (0.00167)	0.000
tr_13	-0.00636*** (0.00148)	0.018			-0.00636*** (0.00148)	0.018
tr_13(+)	-0.00638*** (0.00149)	0.018			-0.00638*** (0.00149)	0.018
tr_13(-)	-0.00367 (0.0113)	0.000			-0.00367 (0.0113)	0.000
us_11	-0.000937* (0.000516)	0.003	0.00116** (0.000500)	0.005	0.000135 (0.000345)	0.000
us_11(+)	-0.00139* (0.000783)	0.003	0.000905 (0.000688)	0.002	-0.000351 (0.000551)	0.000
us_11(-)	-0.000563 (0.000671)	0.001	0.00139* (0.000712)	0.004	0.000713 (0.000558)	0.001
us_12	-0.00191*** (0.000624)	0.009	0.00143*** (0.000516)	0.008	7.08e-05 (0.000392)	0.000
us_12(+)	-0.000928 (0.000890)	0.001	0.00132* (0.000777)	0.003	-8.87e-05 (0.000667)	0.000
us_12(-)	-0.00295*** (0.000889)	0.011	0.00140** (0.000665)	0.004	0.000229 (0.000589)	0.000
us_13	-0.000648 (0.000838)	0.001	0.00183*** (0.000674)	0.007	0.000907* (0.000541)	0.003
us_13(+)	-0.00139 (0.00117)	0.001	0.00221* (0.00114)	0.004	0.000424 (0.000912)	0.000
us_13(-)	0.000125 (0.00115)	0.000	0.00182** (0.000883)	0.004	0.00163** (0.000794)	0.003

Table 5. 17. OLS result of news by expected volatility level

When I analysed results as to volatility expected level, I observed that moderate volatility expected news are more effective on TL/$ exchange rate. The reason of is moderate volatility expected news are more effective than low volatility expected news. The reason for high volatility expected news is that the market thinks the effect is temporal. Owing to these reasons, it is appeared that events having the most effective on TL/$ exchange rate are moderate volatility expected news.

5. 4. b. ARCH-LM Test

I analysed whether the results of OLS which I thought also significant in this chapter have ARCH effect, as in previous chapter, with help of the ARCH-LM test.

As to this test, it concludes that all of significant equations obtained through the method of OLS have ARCH effect (Appendix 4). I research also the results of the model of GARCH to get better results.

5. 4. c. Result of GARCH

The results of regression which I made through the method of GARCH (1,1) are showed in Table 5.15.

Variable	Mean		L.arch		L.Garch	
	Coefficient	Std.Err.	Coef.	Std.Err.	Coef.	Std.Err.
tr_11_All(-)	0.0035***	(0.001)	0.15***	(0.016)	0.87***	(0.013)
tr_11_Bad	0.0055***	(0.001)	0.14***	(0.016)	0.87***	(0.013)
tr_11_Bad(-)	0.0058***	(0.001)	0.15***	(0.016)	0.87***	(0.013)
tr_12_All	-0.0021***	(0.001)	0.15***	(0.016)	0.87***	(0.012
tr_12_All(+)	-0.0028***	(0.001)	0.14***	(0.015)	0.88***	(0.011)
tr_12_Good	-0.0045***	(0.002)	0.14***	(0.015)	0.87***	(0.011)
tr_12_Good(-)	-0.0033*	(0.002)	0.15***	(0.016)	0.86***	(0.012)
tr_12_Good(+)	-0.0056***	(0.001)	0.13***	(0.014)	0.88***	(0.011)

us_11_Bad	0.0007*	(0.001)	0.14***	(0.015)	0.85***	(0.011)
us_11_Good(+)	-0.0011*	(0.001)	0.14***	(0.015)	0.87***	(0.012)
us_12_Bad	0.0012***	(0.001)	0.15***	(0.015)	0.87***	(0.011)
us_12_Bad(-)	0.0012***	(0.000)	0.15***	(0.016)	0.87***	(0.012)
us_12_Good	-0.0012***	(0.001)	0.15***	(0.016)	0.87***	(0.012)
us_12_Good(-)	-0.0017***	(0.001)	0.15***	(0.016)	0.87***	(0.012)

Table 5. 18. GARCH result of news by expected volatility level

As to results of estimation I made by using GARCH, it is appeared that estimations of the news having 3 star are actually inefficient. Similarly, it is also seen that data with 3 stars are inefficient for domestic news. After calculating using GARCH method, the calculated coefficients for other variables are the more corrected.

5. 5. Effect of News by Category

In this chapter, categorizations made by investing.com are analyzed. This category is more significant than the volatility expected level since similar news are gathered in the same category. In total, there are 11 categories, 5 of which are domestic and 6 are foreign.

5. 5. a. Result of OLS

I demonstrated significant results acquired as a consequence of the calculations in Table 5.16. See in Appendix 7 for all results. As to the regression results, domestic variables with significant coefficient are positive news of monetary policy (tr_2), all news of monetary policy (tr_2), negative news of positive news of economic activity (tr_4), all news of economic activity (tr_4), negative news of confidence index (tr_3), inflation (tr_6) and all news of inflation (tr_6); while foreign variables with significant

coefficient are positive news of monetary policy (us_2), negative news of employment (us_6) and all news of employment (us_6).

While the domestic news has a significant coefficient, similar result isn't acquired for foreign news. This reason is that a sufficient separation hasn't been still made for foreign news. For example, the category of economic activity consists of fifty-two different foreign news. Fifty-two different variables act differently, that is, that they create to different effects for exchange effects on calculations. For this reason, a method should be resorted for the best analysis result, as follows. Firstly, the results of estimation should be separately calculated for each variable. As to the results of estimation, news which show similar moves should be determined.

As a consequence of these determinations, categories should be formed. Hence, calculations may be made through new indexes created by aggregating of variables showing similar features. Otherwise, similar matters may be in each category.

Notwithstanding all these problems, categories such as inflation and monetary policy, which have a close relation with $/TL exchange rate, have significant coefficient. The indicators of variables are as expected.

Variable	Symmetry	Coefficient	Constant	R-squared
tr_2 (+)	Positive News	-0.00442*** (0.00103)	0.00184*** (0.00056)	0.018
tr_2	All News	-0.00425*** (0.00101)	0.00180*** (0.00056)	0.017
tr_3 (-)	Negative News	-0.0191** (0.00810)	0.00163** (0.00057)	0.006
tr_4 (+)	Positive News	-0.00665** (0.00288)	0.00194*** (0.00057)	0.005
tr_4	All News	-0.00601*** (0.00223)	0.00180*** (0.00056)	0.007
tr_6 (-)	Negative News	0.00300** (0.00143)	0.00189*** (0.00057)	0.004
tr_6	All News	0.00218* (0.00113)	0.00177*** (0.00056)	0.004

us_2 (+)	Positive News	0.0127* (0.00690)	0.00165*** (0.000566)	0.003
us_6 (-)	Negative News	0.00113* (0.000683)	0.00207*** (0.000597)	0.003
us_6	All News	0.00110** (0.000495)	0.00181*** (0.000564)	0.005

Table 5. 19. OLS results of news by category

5. 5. b. ARCH-LM Test

As in the previous chapters, I viewed whether the results of OLS which I thought significant in this chapter have an ARCH effect, through ARCH-LM Test.

As to this test, it concludes that all significant equations obtained by the method of OLS have an ARCH effect (Appendix 4). I also searched for the results of the model of GARCH to get better results.

5. 5. c. Result of GARCH

The results of regression using GARCH (1,1) estimation are showed in Table 5.17.

Variable	Mean		L.arch		L.Garch	
	Coefficient	Std. Err.	Coef.	Std.Err.	Coef.	Std.Err.
tr_2	-0.00281***	(0.0010)	0.269***	(0.030)	0.515***	(0.061)
tr_2 (+)	-0.00306***	(0.0011)	0.269***	(0.028)	0.516***	(0.061)
tr_4	-0.00453**	(0.0017)	0.275***	(0.030)	0.546***	(0.057)
tr_4 (+)	-0.00563**	(0.0025)	0.281***	(0.031)	0.507***	(0.060)
tr_6	0.00143**	(0.0007)	0.276***	(0.031)	0.492***	(0.062)
tr_6 (-)	0.00193***	(0.0006)	0.268***	(0.031)	0.502***	(0.062)
us_6	0.00103**	(0.0005)	0.291***	(0.032)	0.467***	(0.060)
us_6 (-)	0.00115**	(0.0006)	0.296***	(0.031)	0.464***	(0.061)

Table 5. 20. GARCH result of news by category

As to the results of estimation made with the method of GARCH, all the other variables except for the variable of foreign monetary policy maintained to be

significant. The method of GARCH regulated coefficients of the equations. Thereby, the calculated coefficients were recovered from being inefficient estimators.

CHAPTER VI

CONCLUSION

In this study, the effects of news surprises about a wide set of macro-economic variables on the TL/$ exchange rate in Turkey are researched using real-time data. We are considering both domestic and US related news surprises which is the unanticipated part of a macroeconomic announcement. In other words, news surprises are the difference between the market expectations before an announcement is made and the announcement itself.

In that regard, the reaction of the TL/$ exchange rate for the macro-economic news surprises results from change in expectations when macro fundamental announced in actual time and the pre-announcement expectations differ from each other. The analysis of the exchange rate behavior when expectations differ from market announcements will give us an understanding of exchange market behavior and hence has important implications for policy makers. It will also enable to better predict exchange rate behavior and aid in the design of policy directing expectations.

