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THE EFFECT OF SOVEREIGN CREDIT RATING ANNOUNCEMENTS ON US DOLLAR/TURKISH LIRA EXCHANGE RATE VOLATILITY

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THE EFFECT OF SOVEREIGN CREDIT RATING ANNOUNCEMENTS ON US DOLLAR/TURKISH LIRA EXCHANGE RATE VOLATILITY

KREDİ NOTU DEĞİŞİMLERİNİN DOLAR/TL KURU VOLATİLİTESİ ÜZERİNDEKİ ETKİSİ

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PREFACE

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LIST OF ABBREVIATIONS

S&P	Standard and Poor's
GARCH	Generalized Autoregressive Conditional Heteroskedasticity
EGARCH	Exponential Generalized Autoregressive Conditional Heteroskedasticity
CBRT	Central Bank of Republic of Turkey
JCR	Japan Credit Rating Agency
ABS	Asset-Backed Security
CDO	Collateralized Debt Obligations
EVDS	Electronical Data Distribution Channel
LR	Likelihood-Ratio
CRA	Credit Rating Agencies
USA	United States of America

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ABSTRACT

Credit rating agencies publicly announce their independent evaluations about issuers, securities and countries in the form of letter grades and outlooks in certain periods. These evaluations give an information on the willingness and capability to fulfill debt obligations of issuers. While higher rating grades facilitate borrowers to obtain funds at low costs, lower rating grades increase the funding costs due to the implications of high default risks. Credit rating announcements' role in pricing capital and monet market securities have important effects for fluctuations of macroeconomic variables due to interconnectedness of financial markets. In this thesis, the effects of credit rating announcements of three international credit rating agencies, S&P, Moody's and Fitch, on US Dollar /TL exchange rate volatility is examined. Time period of analysis covers all credit rating announcements between January 6, 1992 and April 8, 2019. In order to examine the effects, GARCH, EGARCH and stochastic volatility models are used. Empirical findings of all models show that positive and negative credit rating announcements have statistically significant impacts on exchange rate volatility. Moreover, negative announcements increase the volatility more than positive annoncements. Lastly, likelihood ratio test is conducted to select the best model that fits on data. Test results exhibit that EGARCH model is the best model for the relationship between rating announcements and exchange rate volatility.

Keywords: Credit Rating Announcements, Credit Rating Agencies, Exchange Rate, Volatility, GARCH, EGARCH, Stochastic Volatility

ÖZET

Kredi derecelendirme kuruluşları; ihraççılar, menkul kıymetler ve ülkeler hakkındaki bağımsız değerlendirmelerini harf notları ve görünümler şeklinde belli periyotlarda halka açık olarak ilan etmeketdirler. Bu değerlendirmeler ihraççıların borç yükümlülüklerini ifa etme kapasiteleri ve istekleri hakkında bilgi vemrmektedir. Yüksek derecelendirme notları ödünç alan kesimlerin düşük maliyetlerle fon elde etmelerini kolaylaştırırken düşük derecelendirme notları yüksek temerrüt riskini ifade ettiği için fonlama maliyetlerini artırmaktadır. Kredi derecelendirme duyurularının para ve sermaye piyasalarında işlem gören menkul kıymetlerin fiyatlamanmasındaki rolü; finansaal piyasaların birbirine bağlılğının dolayı makrekonomic değişkenlerin dalgalanlmasında önemli etkilere sahiptir. Bu tezde üç uluslararası kredi dereclendirme kuruluşu olan S&P, Moody's ve Fitch'in kredi derecelendirme duyurularının Amerikan Doları/Türk Lirası döviz kurunun oynaklığı üzerindeki etkisi incelenmiştir. Analizin zaman periyodu 6 Ocak 1992 ve 8 Nisan 2019 arasındaki bütün kredi deerecelendirme duyurularını kapsamaktadır. Etkileri incelemek için GARCH, EGARCH ve stockastik oynaklık modelleri kullanılmıştır. Bütün modellerin ampirik sonuçları; pozitif ve negatif kredi derecelendirme duyurularının döviz kuru oynaklığı üzerinde istatistiksel olarak anlamlı sonuçları olduğunu göstermektedir. Ayrıca negatif duyuruların pozitif duyurulara göre oynaklığı daha fazla artırmaktadır. Son olarak veriye en uygun modeli seçmek için likelihood ratio testi uygulanmıştır. Test sonuçları EGARCH modelinin kredi derecelendirme duyuruları ve döviz kuru oynaklığı arasındaki ilişki için en iyi model olduğunu göstermektedir.

Anahtar Kelimeler: Kredi Derecelendirme Duyuruları, Kredi Derecelendirme Kuruluşları, Döviz Kuru, Oynaklık, GARCH, EGARCH, Stokastik Oynaklık

INTRODUCTION

Credit rating is a general evaluation of willingness and capability an issuer to fulfill its debt obligations. These evaluations are expressed in letter grades and outlooks by credit rating agencies and are announced by them. Credit rating services are classified into different categories. Criteria for classification is related to the subject that is rated by credit rating agencies. Securities that is traded on over-the-counter markets or organized markets can be rated by credit rating agencies. Also issuers of those securities, financial institutions and non-financial corporations, are assigned rating. Apart from these, credit rating agencies announce their letter grades and outlooks for sovereign governments. Sovereign rating is a type that attracts attention of financial sector participants at most. The reason behind the popularity of sovereign rating lies in the feature that it is a general evluation of overall economy. Also sovereign rating is a ceiling for whole rating grades for securities and issuers. Due to this feature, sovereign rating grades have considerable effects on money and capital markets. Financial capital inflows and outflows are affected by credit rating announcements, since regulations in many countries require investors to invest in securities and corporations that have rating grades in investment-grade categories. In this respect, credit rating announcements have indirect effect on macroeocnomic and finanical variables.

In this study, I analyzed the effect of credit rating changes on US Dollar/Turkish Lira (USD/TL) exchange rate volatility on the next day of credit rating announcements. In addition to local credit rating agencies, there are three big credit rating agencies on the international level, Standard and Poor's (S&P), Moody's and Fitch. Since these firms operate on different countries around the world and have higher market capitalization, their announcements have important influences on macroeconomic variables. In literature, studies investigating the impacts of credit rating announcements in Turkey generally focus on Borsa İstanbul (BIST) returns, bond yields and CDS volatility. This study fills a gap in literature by introducing USD/TL exchange rate as a variable affected by credit rating announcements. In

my analysis, all credit rating announcements are taken into consideration in models until April 6, 2019 and three models are used for estimating volaility of the exchange rate, GARCH, EGARCH and stochastic volatility models. All models are consistent with each other in estimation of volaility of exchange rate; positive and negative announcements have significant impacts and negative announcements increase volatility more than positive announcements.

This study is planned as follows: in chapter 1, details on credit rating services and importance of those services are explained by giving examples from Great Recession, Asian Financial Crisis and Debt Crisis in European Union. Also in this chapter, local and international credit rating agencies operating in Turkey are explained. In chapter 2, previous studies on literature are examined. In chapter 3, credit rating announcements for Turkey are analyzed. These announcements are included in models as independent variables by dividing into two types, positive and negative announcements. In this chapter, rationale behind this classification is given. Also the dependent variable, USD/TL exchange rate volatility, is explained in this chapter. In chapter 4, models used for estimation are explained. In chapter 5, results of models are given in detail and hypothesis testing is made for significance of variables. In chapter 6, conclusion are given.

CHAPTER 1

CREDIT RATING SERVICES AND CREDIT RATING AGENCIES

1.1 What is credit rating?

"In fact, you could almost say that we live again in a two-superpower world. There is the U.S. and there is Moody's. The U.S. can destroy a country by leveling it with bombs; Moody's can destroy a country by downgrading its bonds." Thomas Friedman argues in his column in New York Times on 1995. During the Great Recession in 2007-2008, it is clearly observed that Moody's and two other big credit rating agencies, S&P and Fitch, destroyed even their home country and the rest of the world without downrgrading the risky asset-backed securities.