After estimation made with GARCH (1,1) significant coefficients were obtained for news surprises on Chicago purchasing managers index, Federal Reserve Bank of Kansas City manufacturing index, the Standard & Poor's Case–Shiller home price indices composite - 20 seasonal adjust and trade balance, which didn’t have significant coefficients using OLS method. From the estimation results of GARCH (1,1) and OLS using positive news surprises only, significant coefficients are obtained for overnight lending rate, one-week repo rate, gross domestic product, industrial production, PPI (MoM), PPI (YoY) among the domestic news surprises; and for goods trade balance, the Institute of Supply Management non-manufacturing business activity, jolts job openings among the foreign news surprises. It can be concluded that

the coefficients calculated using OLS method for domestic news surprises on overnight borrowing rate and the foreign news surprises on the Institute of Supply Management manufacturing purchasing managers index and GDP are actually inefficient for GARCH (1,1) method. The findings using the GARCH method for analyses of TL/$ exchange rate shows that the coefficients calculated through the OLS method are inefficient.

The results show that the most important factors affecting the TL/$ exchange rate are domestic inflation and monetary policy news surprises; and employment related US news surprises.

I have obtained same results as Anderson et. al. (2003) regarding the asymmetric effect of news surprises. Specifically, news surprises with negative value have a larger effect than surprises with a positive value on TL/$ exchange rate.

Contrary to the mainstream literature, domestic news is found to be more effective than foreign news on explaining movements of the TL/$ exchange rate between the 2013 and 2016 period. This finding is in line with Cai et. al. (2009) who show that US news were more effective than domestic news for developing countries except for Turkey and Thailand. Hence for Turkey I concluded that domestic news is more effective than the US news in changing the TL/$ exchange rate.

BIBLIOGRAPHY

Akar, C., & Çiçek, S. (2016). "New" monetary policy instruments and exchange rate volatility. Empirica, 43(1), 141-165.

Andersen, T. G., Bollerslev, T., Diebold, F. X., & Vega, C. (2003). Micro effects of macro announcements: Real-time price discovery in foreign exchange. American Economic Review, 93(1), 38-62.

Birz, G., & Lott, J. R. (2011). The effect of macroeconomic news on stock returns: New evidence from newspaper coverage. Journal of Banking & Finance, 35(11), 2791-2800.

Bollerslev, T. (1987). A conditionally heteroskedastic time series model for speculative prices and rates of return. The Review of Economics and Statistics, 542-547.

Brooks, C. (2008): "Introductory Econometrics of Finance." Cambridge: Cambridge University Press. 2nd edition. ISBN-13 978-0-511-39848-3.

Caporale, G. M., Spagnolo, F., & Spagnolo, N. (2016). Exchange Rates and Macro News in Emerging Markets.

Cheung, Y. W., Fatum, R., & Yamamoto, Y. (2017). The Exchange Rate Effects of Macro News after the Global Financial Crisis.

Eddelbüttel, D., & McCurdy, T. H. (1998). The impact of news on foreign exchange rates: evidence from high frequency data. Manuscript, Rotman School of Management, University of Toronto.

Ermisoglu, E., Oduncu, A., & Akcelik, Y. (2013). Rezerv Opsiyonu Mekanizması ve Kur Oynaklığı. CBT Research Notes in Economics, 1304, Research and Monetary Policy Department, Central Bank of the Republic of Turkey.

Fama, E. F. (2011). My life in finance. Annual Review of Financial Economics, 3(1), 1-15.

Galati, G., & Ho, C. (2003). Macroeconomic news and the euro/dollar exchange rate. Economic Notes, 32(3), 371-398.

Ghent, A. C. (2010). Why Do Markets React Badly to Good News? Evidence from Fed Funds Futures. Available at SSRN: https://ssrn.com/abstract=1153122 or http://dx.doi.org/10.2139/ssrn.1153122

Hyndman, R. J., & Athanasopoulos, G. (2014). Forecasting: principles and practice. OTexts. Available online at https://otexts.org/fpp

Joo, H., Zhang, Z., & Cai, F. (2009). The impact of macroeconomic announcements on real time foreign exchange rates in emerging markets. International Finance Discussion Papers 973, Board of Governors of the Federal Reserve System (U.S.).

Lott, J. R., & Hassett, K. A. (2014). Is newspaper coverage of economic events politically biased?. Public Choice, 160(1-2), 65-108.

Neely, C. J. (2011). A survey of announcement effects on foreign exchange volatility and jumps. Federal Reserve Bank of St. Louis Review, 93(5), 361-385.

Neely, C. J., & Dey, S. R. (2010). A survey of announcement effects on foreign exchange returns. Federal Reserve Bank of St. Louis Review, 92(5), 417-463.

Özlü, P., & Ünalmış, D. (2012). Makroekonomik Göstergelerin Döviz Kurları Üzerine Etkisi, CBT Research Notes in Economics, 1221, Research and Monetary Policy Department, Central Bank of the Republic of Turkey.

APPENDIX

Appendix 1. List of Turkey Events

Variable	Event Name	Category	Volatility Expected Level	Observation	Unit	Frequency
tr01	Current Account	Balance	1star	28	Billion USD	Monthly
tr02	Trade Balance	Balance	1star	39	Billion	Monthly
tr03	Overnight Borrowing Rate	Monetary Policy	3star	35	Percent	Monthly
tr04	Overnight Lending Rate	Monetary Policy	2star	36	Percent	Monthly
tr05	One-Week Repo Rate	Monetary Policy	3star	39	Percent	Monthly
tr06	Consumer Confidence	Confidence Index	1star	12	Index	Monthly
tr07	Manufacturing Confidence	Confidence Index	1star	3	Index	Monthly
tr08	Capacity Utilization Rate	Economic Activity	2star	8	Percent	Quarterly
tr09	Gross Domestic Product	Economic Activity	2star	15	Percent	Quarterly
tr10	Industrial Production	Economic Activity	1star	38	Percent	Monthly
tr11	Manufacturing Purchasing Managers Index	Economic Activity	1star	4	Index	Quarterly
tr12	3-month Jobless Average	Employment	2star	35	Percent	Monthly
tr13	Consumer Price Index (MoM)	Inflation	2star	46	Percent	Monthly
tr14	Consumer Price Index (YoY)	Inflation	2star	39	Percent	Monthly
tr15	Producer Price Index (MoM)	Inflation	1star	18	Percent	Monthly
tr16	Producer Price Index (YoY)	Inflation	1star	15	Percent	Monthly

Appendix 2. List of US Events

Variable	Event Name	Category	Volatility Expected Level	Observation	Unit	Frequency
us01	American Petroleum Institute Crude Oil Stock	Balance	2 star	165	Million	Weekly
us02	American Petroleum Institute Gasoline Stock	Balance	1 star	87	Million	Weekly
us03	Business Inventories	Balance	2 star	48	Percent	Monthly
us04	Crude Oil Inventories	Balance	3 star	209	Million	Weekly
us05	Current Account	Balance	2 star	16	Billion	Quarterly
us06	Federal Budget Balance	Balance	2 star	48	Billion	Monthly
us07	Gasoline Inventories	Balance	1 star	209	Million	Weekly
us08	Goods Trade Balance	Balance	2 star	16	Billion	Monthly
us09	Personal Income	Balance	1 star	48	Percent	Monthly
us10	Treasury International Capital Net Long-Term Transactions	Balance	2 star	45	Billion	Monthly
us11	Trade Balance	Balance	2 star	48	Billion	Monthly
us12	Wholesale Inventories	Balance	1 star	51	Percent	Monthly
us13	Chicago FED National Activity	Monetary Policy	1 star	39	Percent	Monthly
us14	FED Interest Rate Decision	Monetary Policy	3 star	32	Percent	Monthly
us15	Conference Board Consumer Confidence	Confidence Index	3 star	48	Index	Monthly
us16	Conference Board Leading Index	Confidence Index	1 star	48	Percent	Monthly
us17	The Investor's Business Daily/ TechnoMetrica Institute of Policy and Politics Economic Optimism	Confidence Index	1 star	48	Index	Monthly

us18	Michigan Consumer Sentiment	Confidence Index	2 star	96	Index	Weekly
us19	The National Association of Purchasing Managers Housing Market Index	Confidence Index	1 star	48	Index	Monthly
us20	National Federation of Independent Business Small Business Optimism	Confidence Index	1 star	48	Index	Monthly
us21	Consumer Credit	Credit	1 star	48	Billion	Monthly
us22	American Petroleum InstituteDistillates Stocks	Economic Activity	1 star	57	Million	Weekly
us23	Building Permits	Economic Activity	2 star	37	Percent	Monthly
us24	Building Permits	Economic Activity	3 star	47	Million	Monthly
us25	Capacity Utilization Rate	Economic Activity	1 star	48	Percent	Monthly
us26	Chicago Purchasing Managers Index	Economic Activity	2 star	48	Index	Monthly
us27	Construction Spending	Economic Activity	1 star	47	Percent	Monthly
us28	Core Durable Goods Orders	Economic Activity	3 star	48	Percent	Monthly
us29	Core Retail Sales	Economic Activity	3 star	48	Percent	Monthly
us30	Corporate Profits	Economic Activity	1 star	6	Percent	Quarterly
us31	Dallas FED Manufacturing Business Index	Economic Activity	1 star	40	Index	Monthly
us32	Domestic Car Sales	Economic Activity	1 star	11	Million	Monthly
us33	Domestic Truck Sales	Economic Activity	1 star	25	Million	Monthly
us34	Durable Goods Orders	Economic Activity	2 star	48	Percent	Monthly
us35	Durables Excluding Defense	Economic Activity	1 star	10	Percent	Monthly
us36	Energy Information Administration Distillates Stocks	Economic Activity	1 star	188	Million	Weekly
us37	Existing Home Sales	Economic Activity	3 star	48	Million	Monthly
us38	Existing Home Sales	Economic Activity	2 star	42	Percent	Monthly

us39	Factory Orders	Economic Activity	2 star	47	Percent	Monthly
us40	Gross Domestic Product	Economic Activity	3 star	48	Percent	Monthly
us41	Gross Domestic Product Price Index	Economic Activity	2 star	48	Percent	Monthly
us42	Gross Domestic Product Sales	Economic Activity	1 star	10	Percent	Quarterly
us43	Goods Orders Non Defense Ex Air	Economic Activity	1 star	39	Percent	Monthly
us44	Housing Starts	Economic Activity	2 star	46	Million	Monthly
us45	Housing Starts	Economic Activity	2 star	36	Percent	Monthly
us46	Industrial Production	Economic Activity	2 star	48	Percent	Monthly
us47	ISM Manufacturing PMI	Economic Activity	3 star	48	Index	Monthly
us48	The Institute of Supply Management Non-Manufacturing Employment	Economic Activity	2 star	71	Index	Weekly
us49	The Institute of Supply Management Non-Manufacturing Purchasing Managers Index	Economic Activity	3 star	48	Index	Monthly
us50	Federal Reserve Bank of Kansas City Composite Index	Economic Activity	1 star	26	Index	Monthly
us51	Federal Reserve Bank of Kansas City Manufacturing Index	Economic Activity	1 star	4	Index	Quarterly
us52	Manufacturing Purchasing Managers Index	Economic Activity	2 star	96	Index	Weekly
us53	Manufacturing Production	Economic Activity	1 star	28	Percent	Monthly
us54	Markit Composite Purchasing Managers Index	Economic Activity	2 star	8	Index	Monthly
us55	Michigan Consumer Expectations	Economic Activity	2 star	64	Index	Weekly
us56	Michigan Current Conditions	Economic Activity	1 star	71	Index	Weekly
us57	Natural Gas Storage	Economic Activity	1 star	207	Billion	Weekly

us58	New Home Sales	Economic Activity	3 star	47	Thousand	Monthly
us59	New Home Sales	Economic Activity	2 star	38	Thousand	Monthly
us60	Nonfarm Productivity	Economic Activity	2 star	32	Percent	Monthly
us61	New York Empire State Manufacturing Index	Economic Activity	2 star	48	Index	Monthly
us62	Pending Home Sales	Economic Activity	3 star	48	Percent	Monthly
us63	Personal Spending	Economic Activity	2 star	48	Percent	Monthly
us64	Philadelphia FED Manufacturing Index	Economic Activity	3 star	48	Index	Monthly
us65	Real Consumer Spending	Economic Activity	1 star	28	Percent	Monthly
us66	Real Personal Consumption	Economic Activity	1 star	15	Percent	Monthly
us67	Retail Control	Economic Activity	1 star	27	Percent	Monthly
us68	Retail Sales	Economic Activity	3 star	48	Percent	Monthly
us69	Retail Sales Ex Gas/Autos	Economic Activity	1 star	12	Percent	Monthly
us70	Richmond Manufacturing Index	Economic Activity	1 star	48	Index	Monthly
us71	The Standard & Poor's Case–Shiller Home Price Indices Composite - 20 N.S.A. (YoY)	Economic Activity	1 star	39	Percent	Monthly
us72	The Standard & Poor's Case–Shiller Home Price Indices Composite - 20 N.S.A (MoM)	Economic Activity	2 star	48	Percent	Monthly
us73	Total Vehicle Sales	Economic Activity	1 star	48	Million	Monthly
us74	Automatic Data Processing Nonfarm Employment Change	Employment	3 star	48	Thousand	Monthly
us75	Average Hourly Earnings	Employment	2 star	48	Percent	Monthly
us76	Average Weekly Hours	Employment	1 star	48	Hour	Monthly
us77	Continuing Jobless Claims	Employment	1 star	208	Thousand	Weekly

us78	Employment Cost Index	Employment	2 star	16	Percent	Quarterly
us79	FED Labor Market Conditions Index	Employment	1 star	13	Index	Monthly
us80	Initial Jobless Claims	Employment	2 star	209	Thousand	Weekly
us81	The Institute of Supply Management Manufacturing Employment	Employment	2 star	37	Index	Monthly
us82	The Institute of Supply Management Non-Manufacturing Business Activity	Employment	1 star	25	Index	Monthly
us83	Jolts Job Openings	Employment	3 star	41	Million	Monthly
us84	Manufacturing Payrolls	Employment	1 star	26	Thousand	Monthly
us85	Nonfarm Payrolls	Employment	3 star	48	Thousand	Monthly
us86	Private Nonfarm Payrolls	Employment	2 star	48	Thousand	Monthly
us87	Real Earnings	Employment	1 star	18	Percent	Monthly
us88	Unemployment Rate	Employment	3 star	48	Percent	Monthly
us89	Unit Labor Costs	Employment	2 star	32	Percent	Monthly
us90	Core Consumer Price Index (MoM)	Inflation	3 star	48	Percent	Monthly
us91	Core Consumer Price Index (YoY)	Inflation	2 star	48	Percent	Monthly
us92	Core Consumer Price Index, Non-Seasonal Adjust	Inflation	1 star	7	Index	Quarterly
us93	Core Personal Consumption Expenditure Price Index (MoM)	Inflation	2 star	48	Percent	Monthly
us94	Core Personal Consumption Expenditure Price Index (YoY)	Inflation	2 star	21	Percent	Monthly
us95	Core Personal Consumption Expenditure Prices	Inflation	1 star	10	Percent	Quarterly
us96	Core Producer Price Index (MoM)	Inflation	1 star	48	Percent	Monthly
us97	Core Producer Price Index (YoY)	Inflation	2 star	48	Percent	Monthly

us98	Consumer Price Index (MoM)	Inflation	1 star	48	Percent	Monthly
us99	Consumer Price Index (YoY)	Inflation	2 star	48	Percent	Monthly
us100	Consumer Price Index, Non-Seasonal Adjust	Inflation	1 star	28	Index	Monthly
us101	Export Price Index	Inflation	2 star	29	Percent	Monthly
us102	House Price Index(MoM)	Inflation	1 star	47	Percent	Monthly
us103	House Price Index (YoY)	Inflation	1 star	10	Percent	Monthly
us104	Import Price Index	Inflation	2 star	48	Percent	Monthly
us105	The Institute of Supply Management Manufacturing Prices	Inflation	1 star	48	Index	Monthly
us106	Personal Consumption Expenditure Prices	Inflation	1 star	10	Percent	Quarterly
us107	Producer Price Index (MoM)	Inflation	3 star	48	Percent	Monthly
us108	Producer Price Index (YoY)	Inflation	1 star	48	Percent	Monthly
us109	The Standard & Poor's Case–Shiller Home Price Indices Composite - 20 S.A	Inflation	1 star	27	Percent	Monthly

Appendix 3. List of Non-Business Days

Date	Name of non-business days	Duration
January 01, 2013	The new year's day's day	1 Day
April 23, 2013	National sovereignty and children's day	1 Day
May 01, 2013	Labor and solidarity day	1 Day
May 19, 2013	Commemoration of Atatürk youth and sports day	1 Day
Aug. 08-10, 2013	Ramadan feast	3 Day
August 30, 2013	Victory day	1 Day
Oct. 15-18, 2013	Sacrifice feast	4 Day
October 29, 2013	Republic day	1 Day
January 01, 2014	The new year's day	1 Day
April 23, 2014	National sovereignty and children's day	1 Day
May 01, 2014	Labor and solidarity day	1 Day
May 19, 2014	Commemoration of Atatürk youth and sports day	1 Day
July 28-30, 2014	Ramadan feast	3 Day
August 30, 2014	Victory day	1 Day
Oct. 04-07, 2014	Sacrifice feast	4 Day
October 29, 2014	Republic day	1 Day
January 01, 2015	The new year's day	1 Day
April 23, 2015	National sovereignty and children's day	1 Day
May 01, 2015	Labor and solidarity day	1 Day
May 19, 2015	Commemoration of Atatürk youth and sports day	1 Day
July 17-19, 2015	Ramadan feast	3 Day
August 30, 2015	Victory day	1 Day
Sep. 24-27, 2015	Sacrifice feast	4 Day
October 29, 2015	Republic day	1 Day
January 01, 2016	The new year's day	1 Day
April 23, 2016	National sovereignty and children's day	1 Day
May 01, 2016	Labor and solidarity day	1 Day
May 19, 2016	Commemoration of Atatürk youth and sports day	1 Day
July 05-07, 2016	Ramadan feast	3 Day
August 30, 2016	Victory day	1 Day
Sept. 12-15,2016	Sacrifice feast	4 Day
October 29, 2016	Republic day	1 Day