Credit rating has an important role in capital markets and money markets. It is an independent opinion about the willingness and the capacity of an issuer to fulfill its debt obligations (Guide to Credit Rating Essentials, S&P). The subject to credit rating can be a debt security, a corporation, a financial institution or a government. Credit rating agencies inform the society by publicly announcing their opinions about those capital and money market instruments or actors.

There are several numbers of credit rating agencies on regional and country level around the world, however three big international credit rating agencies have more influence over financial markets. As stated in the first paragraph, those are Moody's, Fitch and S&P. Financial market participants, mostly, demand credit rating for their securities that will be issued. Credit rating agencies form a common language for the assessment of creditworthiness and credibility of the issuer by assigining letter grades and its extensions to these securities, such as AAA+ or Baa2. They use public data and non-public data of the issuer and announce their notations after analyzing these data with their own methodolgy. The securities that are rated by credit agencies are summarized as:

- Corporate market: collateralized and non-collateralized bonds, senior security, commercial paper, project finance
- Sovereign Debt: Government bonds
- Local Administration Debts: Municipality bonds
- Securitization: Asset-backed securities and mortgage-backed securities
- Funds: Mutual Funds, money market funds, bond funds
- Swap risk rating: Risks based on unfunded loans

It is often emphasized that credit notations on securities do not aim to give an advice for investment. Moreover, they are not an absolute expression of probability of default and do not include a comment on the price of securities. Also credit rating agencies make an evaluation about prospective effects of important events, however credit rating do not guarantee a certain level of credit quality and credit risk.

1.2 Importance of Credit Rating

With the financial globalization and liberalization after 1970s, financial markets rapidly deepened and financial flows graudally increased. Different participants of financial markets have the opportunity to get benefit from this deepening. However, as the market deepens, the asymmetric information problem threatens the health of financial markets. The reason implies that lenders, that have excess funds, do not generally have detailed information about the capacity and willingness of borrowers, that demand funds, to repay its debts that consists of those excess funds. In this respect, credit rating leads to decline in asymmetric information by informing savers on the financial condition of borrowers. As a result, savers consider those credit notations and its extensions for evaluation of riskiness in their investments in the financial market instruments and issuers.

1.3 Macroconomic Effects of Credit Rating Announcements

Credit rating agencies are often subject to critiques of presidents, ministers and managers from business environment. Those critiques and harsh comments generally arise in case of downgrading of sovereign credit rating. The reason for such negative reactions stem from the opinion that the aforementioned country that

is subject to downgrading do not deserve this negative assessment. Also, sovereign rating notation is an upper limit for the companies of the country that receives rating. In other words, although the banking sector of a country has the enough required reserves as stated in Basel Criteria and is very strong in terms of fulfilling its debt obligations, sovereign rating of the country can be an obstacle for portfolio investments in banking sector. Downgrading is perceived as an increase in riskiness in paying debts and investors often tend to avoid from investing in risky countries and risky bonds.

In most of countries around the world, it is a requirement that a traded debt security should be rated by the regulations. In Turkey, capital market regulations require rating in the following situations:

- Issuers that offer the capital market instruments to public, excluding common stock should announce the credit notations and the changes of those notations
- In repo and reverse repo agreements out of stock market, investment trusts should have a certain rating notation that is stated by Capital Market regulations related to mutual funds. Also they should announce these credit notations on Public Disclosure Platform.
- The counterparties of open-ended investment trusts should have a rating notation in an agreement out of stock market
- In case of the requirement of rating notation, it is an obligation to have a investment-grade that is given by a credit rating agency authorized by capital market board.
- The counterparties of founder of a mutual fund should have an investment grade in an agreement out of stock market.
- The capital-protected and guaranteed funds that invest in money market funds, short-term debt security funds and private sector debt security should have a investment-grade that is given by a credit rating agency authorized by Capital Market Board.