Appendix 4. LM Test for Autoregressive Conditional Heteroskedasticity

Variable Code	All News		Positive News		Negative News	
	Chi^2	$Prob>chi^2$	Chi^2	$Prob>chi^2$	Chi^2	$Prob>chi^2$
tr01	45.518	0.0000	45.413	0.0000	45.461	0.0000
tr02	45.294	0.0000	45.334	0.0000	45.331	0.0000
tr03	41.876	0.0000	41.962	0.0000	45.370	0.0000
tr04	42.088	0.0000	41.962	0.0000	45.370	0.0000
tr05	41.898	0.0000	41.962	0.0000	45.370	0.0000
tr06	43.468	0.0000	45.369	0.0000	41.348	0.0000
tr07	45.365	0.0000	45.370	0.0000	45.357	0.0000
tr08	45.536	0.0000	45.363	0.0000	45.495	0.0000
tr09	30.523	0.0000	43.100	0.0000	30.083	0.0000
tr10	45.885	0.0000	45.579	0.0000	45.598	0.0000
tr11	45.358	0.0000	45.359	0.0000	45.357	0.0000
tr12	45.352	0.0000	45.310	0.0000	45.369	0.0000
tr13	46.711	0.0000	45.401	0.0000	55.714	0.0000
tr14	45.701	0.0000	45.306	0.0000	56.734	0.0000
tr15	60.747	0.0000	45.600	0.0000	60.006	0.0000
tr16	69.090	0.0000	45.651	0.0000	64.831	0.0000
us01	45.224	0.0000	45.377	0.0000	47.426	0.0000
us02	45.363	0.0000	45.490	0.0000	45.346	0.0000
us03	45.416	0.0000	45.322	0.0000	44.866	0.0000
us04	45.712	0.0000	44.860	0.0000	45.369	0.0000
us05	45.205	0.0000	45.275	0.0000	44.920	0.0000
us06	45.970	0.0000	45.052	0.0000	45.356	0.0000
us07	45.323	0.0000	44.860	0.0000	43.937	0.0000
us08	45.971	0.0000	45.569	0.0000	45.525	0.0000
us09	45.360	0.0000	45.361	0.0000	45.353	0.0000
us10	45.045	0.0000	45.399	0.0000	45.165	0.0000
us100	45.378	0.0000	45.334	0.0000	45.389	0.0000
us101	44.736	0.0000	45.954	0.0000	45.137	0.0000
us102	44.901	0.0000	45.383	0.0000	45.941	0.0000
us103	45.347	0.0000	45.356	0.0000	45.240	0.0000
us104	44.988	0.0000	45.509	0.0000	45.125	0.0000
us105	45.321	0.0000	45.293	0.0000	45.398	0.0000
us106	45.337	0.0000	45.396	0.0000	45.373	0.0000
us107	45.596	0.0000	44.224	0.0000	44.997	0.0000
us108	45.641	0.0000	44.224	0.0000	44.997	0.0000
us109	45.341	0.0000	45.435	0.0000	45.404	0.0000

us11	46.196	0.0000	45.314	0.0000	45.003	0.0000
us12	45.631	0.0000	45.647	0.0000	45.503	0.0000
us13	45.399	0.0000	45.483	0.0000	45.357	0.0000
us14	45.356	0.0000	45.356	0.0000	45.391	0.0000
us15	45.151	0.0000	44.669	0.0000	45.450	0.0000
us16	45.430	0.0000	45.295	0.0000	44.438	0.0000
us17	45.115	0.0000	45.828	0.0000	45.046	0.0000
us18	44.678	0.0000	41.620	0.0000	44.825	0.0000
us19	45.451	0.0000	45.699	0.0000	45.346	0.0000
us20	45.382	0.0000	43.806	0.0000	45.960	0.0000
us21	44.405	0.0000	44.702	0.0000	45.064	0.0000
us22	45.368	0.0000	45.349	0.0000	45.367	0.0000
us23	45.345	0.0000	45.754	0.0000	45.045	0.0000
us24	45.318	0.0000	45.650	0.0000	44.993	0.0000
us25	45.409	0.0000	45.679	0.0000	45.113	0.0000
us26	45.496	0.0000	45.440	0.0000	45.578	0.0000
us27	45.513	0.0000	45.329	0.0000	45.195	0.0000
us28	45.317	0.0000	45.369	0.0000	45.548	0.0000
us29	45.293	0.0000	45.416	0.0000	44.997	0.0000
us30	45.574	0.0000	45.359	0.0000	45.226	0.0000
us31	45.400	0.0000	45.397	0.0000	45.348	0.0000
us32	45.360	0.0000	45.362	0.0000	45.376	0.0000
us33	45.344	0.0000	45.364	0.0000	45.680	0.0000
us34	44.494	0.0000	45.369	0.0000	45.403	0.0000
us35	45.393	0.0000	45.359	0.0000	45.457	0.0000
us36	45.356	0.0000	45.164	0.0000	45.548	0.0000
us37	45.353	0.0000	45.352	0.0000	45.044	0.0000
us38	45.348	0.0000	45.354	0.0000	45.316	0.0000
us39	45.419	0.0000	45.136	0.0000	45.344	0.0000
us40	45.611	0.0000	45.276	0.0000	45.386	0.0000
us41	45.333	0.0000	45.276	0.0000	44.920	0.0000
us42	45.356	0.0000	45.356	0.0000	43.274	0.0000
us43	46.088	0.0000	45.401	0.0000	43.274	0.0000
us44	45.413	0.0000	45.763	0.0000	45.363	0.0000
us45	45.733	0.0000	45.765	0.0000	44.993	0.0000
us46	45.018	0.0000	45.679	0.0000	45.113	0.0000
us47	45.371	0.0000	45.330	0.0000	45.195	0.0000
us48	45.314	0.0000	43.576	0.0000	45.312	0.0000
us49	43.536	0.0000	43.598	0.0000	45.405	0.0000

us50	45.283	0.0000	45.354	0.0000	45.417	0.0000
us51	45.367	0.0000	46.136	0.0000	45.518	0.0000
us52	45.328	0.0000	45.390	0.0000	45.217	0.0000
us53	45.392	0.0000	45.909	0.0000	44.366	0.0000
us54	45.390	0.0000	45.323	0.0000	44.539	0.0000
us55	45.384	0.0000	43.748	0.0000	45.432	0.0000
us56	44.542	0.0000	44.089	0.0000	45.543	0.0000
us57	45.784	0.0000	45.335	0.0000	44.942	0.0000
us58	45.368	0.0000	45.354	0.0000	45.273	0.0000
us59	45.349	0.0000	45.360	0.0000	45.230	0.0000
us60	45.324	0.0000	45.327	0.0000	45.439	0.0000
us61	45.723	0.0000	44.975	0.0000	45.741	0.0000
us62	44.422	0.0000	45.274	0.0000	42.465	0.0000
us63	45.309	0.0000	45.354	0.0000	45.450	0.0000
us64	45.331	0.0000	45.004	0.0000	45.068	0.0000
us65	45.862	0.0000	45.513	0.0000	43.493	0.0000
us66	45.423	0.0000	45.344	0.0000	45.448	0.0000
us67	45.368	0.0000	45.434	0.0000	45.222	0.0000
us68	45.103	0.0000	45.416	0.0000	45.226	0.0000
us69	45.415	0.0000	45.356	0.0000	45.414	0.0000
us70	45.261	0.0000	45.365	0.0000	43.968	0.0000
us71	45.396	0.0000	45.446	0.0000	43.602	0.0000
us72	45.082	0.0000	45.457	0.0000	42.911	0.0000
us73	45.634	0.0000	45.539	0.0000	45.384	0.0000
us74	45.357	0.0000	45.436	0.0000	45.690	0.0000
us75	45.335	0.0000	45.211	0.0000	45.503	0.0000
us76	45.185	0.0000	45.211	0.0000	45.503	0.0000
us77	44.901	0.0000	45.413	0.0000	44.954	0.0000
us78	45.361	0.0000	45.376	0.0000	45.064	0.0000
us79	45.305	0.0000	45.029	0.0000	45.431	0.0000
us80	45.657	0.0000	45.413	0.0000	44.952	0.0000
us81	46.648	0.0000	45.835	0.0000	45.304	0.0000
us82	43.631	0.0000	42.888	0.0000	45.610	0.0000
us83	52.399	0.0000	47.014	0.0000	46.662	0.0000
us84	45.118	0.0000	44.987	0.0000	45.820	0.0000
us85	45.648	0.0000	45.211	0.0000	45.503	0.0000
us86	45.655	0.0000	45.211	0.0000	45.503	0.0000
us87	45.344	0.0000	45.383	0.0000	45.356	0.0000
us88	45.386	0.0000	45.211	0.0000	45.507	0.0000

us89	45.300	0.0000	45.356	0.0000	44.974	0.0000
us90	45.413	0.0000	45.335	0.0000	45.369	0.0000
us91	45.416	0.0000	45.335	0.0000	45.369	0.0000
us92	45.386	0.0000	45.381	0.0000	45.349	0.0000
us93	45.320	0.0000	45.355	0.0000	45.337	0.0000
us94	45.283	0.0000	45.353	0.0000	45.359	0.0000
us95	45.263	0.0000	45.396	0.0000	45.373	0.0000
us96	45.093	0.0000	42.685	0.0000	45.350	0.0000
us97	45.724	0.0000	44.224	0.0000	44.998	0.0000
us98	45.397	0.0000	45.335	0.0000	45.369	0.0000
us99	45.372	0.0000	45.335	0.0000	45.407	0.0000
tr_1	45.343	0.0000	45.357	0.0000	45.337	0.0000
tr_2	41.921	0.0000	41.964	0.0000	45.371	0.0000
tr_3	43.549	0.0000	45.353	0.0000	41.486	0.0000
tr_4	39.372	0.0000	44.101	0.0000	41.084	0.0000
tr_5	45.352	0.0000	45.310	0.0000	45.369	0.0000
tr_6	51.644	0.0000	45.372	0.0000	53.723	0.0000
us_1	45.721	0.0000	45.366	0.0000	45.968	0.0000
us_2	45.399	0.0000	45.483	0.0000	45.357	0.0000
us_3	45.207	0.0000	45.165	0.0000	45.336	0.0000
us_4	44.405	0.0000	44.702	0.0000	45.064	0.0000
us_5	45.244	0.0000	45.352	0.0000	45.171	0.0000
us_6	47.180	0.0000	46.474	0.0000	46.296	0.0000
us_7	45.443	0.0000	45.010	0.0000	45.234	0.0000
tr_11	40.706	0.0000	43.362	0.0000	58.965	0.0000
tr_11_good	48.898	0.0000	41.751	0.0000	68.951	0.0000
tr_11_bad	43.571	0.0000	44.607	0.0000	43.151	0.0000
tr_12	43.052	0.0000	44.619	0.0000	44.549	0.0000
tr_12_good	45.026	0.0000	44.406	0.0000	45.218	0.0000
tr_12_bad	38.138	0.0000	44.755	0.0000	40.170	0.0000
tr_13	41.345	0.0000	41.345	0.0000	44.450	0.0000
tr_13_bad	41.345	0.0000	41.345	0.0000	44.450	0.0000
us_11	45.327	0.0000	45.370	0.0000	45.288	0.0000
us_11_good	45.022	0.0000	44.426	0.0000	44.629	0.0000
us_11_bad	44.752	0.0000	44.725	0.0000	44.724	0.0000
us_12	45.533	0.0000	45.191	0.0000	45.504	0.0000
us_12_good	46.415	0.0000	43.185	0.0000	44.825	0.0000
us_12_bad	42.052	0.0000	45.648	0.0000	45.069	0.0000
us_13	44.772	0.0000	45.495	0.0000	43.828	0.0000

us_13_good	43.490	0.0000	44.553	0.0000	44.450	0.0000
us_13_bad	44.524	0.0000	45.445	0.0000	42.784	0.0000
tr	36.169	0.0000	43.199	0.0000	51.142	0.0000
tr_good	37.159	0.0000	43.344	0.0000	39.373	0.0000
tr_bad	49.761	0.0000	44.567	0.0000	61.077	0.0000
us	45.690	0.0000	45.652	0.0000	45.091	0.0000
us_good	44.623	0.0000	44.122	0.0000	45.831	0.0000
us_bad	46.575	0.0000	46.943	0.0000	44.722	0.0000

H0: no ARCH effects vs. H1: ARCH(p) disturbance

Appendix 5. OLS Result of Events

Variable	Positive News		Negative News		All News	
	Coefficient	R^2	Coefficient	R^2	Coefficient	R^2
tr01	0.00321 (0.00566)	0.000	0.00245 (0.00429)	0.000	0.00251 (0.00364)	0.002
tr02	-0.00152 (0.00395)	0.000	-0.00304 (0.00430)	0.000	-0.00220 (0.00311)	0.002
tr03	-0.0044*** (0.00102)	0.018	0.00201 (0.00629)	0.000	-0.0125*** (0.00313)	0.060
tr04	-0.0044*** (0.00102)	0.018	0.00201 (0.00629)	0.000	-0.0111*** (0.00315)	0.047
tr05	-0.0044*** (0.00102)	0.018	0.000210 (0.00264)	0.000	-0.0119*** (0.00301)	0.058
tr06	0.00117 (0.00102)	0.000	-0.0204** (0.00831)	0.006	-0.00787 (0.00571)	0.007
tr07	-0.00703 (0.0129)	0.000	0.000686 (0.00102)	0.000	-0.00527 (0.0130)	0.001
tr08	0.00178 (0.0111)	0.000	0.0165** (0.00817)	0.004	0.0110 (0.00701)	0.010
tr09	-0.0119* (0.00651)	0.003	-0.0206*** (0.00673)	0.009	-0.0158*** (0.00492)	0.039
tr10	-0.00691* (0.00356)	0.004	0.000263 (0.000896)	0.000	-0.00608* (0.00309)	0.015
tr11	0.000867 (0.00932)	0.000	-0.000380 (0.000996)	0.000	0.00117 (0.00941)	0.000
tr12	0.00125 (0.00685)	0.000	0.000428 (0.00326)	0.000	0.000224 (0.00316)	0.000
tr13	-0.000103 (0.00176)	0.000	0.00332** (0.00138)	0.006	-0.00259 (0.00285)	0.003
tr14	0.000121 (0.00178)	0.000	0.00368*** (0.00142)	0.007	0.00122 (0.00311)	0.001
tr15	-0.000590 (0.00252)	0.000	0.00681*** (0.00175)	0.015	0.0129*** (0.00422)	0.036
tr16	-0.000726 (0.00254)	0.000	0.00191* (0.00106)	0.003	0.0193*** (0.00436)	0.072
us01	3.84e-05 (0.000961)	0.000	-0.00209* (0.00108)	0.004	-0.00224 (0.00140)	0.003
us02	-0.00171 (0.00126)	0.002	0.000571 (0.00133)	0.000	-8.33e-05 (0.00196)	0.000

us03	-0.000152 (0.00240)	0.000	0.00168 (0.00294)	0.000	-0.000728 (0.00259)	0.000
us04	-0.00114 (0.000834)	0.002	0.000582 (0.000887)	0.000	-0.000646 (0.00125)	0.000
us05	0.00201 (0.00386)	0.000	-0.000165 (0.00558)	0.000	-0.00388 (0.00461)	0.001
us06	-0.00110 (0.00160)	0.000	0.00238 (0.00259)	0.001	0.00170 (0.00249)	0.001
us07	-0.00114 (0.000834)	0.002	0.000582 (0.000887)	0.000	0.000230 (0.00124)	0.000
us08	0.00244 (0.00312)	0.001	-0.0102** (0.00419)	0.006	-0.00884* (0.00458)	0.004
us09	-0.000920 (0.00326)	0.000	-0.000598 (0.00113)	0.000	-0.000587 (0.00261)	0.000
us10	0.000533 (0.00218)	0.000	-0.00116 (0.00243)	0.000	-0.00229 (0.00263)	0.001
us100	-0.000833 (0.00143)	0.000	0.00722** (0.00363)	0.004	-0.00229 (0.00331)	0.001
us101	-0.00217 (0.00317)	0.000	0.00384 (0.00277)	0.002	0.00519 (0.00346)	0.002
us102	-0.00318 (0.00236)	0.002	-0.000426 (0.00201)	0.000	-0.00233 (0.00261)	0.001
us103	0.000177 (0.00410)	0.000	-0.00147 (0.00476)	0.000	0.00156 (0.00491)	0.000
us104	-0.000555 (0.00281)	0.000	-0.00508 (0.00507)	0.001	0.00177 (0.00260)	0.001
us105	-0.00128 (0.00354)	0.000	0.00324 (0.00304)	0.001	-0.00114 (0.00267)	0.000
us106	-0.00717 (0.00707)	0.001	0.00223* (0.00124)	0.003	-0.000675 (0.00556)	0.000
us107	-0.00169 (0.00148)	0.001	0.00191* (0.00106)	0.003	0.00266 (0.00260)	0.001
us108	-0.00169 (0.00148)	0.001	0.000279 (0.000793)	0.000	0.00179 (0.00261)	0.001
us109	0.00561 (0.00559)	0.001	-0.000152 (0.00142)	0.000	-0.00552 (0.00349)	0.003
us11	0.000221 (0.00249)	0.000	-0.00235 (0.00169)	0.002	-0.00340 (0.00260)	0.002
us12	0.000891 (0.00210)	0.000	-0.00216 (0.00222)	0.001	0.00100 (0.00256)	0.000