- In terms of capital-protected and guaranteed funds, the guarantor should have an investment grade that is specified by “Evaluation Related to Investment Grade”
- The issuer of bank debt securities and private sector debts securities that are included in the portfolio of exchange-traded funds should have an investment-grade assigned by an authorized credit rating agency.
- The upper limit of bond issue of banks can be increased by 100% if the issuer bank have one of the highest 3 stages of investment grades.

As can be understood from these articles, credit rating has an important role in Turkish capital markets. Issuers that need funds should have a certain grade and should announce it to the public. In Turkey, issuers announce their rating through The Public Disclosure Platform. Moreover, investment companies should allocate their portfolio according to the notations of securities. In this respect, it can be concluded that credit rating has a directing role in flowing funds in a country and around the world.

Outflow of funds from a country due to a downgrading is a severely negative event for an issuer and a country as a whole. Insuffiency of financial capital creates various problems for different issuers. A corporation that plans to enlarge its operation may face with a delay or even with cancelling its business plans, because a sovereign downgrading causes a higher pricing of its bonds. The reason for that situation is the increase in perceived country risk related to soveregin rating downgrading. The increase in risk leads to an increase in cost of borrowing and to a tendency of lenders to move to invest in both less risky and lower-cost bonds.

The interest rate, cost of borrowing, can be summarized as:

$$k=Rf + \text{Default Risk} + \text{Maturity Risk} + \text{Liquidity Risk} + \text{Country Risk}$$

where Rf: Risk-free rate (Interest rate on government debt = (1+Real Interest Rate)x(1+ Expected Inflation) (Credit Rating, Capital Market Licensing Study Notes)

On the equation above, two variables, default risk and country risk are directly related to credit rating, while risk-free rate indirectly depends on those grades.

Default risk is the proability of the issuer to fail in fulfillment on its debt at maturity. It shows the creditwothiness of the issuer. Country risk indicates that higher country notation contributes less to the interest rate, whereas lower notations is an expression of higher risks and higher interest rates. Also, an increase in country risk due to a downgrading or lower credit notation causes the risk-free rate to increase.

Tennant and Tracey (2016) argues that developing and poor countries need sources to overcome their 3-F crisis (Food-Fuel-Financial). This condition increases their sovereign debts. However, this increase brings about an additional problem: repaying of those debts prevents growth-inducing and poverty-reducing expenditures. The authors argue that the countries which have an unsustainable increasing amount of debts tend to borrow from investors in order to repay their current debt. Investors are benefited from the letter grades of credit rating agencies in assessing the creditworthiness of sovereign debt issuers. Credit rating agencies collect data from borrowers and reach a conclusion about default risk. They inform the investors about the security offered by announcing their conclusive opinions as letter grades.

1.3.1 Great Recession

Credit rating agencies are often criticized for their failure in predicting economic and financial crises. The most severe criticisms arise from their rating policy before the subprime mortgage crisis in 2007-2008. As an example of financial deepening, in 1960s, US banks introduced mortgage-backed securities in order to fulfill increasing demand for housing loans. In 1980s, asset-backed securities (ABS) were introduced. They cover automobile loans and credit card receivables. Those loans and receivables are located in the asset side of banks' balance sheets. They sell them to special purpose vehicles in order to increase their lending capacity. Special purpose vehicles form tranches from these loans and cash flows are allocated to tranches. Generally, there are three tranches: Senior tranche, meazzanine tranche