us13	0.0127* (0.00690)	0.003	-0.000515 (0.00306)	0.000	0.00164 (0.00277)	0.000
us14	-	0.000	-	0.000	-	0.000
us15	0.00611* (0.00344)	0.003	-0.00458 (0.00400)	0.001	0.00169 (0.00264)	0.000
us16	0.00247 (0.00278)	0.001	-0.00401 (0.00399)	0.001	0.000301 (0.00261)	0.000
us17	-0.00347 (0.00388)	0.001	0.00414* (0.00234)	0.003	-0.000902 (0.00260)	0.000
us18	-0.00401 (0.00247)	0.003	-0.000197 (0.000877)	0.000	-0.000871 (0.00184)	0.000
us19	-0.00328 (0.00381)	0.001	0.000280 (0.000679)	0.000	-0.000996 (0.00262)	0.000
us20	0.00612 (0.00403)	0.002	-0.000796 (0.000892)	0.001	-6.59e-05 (0.00250)	0.000
us21	0.00336 (0.00295)	0.001	0.00269 (0.00554)	0.000	0.00317 (0.00258)	0.002
us22	0.000305 (0.000866)	0.000	0.000320 (0.00161)	0.000	0.000669 (0.00235)	0.000
us23	0.00198 (0.00132)	0.002	-0.000794 (0.00113)	0.000	-0.000155 (0.00359)	0.000
us24	0.00163 (0.00126)	0.002	-0.00104 (0.00107)	0.001	-0.000466 (0.00302)	0.000
us25	-0.000623 (0.00116)	0.000	0.000263 (0.000896)	0.000	-0.000342 (0.00258)	0.000
us26	0.000509 (0.00162)	0.000	-0.000558 (0.00123)	0.000	-0.00331 (0.00260)	0.002
us27	-0.000989 (0.00135)	0.001	0.000455 (0.00137)	0.000	-0.00107 (0.00261)	0.000
us28	-0.000232 (0.000840)	0.000	0.000132 (0.000895)	0.000	-7.47e-05 (0.00253)	0.000
us29	-0.000533 (0.00124)	0.000	0.000182 (0.000832)	0.000	0.000383 (0.00253)	0.000
us30	0.000256 (0.00249)	0.000	0.000879 (0.00177)	0.000	-0.00477 (0.00713)	0.000
us31	0.000854 (0.00165)	0.000	-0.000460 (0.00163)	0.000	0.000520 (0.00274)	0.000
us32	-0.000244 (0.00188)	0.000	-0.00329 (0.00310)	0.001	-0.000327 (0.00511)	0.000

us33	0.000110 (0.00173)	0.000	0.00131 (0.00171)	0.001	0.000749 (0.00323)	0.000
us34	-0.000232 (0.000840)	0.000	0.000132 (0.000895)	0.000	-0.00219 (0.00259)	0.001
us35	0.000683 (0.00222)	0.000	-0.00122 (0.00162)	0.001	-0.00264 (0.00467)	0.000
us36	0.000305 (0.000779)	0.000	0.00109 (0.000723)	0.002	-8.45e-06 (0.00133)	0.000
us37	6.79e-05 (0.00130)	0.000	-0.000120 (0.00117)	0.000	0.00163 (0.00260)	0.000
us38	2.33e-05 (0.00132)	0.000	-3.46e-05 (0.00120)	0.000	0.00134 (0.00278)	0.000
us39	0.00188 (0.00161)	0.001	0.000323 (0.00182)	0.000	0.000755 (0.00257)	0.000
us40	-0.000309 (0.00136)	0.000	0.00133 (0.000984)	0.002	0.00453* (0.00271)	0.003
us41	-0.000309 (0.00136)	0.000	0.00133 (0.000984)	0.002	0.00113 (0.00263)	0.000
us42	-4.23e-06 (0.00236)	0.000	0.000769 (0.00157)	0.000	0.000144 (0.00498)	0.000
us43	-0.000579 (0.000977)	0.000	0.000117 (0.000922)	0.000	0.00237 (0.00283)	0.001
us44	0.00195 (0.00128)	0.002	-0.00104 (0.00107)	0.001	0.000775 (0.00272)	0.000
us45	0.00205 (0.00136)	0.002	-0.000789 (0.00113)	0.000	0.00215 (0.00299)	0.001
us46	-0.000623 (0.00116)	0.000	0.000953 (0.00102)	0.001	0.00166 (0.00258)	0.000
us47	-0.00101 (0.00135)	0.001	0.000968 (0.00276)	0.000	-0.000277 (0.00260)	0.000
us48	0.00223** (0.00110)	0.004	0.000627 (0.00194)	0.000	0.00251 (0.00213)	0.002
us49	0.00198 (0.00134)	0.002	0.0128** (0.00521)	0.006	0.00611** (0.00266)	0.006
us50	4.14e-05 (0.00139)	0.000	0.00227 (0.00365)	0.000	-0.00418 (0.00356)	0.002
us51	-0.00698* (0.00398)	0.003	0.00464 (0.0356)	0.000	0.00118 (0.00727)	0.000
us52	-0.000361 (0.000847)	0.000	0.00113 (0.00114)	0.001	-9.17e-05 (0.00191)	0.000

us53	-0.00104 (0.00129)	0.001	-0.00440 (0.00421)	0.001	-0.000540 (0.00344)	0.000
us54	0.00282 (0.00324)	0.001	-7.86e-05 (0.000908)	0.000	0.00172 (0.00662)	0.000
us55	-0.00130 (0.000993)	0.002	0.00251 (0.00242)	0.001	0.000141 (0.00226)	0.000
us56	-0.00112 (0.000996)	0.001	0.00111 (0.00368)	0.000	-0.00127 (0.00224)	0.000
us57	0.000658 (0.000705)	0.001	-0.000346 (0.00109)	0.000	0.000787 (0.00127)	0.000
us58	0.000393 (0.000911)	0.000	-0.000537 (0.00118)	0.000	-0.000897 (0.00274)	0.000
us59	0.000604 (0.00104)	0.000	0.000279 (0.000793)	0.000	0.000727 (0.00286)	0.000
us60	0.000245 (0.00168)	0.000	-0.00335 (0.00217)	0.002	0.00225 (0.00320)	0.001
us61	0.00127 (0.00142)	0.001	0.00201 (0.00629)	0.000	-0.00300 (0.00255)	0.002
us62	-0.00101 (0.00173)	0.000	-0.000584 (0.00334)	0.000	0.000616 (0.00259)	0.000
us63	6.93e-05 (0.00118)	0.000	-0.00152 (0.00117)	0.002	0.000907 (0.00272)	0.000
us64	0.00154 (0.00120)	0.002	0.00481*** (0.00157)	0.009	0.000446 (0.00268)	0.000
us65	0.000604 (0.00193)	0.000	3.87e-05 (0.00436)	0.000	-0.00134 (0.00355)	0.000
us66	0.000408 (0.00173)	0.000	0.000190 (0.000895)	0.000	-0.00411 (0.00471)	0.001
us67	-0.000648 (0.00134)	0.000	0.000182 (0.000832)	0.000	-6.05e-05 (0.00329)	0.000
us68	-0.000533 (0.00124)	0.000	-0.000578 (0.00119)	0.000	0.00155 (0.00256)	0.000
us69	-8.38e-06 (0.00247)	0.000	-0.000842 (0.00108)	0.001	-0.00264 (0.00531)	0.000
us70	8.33e-05 (0.000858)	0.000	-0.00257* (0.00135)	0.004	-0.000840 (0.00261)	0.000
us71	0.000482 (0.000998)	0.000	-0.00292** (0.00129)	0.005	0.00185 (0.00301)	0.000
us72	0.000556 (0.000981)	0.000	-0.00871*** (0.00319)	0.007	-0.00252 (0.00271)	0.001

us73	-0.000174 (0.00107)	0.000	-0.00315 (0.00255)	0.002	-0.000714 (0.00265)	0.000
us74	-0.000187 (0.00224)	0.000	0.00269 (0.00240)	0.001	-9.18e-05 (0.00263)	0.000
us75	0.00128 (0.00109)	0.001	0.000279 (0.000793)	0.000	-0.000150 (0.00251)	0.000
us76	0.00128 (0.00109)	0.001	0.000279 (0.000793)	0.000	0.00179 (0.00256)	0.001
us77	0.000172 (0.000999)	0.000	0.000949 (0.00102)	0.001	0.00106 (0.00126)	0.001
us78	-0.00140 (0.00504)	0.000	0.00312 (0.00408)	0.001	0.000987 (0.00459)	0.000
us79	-0.0139 (0.0112)	0.002	0.00136 (0.00418)	0.000	-0.00234 (0.00452)	0.000
us80	0.000172 (0.000999)	0.000	-0.000518 (0.00261)	0.000	0.000905 (0.00126)	0.001
us81	0.00253 (0.00300)	0.001	0.000456 (0.00137)	0.000	0.00295 (0.00303)	0.001
us82	0.00876** (0.00341)	0.007	-0.00129 (0.00112)	0.001	0.0105*** (0.00369)	0.009
us83	0.00163 (0.00294)	0.000	0.000252 (0.00153)	0.000	0.00608** (0.00278)	0.005
us84	0.00129 (0.00136)	0.001	-0.00211 (0.0260)	0.000	0.00127 (0.00353)	0.000
us85	0.00128 (0.00109)	0.001	0.00144 (0.00248)	0.000	0.00299 (0.00260)	0.001
us86	0.00128 (0.00109)	0.001	0.00124 (0.00115)	0.001	0.00302 (0.00260)	0.001
us87	-0.000694 (0.00275)	0.000	-0.00238 (0.00243)	0.001	0.000276 (0.00429)	0.000
us88	0.00128 (0.00109)	0.001	0.000279 (0.000793)	0.000	9.91e-05 (0.00248)	0.000
us89	6.81e-06 (0.00318)	0.000	0.00188 (0.00231)	0.001	0.00193 (0.00320)	0.000
us90	-0.000217 (0.00116)	0.000	-0.000256 (0.000842)	0.000	-0.00184 (0.00258)	0.001
us91	-0.000217 (0.00116)	0.000	-0.000256 (0.000842)	0.000	-0.00184 (0.00259)	0.001
us92	0.000335 (0.00218)	0.000	0.000478 (0.00181)	0.000	0.00193 (0.00714)	0.000

us93	0.000618 (0.00262)	0.000	0.000809 (0.00186)	0.000	0.00106 (0.00253)	0.000
us94	0.00120 (0.00296)	0.000	-4.31e-05 (0.00269)	0.000	0.00280 (0.00393)	0.001
us95	-0.00717 (0.00707)	0.001	0.000210 (0.00264)	0.000	-0.00426 (0.00687)	0.000
us96	-0.00437 (0.00284)	0.002	-0.000540 (0.000971)	0.000	-0.00329 (0.00787)	0.000
us97	-0.00169 (0.00148)	0.001	0.00191* (0.00106)	0.003	0.00228 (0.00259)	0.001
us98	-0.000217 (0.00116)	0.000	-0.000256 (0.000842)	0.000	0.00112 (0.00259)	0.000
us99	-0.000217 (0.00116)	0.000	-0.000256 (0.000842)	0.000	0.000224 (0.00252)	0.000