and equity tranche. Senior tranche, which most part of cash flow are allocated to, receives the highest rating, AAA, from credit rating agencies. Meazzanine tranche, which obtains relatively less amount o cash flow, are rated as BBB and equity tranche are not rated. In order to easily sell and to market the BBB-rated meazzanine tranche, financial institutions created collateralized debt obligations (CDO) based on the meazzanine tranches of ABSs. This tranche is divided into sub-tranches and as similar to ABS tranches, highest subtranche received AAA from credit rating agencies. To summarize this process, the big part of meazannine tranche, that are relatively risky and are BBB-rated, received AAA in the form of ABS CDO. The whole ABS portfolio includes more AAA-rated loan tranches than it should actually include. Investors that do not assume the decline of housing prices invested in these senior tranches of ABSs and AAA-rated tranches of ABS CDO (Hull, 2018). When housing prices declined and defaults on mortgage loans occurred, cash flows to those tranches stopped. Having realized that selling collateral houses was not sufficient for cash flows to investors investing huge amount of their portfolio in asset-backed securities, big investment companies, such as Lehman Brothers, collapsed and other investment banks suffered from liquidty crises. The result was a severe recession for the USA. The contagious effect of the recession led to a severe recession in the countries of European Union and other countries around the world. As a result, evaluating relatively risky securities with risk-free securities brought about the loss of confidence on credit rating agencies.

1.3.1 Asian Financial Crisis

During the East Asian Crisis in 1997-1998, it is argued that credit rating agencies have a key role in deepening of crisis (Rafailov, 2011). From July 1997 to November 1998, three major credit rating agencies downgraded the sovereign rating of Asian countries.

Table 1.1 Rating Grades of Asian Countries During 1997-1998

Country	Rates on July 1, 1997	Rates on November 30, 1998
Thailand	A	BBB-
South Korea	AA-	BB-
Indonesia	BBB	CCC+
Malaysia	A+	BBB-

Source: Kraussl, 2000

As can be seen from the table, S&P downgraded South Korea and Indonesia by eight grades. Also it downgraded Thailand by 5 grades and Malaysia by 4 grades. At the same time period, Moody's changed Indonesia, Thailand and South Korea's rating from investment grade to non-investment grade. These sharpest and strongest downgrading negatively affected the stability of bond prices (Kraussl, 2000) and deepened the crisis. Reissen (1999) argues that after the crisis began, negative changes of grades resulted in worsened outcome through many channels. One of them is that commercial banks could not issue international letter of credit for the importers and exporters of local country. Another factor is the offload of Asian assets due to junk status. After downgrading, some countries falled into specualtive status and received non-investment grades. Institutional investors had to withdraw their funds from those assets, because of the requirement that a portfolio must include investment only grade securities. Following the same pattern, foreign creditors have withdrawn their loans. As a result, during the crisis, strong and sharp downgradings in Asian countries worsened the financial turbunlence and caused countries to suffer from lack of funds by fuelling capital outflow.

1.3.3. European Debt Crisis

Another controversy about the credit rating agencies is related to downgrading announcements during the European Debt Crisis. In order to alleviate the negative effects of capital losses and liquidity inadequacy after the Great Recession, many European governments implemented bailout for bank recapitalizations and fiscal

stimuli programs. However, the adverse effects of these programs put those countries and other European members into a more problematic situation. Budget deficits graduallay grow in various countries and unsustainibility of public debts caused increase in interest rates due to the investors' concern about the future sustainability of public debts. In this environment, credit rating agencies downgraded the sovereign rating of Greece, Ireland and Portugal and exacerbated the debt crisis (Ryan, 2011). These downgradings resulted in an increase in risk levels of goverenment bonds and the interest rates on those securities increased. Difficulties on lowering deficits and fears about the further unsustainability of increasing amount of debts brought about successive downgradings (Bayar, 2014). Politicians and governors of European Union members complained on the exacerbating behavior of credit rating agencies during the ongoing debt crisis and suggested the establisment of new European credit rating agencies.