Standard errors in parentheses and *** p<0.01, ** p<0.05, * p<0.1

Appendix 6. GARCH Result of Events

Variable Code	Mean		L.arch		L.Garch	
	Coefficient	Standard Error	Coefficient.	Standard Error	Coefficient.	Standard Error
tr01	0.00327	(0.0057)	0.0530	(0.166)	-4.862**	(2.165)
tr02	-0.00178	(0.0093)	0.0559	(0.187)	-4.772**	(2.281)
tr03	-0.0125	(0.0114)	0.0548	(0.192)	-4.661*	(2.436)
tr04	-0.0122***	(0.0036)	0.201	(0.230)	-4.931	(3.890)
tr05	-0.0119*	(0.0072)	0.0544	(0.186)	-4.659*	(2.410)
tr06	-0.00543	(0.0035)	0.0274	(0.173)	-4.754**	(2.336)
tr07	-0.00538	(0.1980)	0.0564	(0.188)	-4.758**	(2.290)
tr08	0.0110	(0.0115)	0.0566	(0.190)	-4.750**	(2.310)
tr09	-0.0162***	(0.0030)	0.0421	(0.105)	-5.063**	(2.065)
tr10	-0.00602*	(0.0035)	0.0512	(0.172)	-4.749**	(2.276)
tr11	0.000753	(0.0222)	0.0546	(0.181)	-4.780**	(2.281)
tr12	0.000441	(0.0049)	0.0548	(0.182)	-4.787**	(2.279)
tr13	-0.00299	(0.0036)	0.0543	(0.171)	-4.845**	(2.382)
tr14	0.000608	(0.0046)	0.0544	(0.181)	-4.751**	(2.344)
tr15	0.0129***	(0.0020)	0.0549	(0.192)	-4.714*	(2.690)
tr16	0.0193***	(0.0019)	0.0551	(0.200)	-4.638*	(2.814)
us01	-0.00190	(0.0012)	0.242***	(0.039)	0.615***	(0.070)
us02	-0.000717	(0.0025)	0.245***	(0.039)	0.595***	(0.073)
us03	-0.00168	(0.0028)	0.248***	(0.039)	0.594***	(0.074)
us04	-0.000584	(0.0015)	0.245***	(0.039)	0.591***	(0.074)
us05	-0.00174	(0.0050)	0.245***	(0.040)	0.593***	(0.074)
us06	0.00133	(0.0037)	0.245***	(0.039)	0.587***	(0.074)

us07	0.000236	(0.0012)	0.245***	(0.039)	0.594***	(0.073)
us08	-0.0175***	(0.0029)	0.269***	(0.043)	0.604***	(0.063)
us09	-0.000499	(0.0031)	0.245***	(0.039)	0.595***	(0.073)
us10	-0.00168	(0.0017)	0.245***	(0.039)	0.593***	(0.074)
us100	-0.00171	(0.0064)	0.244***	(0.039)	0.599***	(0.073)
us101	0.00661	(0.0075)	0.243***	(0.039)	0.602***	(0.072)
us102	-0.00129	(0.0030)	0.244***	(0.039)	0.598***	(0.073)
us103	0.00108	(0.0080)	0.245***	(0.039)	0.592***	(0.074)
us104	0.00175	(0.0029)	0.243***	(0.039)	0.600***	(0.073)
us105	-0.00104	(0.0029)	0.249***	(0.040)	0.579***	(0.074)
us106	-0.00114	(0.0174	0.246***	(0.039)	0.592***	(0.074)
us107	0.00240	(0.0020)	0.248***	(0.040)	0.581***	(0.076)
us108	0.00230	(0.0021)	0.249***	(0.040)	0.580***	(0.076)
us109	-0.00659**	(0.0030)	0.260***	(0.040)	0.575***	(0.072)
us11	-0.00391*	(0.0022)	0.252***	(0.039)	0.578***	(0.075)
us12	-0.000723	(0.0021)	0.244***	(0.039)	0.602***	(0.072)
us13	0.00233	(0.0038)	0.247***	(0.040)	0.594***	(0.074)
us14	-	(0.0000)	-	(0.000)	-	(0.000)
us15	0.00241	(0.0019)	0.240***	(0.039)	0.614***	(0.072)
us16	0.00176	(0.0033)	0.247***	(0.040)	0.591***	(0.073)
us17	-6.27e-05	(0.0019)	0.246***	(0.040)	0.592***	(0.075)
us18	-0.00106	(0.0018)	0.251***	(0.040)	0.580***	(0.076)
us19	-0.00156	(0.0033)	0.247***	(0.040)	0.590***	(0.074)
us20	-0.000737	(0.0019)	0.246***	(0.039)	0.591***	(0.074)
us21	0.000390	(0.0023)	0.244***	(0.039)	0.598***	(0.074)
us22	0.00119	(0.0027)	0.244***	(0.039)	0.603***	(0.072)

us23	0.000390	(0.0050)	0.246***	(0.039)	0.592***	(0.074)
us24	0.000637	(0.0045)	0.246***	(0.039)	0.592***	(0.074)
us25	-0.00115	(0.0029)	0.245***	(0.039)	0.593***	(0.073)
us26	-0.00476*	(0.0025)	0.252***	(0.040)	0.596***	(0.071)
us27	-0.00162	(0.0016)	0.247***	(0.039)	0.588***	(0.074)
us28	0.00176	(0.0024)	0.245***	(0.040)	0.596***	(0.073)
us29	-3.89e-05	(0.0038)	0.245***	(0.040)	0.593***	(0.074)
us30	-0.00694	(0.0072)	0.249***	(0.040)	0.582***	(0.074)
us31	0.000462	(0.0025)	0.246***	(0.040)	0.589***	(0.074)
us32	-0.000134	(0.0053)	0.245***	(0.039)	0.593***	(0.074)
us33	0.00348	(0.0034)	0.246***	(0.039)	0.607***	(0.071)
us34	-0.000701	(0.0023)	0.244***	(0.040)	0.599***	(0.073)
us35	-0.00262	(0.0047)	0.246***	(0.039)	0.586***	(0.074)
us36	6.62e-05	(0.0012)	0.245***	(0.039)	0.594***	(0.074)
us37	0.000275	(0.0033)	0.245***	(0.039)	0.592***	(0.074)
us38	-7.19e-05	(0.0034)	0.245***	(0.039)	0.593***	(0.074)
us39	0.000671	(0.0027)	0.244***	(0.039)	0.600***	(0.073)
us40	0.00311	(0.0024)	0.244***	(0.039)	0.603***	(0.071)
us41	0.000111	(0.0014)	0.245***	(0.039)	0.594***	(0.074)
us42	0.00188	(0.0105	0.245***	(0.039)	0.593***	(0.074)
us43	0.00396	(0.0029)	0.248***	(0.040)	0.589***	(0.074)
us44	0.00205	(0.0030)	0.245***	(0.039)	0.595***	(0.074)
us45	0.00357	(0.0028)	0.246***	(0.040)	0.599***	(0.074)
us46	-0.000234	(0.0033)	0.246***	(0.039)	0.593***	(0.074)
us47	-0.000402	(0.0034)	0.245***	(0.039)	0.594***	(0.074)
us48	0.00254	(0.0020)	0.244***	(0.040)	0.591***	(0.075)

us49	0.00394	(0.0026)	0.243***	(0.039)	0.583***	(0.077)
us50	-0.00466	(0.0037)	0.240***	(0.039)	0.616***	(0.070)
us51	0.00930**	(0.0042)	0.249***	(0.040)	0.615***	(0.068)
us52	0.000846	(0.0017)	0.245***	(0.039)	0.600***	(0.073)
us53	-0.00383	(0.0031)	0.250***	(0.039)	0.595***	(0.072)
us54	0.00179	(0.0148	0.246***	(0.039)	0.592***	(0.074)
us55	2.45e-05	(0.0020)	0.245***	(0.040)	0.593***	(0.076)
us56	-0.00239	(0.0019)	0.255***	(0.040)	0.567***	(0.077)
us57	0.000893	(0.0015)	0.246***	(0.039)	0.588***	(0.075)
us58	-0.00211	(0.0015)	0.237***	(0.039)	0.640***	(0.065)
us59	-0.000808	(0.0021)	0.243***	(0.039)	0.608***	(0.071)
us60	0.00155	(0.0058)	0.241***	(0.039)	0.602***	(0.073)
us61	-0.00244	(0.0016)	0.243***	(0.039)	0.604***	(0.073)
us62	-0.00322	(0.0022)	0.251***	(0.040)	0.588***	(0.073)
us63	0.000252	(0.0025)	0.246***	(0.039)	0.593***	(0.074)
us64	-0.000585	(0.0024)	0.246***	(0.039)	0.592***	(0.074)
us65	-0.00209	(0.0023)	0.245***	(0.039)	0.597***	(0.073)
us66	-0.00513	(0.0048)	0.244***	(0.039)	0.594***	(0.074)
us67	-2.51e-05	(0.0040)	0.245***	(0.040)	0.593***	(0.074)
us68	0.00127	(0.0038)	0.244***	(0.040)	0.597***	(0.075)
us69	-0.00216	(0.0065)	0.245***	(0.039)	0.594***	(0.075)
us70	-0.000372	(0.0028)	0.245***	(0.039)	0.594***	(0.074)
us71	0.000851	(0.0036)	0.247***	(0.039)	0.588***	(0.074)
us72	-0.00289	(0.0025)	0.248***	(0.039)	0.593***	(0.073)
us73	-4.98e-05	(0.0024)	0.245***	(0.039)	0.593***	(0.074)
us74	0.000900	(0.0025)	0.246***	(0.039)	0.594***	(0.074)

us75	0.000206	(0.0016)	0.245***	(0.040)	0.592***	(0.074)
us76	0.00105	(0.0030)	0.244***	(0.039)	0.594***	(0.074)
us77	0.000816	(0.0017)	0.248***	(0.040)	0.583***	(0.075)
us78	0.000207	(0.0037)	0.245***	(0.039)	0.593***	(0.074)
us79	0.000905	(0.0038)	0.246***	(0.039)	0.595***	(0.072)
us80	0.000736	(0.0013)	0.247***	(0.040)	0.584***	(0.074)
us81	0.00860***	(0.0016)	0.278***	(0.039)	0.552***	(0.069)
us82	0.00810**	(0.0038)	0.252***	(0.040)	0.555***	(0.079)
us83	0.00689***	(0.0013)	0.252***	(0.041)	0.543***	(0.082)
us84	-0.00119	(0.0020)	0.247***	(0.040)	0.590***	(0.074)
us85	0.00189	(0.0033)	0.245***	(0.039)	0.586***	(0.074)
us86	0.00166	(0.0031)	0.244***	(0.039)	0.589***	(0.074)
us87	-0.00187	(0.0043)	0.249***	(0.040)	0.583***	(0.074)
us88	0.00150	(0.0016)	0.244***	(0.039)	0.590***	(0.074)
us89	0.00150	(0.0034)	0.246***	(0.039)	0.591***	(0.074)
us90	-0.000770	(0.0025)	0.245***	(0.039)	0.593***	(0.073)
us91	-0.000537	(0.0025)	0.245***	(0.039)	0.595***	(0.073)
us92	0.0137***	(0.0038)	0.263***	(0.042)	0.560***	(0.078)
us93	0.000668	(0.0035)	0.246***	(0.039)	0.592***	(0.074)
us94	0.00203	(0.0037)	0.249***	(0.040)	0.584***	(0.074)
us95	-0.00535	(0.0180)	0.244***	(0.039)	0.599***	(0.073)
us96	-0.00360	(0.0123)	0.247***	(0.040)	0.592***	(0.075)
us97	0.00292	(0.0021)	0.250***	(0.041)	0.578***	(0.077)
us98	0.00135	(0.0024)	0.248***	(0.040)	0.581***	(0.075)
us99	0.00129	(0.0026)	0.249***	(0.040)	0.579***	(0.075)

Appendix 7. OLS Result of Category

Var. Code	Positive News		Negative News		All News	
	Coefficient	R^2	Coefficient	R^2	Coefficient	R^2
tr_1	2.63e-05 (0.00324)	0.000	-0.000288 (0.00304)	0.000	-0.000139 (0.00221)	0.000
tr_2	-0.00442*** (0.00103)	0.000	0.00207 (0.00636)	0.000	-0.00425*** (0.00101)	0.017
tr_3	-0.000690 (0.00615)	0.006	-0.0191** (0.00810)	0.006	-0.00737 (0.00489)	0.002
tr_4	-0.00665** (0.00288)	0.002	-0.00530 (0.00362)	0.002	-0.00601*** (0.00223)	0.007
tr_5	0.00125 (0.00685)	0.000	0.000428 (0.00326)	0.000	0.000575 (0.00293)	0.000
tr_6	0.000856 (0.00187)	0.004	0.00300** (0.00143)	0.004	0.00218* (0.00113)	0.004
us_1	-0.000571 (0.000840)	0.003	-0.00147 (0.000904)	0.003	-0.000866 (0.000576)	0.002
us_2	0.0127* (0.00690)	0.000	-0.000515 (0.00306)	0.000	0.00163 (0.00278)	0.000
us_3	-0.000517 (0.00174)	0.000	-0.000250 (0.00137)	0.000	-0.000325 (0.00104)	0.000
us_4	0.00336 (0.00295)	0.000	0.00269 (0.00554)	0.000	0.00317 (0.00259)	0.001
us_5	0.000105 (0.000543)	0.001	0.000392 (0.000475)	0.001	0.000213 (0.000319)	0.000
us_6	0.00135* (0.000812)	0.003	0.00113* (0.000683)	0.003	0.00110** (0.000495)	0.005
us_7	-0.000688 (0.000849)	0.001	0.000725 (0.000624)	0.001	0.000216 (0.000488)	0.000

Appendix 6. GARCH Result of Events

Variable Code	Mean		L.arch		L.Garch	
	Coefficient	Standard Error	Coefficient.	Standard Error	Coefficient.	Standard Error
tr_1	-0.000666	(0.0026)	0.149***	(0.016)	0.868***	(0.012)
tr_2	-0.00218	(0.0034)	0.136***	(0.014)	0.878***	(0.011)
tr_3	-0.00582***	(0.0021)	0.153***	(0.016)	0.862***	(0.013)
tr_4	-0.00200	(0.0013)	0.149***	(0.016)	0.867***	(0.012)
tr_5	-2.56e-05	(0.0026)	0.147***	(0.015)	0.868***	(0.012)
tr_6	-5.24e-05	(0.0008)	0.147***	(0.015)	0.869***	(0.012)
us_1	-0.000410	(0.0003)	0.148***	(0.015)	0.867***	(0.012)
us_2	0.00433**	(0.0021)	0.149***	(0.016)	0.867***	(0.012)
us_3	-0.000378	(0.0005)	0.146***	(0.016)	0.870***	(0.012)
us_4	-0.000357	(0.0010)	0.149***	(0.016)	0.867***	(0.012)
us_5	0.000179	(0.0002)	0.147***	(0.016)	0.870***	(0.012)
us_6	0.000467	(0.0003)	0.144***	(0.015)	0.871***	(0.012)
us_7	6.79e-05	(0.0003)	0.147***	(0.015)	0.869***	(0.012)
tr_1 (+)	-0.00133	(0.0053)	0.149***	(0.016)	0.868***	(0.012)
tr_2 (+)	-0.00436	(0.0068)	0.136***	(0.014)	0.878***	(0.011)
tr_3 (+)	-0.0116***	(0.0043)	0.153***	(0.016)	0.862***	(0.013)
tr_4 (+)	-0.00401	(0.0026)	0.149***	(0.016)	0.867***	(0.012)
tr_5 (+)	-5.13e-05	(0.0052)	0.147***	(0.015)	0.868***	(0.012)
tr_6 (+)	-0.000105	(0.0017)	0.147***	(0.015)	0.869***	(0.012)
us_1 (+)	-0.000820	(0.0007)	0.148***	(0.015)	0.867***	(0.012)
us_2 (+)	0.00865**	(0.0042)	0.149***	(0.016)	0.867***	(0.012)
us_3 (+)	-0.000756	(0.0010)	0.146***	(0.016)	0.870***	(0.012)

us_4 (+)	-0.000715	(0.0020)	0.149***	(0.016)	0.867***	(0.012)
us_5 (+)	0.000358	(0.0004)	0.147***	(0.016)	0.870***	(0.012)
us_6 (+)	0.000933	(0.0007)	0.144***	(0.015)	0.871***	(0.011)
us_7 (+)	0.000136	(0.0007)	0.147***	(0.015)	0.869***	(0.011)
tr_1 (-)	0.000738	(0.0050)	0.148***	(0.016)	0.868***	(0.012)
tr_2 (-)	0.00269	(0.0073)	0.148***	(0.016)	0.868***	(0.012)
tr_3 (-)	-0.0126	(0.0081)	0.145***	(0.015)	0.871***	(0.012)
tr_4 (-)	-0.00496**	(0.0023)	0.156***	(0.017)	0.861***	(0.013)
tr_5 (-)	-0.00156	(0.0028)	0.148***	(0.016)	0.868***	(0.012)
tr_6 (-)	0.00111	(0.0008)	0.145***	(0.016)	0.870***	(0.012)
us_1 (-)	-0.000742	(0.0005)	0.152***	(0.016)	0.865***	(0.012)
us_2 (-)	-0.000387	(0.0054)	0.147***	(0.016)	0.869***	(0.012)
us_3 (-)	0.000721	(0.0008)	0.148***	(0.016)	0.868***	(0.012)
us_4 (-)	0.000436	(0.0052)	0.147***	(0.056)	0.868***	(0.012)
us_5 (-)	0.000254	(0.0003)	0.147***	(0.016)	0.869***	(0.012)
us_6 (-)	0.00104**	(0.0005)	0.147***	(0.015)	0.870***	(0.012)
us_7 (-)	7.77e-05	(0.0004)	0.147***	(0.015)	0.869***	(0.012)