1.4 Credit Rating Agencies

Credit rating agencies determine a letter grade for corporations, financial institutions, countries and financial market securities. Each agency collects data from the source that will be rated and by using their own methodolgy, they announce the grade to public. These letter grades are independent opinions of credit rating agencies on the credit risk and the probability risk of the issuer, or a security. Credit rating agencies differ from each other in rating scales and rating methodology. Around the world, there are three big famous credit rating agencies: Standard and Poors, Moody's and Fitch. Also there are various credit rating agencies on regional and country level. In Turkey, five credit rating agencies are established and are authorized by the communique of Capital Market Board.

Table 1.2 Credit Rating Agencies in Turkey

Credit rating agencies established in Turkey and authorized by Capital Market Board	International credit rating agencies that operate in Turkey through the approval of Capital Market Board
1-JCR Eurasia Rating Corporation	1-Standard and Poor's Global Ratings Europe Limited
2-Saha Corporate Governance and Credit Rating Services Corporation	2-Moody's Investor Services Inc.
3-Kobirate International Credit Rating and Corporate Governance Services Corporation	3-Fitch Ratings Ltd.
4-TURKRATING Istanbul International Rating Services Corporation	
5-DRC Rating Services Corporation	

Source: http://www.spk.gov.tr

1.4.1. Credit Rating Agencies Established In Turkey

1.4.1.1. JCR Eurasia Rating Corporation

Eurasia Rating Corporation applied to Capital Market Board for the credit rating license on November 30, 2006. After being registered to the trade register, it started its operations on February 22, 2007. The institution signed a deed of partnership with Japan Credit Rating Agency Ltd. (JCR) and its name changed to JCR Eurasia Rating Corporation.

The partner of JCR Eurasia Rating Corporation that have more than 50% of shares are settled abroad. Rating services of the corporation covers sovereign rating, financial institutions, SMEs, issues of bonds and structured securities. Moreover, JCR Eurasia Rating Corporation provides services on corporate governanceö.

1.4.1.2. Saha Corporate Governance and Credit Rating Services Corporation

SAHA Corporate Governance and Credit Rating Services Corporation was founded in December, 2005. It obtained the certificate of Corporate Governance Compliance Rating on December 14, 2006 and the certificate of Credit Rating on September 11, 2007.

SAHA is the first local corporation authorized in Turkey on the field of corporate governance compliance rating. Moreover, it led the formation of BIST Corporate Governance Index. Most of companies on the index are rated by SAHA. Also the company rates the privately-held corporations in Turkey.

On the field of corporate goverenance compliance rating, SAHA aims to increase corporate governance compliance standarts and to support all companies in reaching these standarts. In the long-term, its goal is to service in the neighboring region.

On the field of credit rating, its goal is to have a reputation in international finance environment and to become one of a leading credit rating agencies.

1.4.1.3. Kobirate International Credit Rating and Corporate Governance Services Corporation

Kobirate International Credit Rating and Corporate Governance Services Corporation were established in June, 2008. It was authorized on the fields of corporate governance compliance rating and credit rating in April, 2009.

The methodology of Kobirate conforms to the international standards, however it is emphasized that it includes local factors. The company gives credit rating services for corporate rating, which includes industrial and trading companies, banks and financial institutions, public entities and municipalities, issue rating, which includes equity rating and financial structuring. Also on the fields of corporate governance compliance rating, Kobirate provides services in bank rating, rating companies traded on ISE, rating the non-ISE-listed companies.

1.4.1.4. TURKRATING Istanbul International Rating Services Corporation

TURKRATING Istanbul International Rating Services Corporation was established in 2006 with the license of Capital Market Board. The share of foreign partners in the company is 65%. According to the statements of TURKRATING, foreign partners have experiences in rating banks and structured finance, especially in emerging markets, and also in developing methologies. Moreover, Turkish partners are specialized in bank loans in Turkey, international capital markets, sectoral view and rating.

TURKRATING's head of board of directors is Roy Weinberger, who is an old employee of S&P. In this regard, the methodology of the company is based on the methodologies that Roy Weinberger developed in S&P. Those methodologies is developed by revising the conditions of Turkey. Furthermore, TURKRATING provided Alpha Credit Rating established in Bangladesh with consulting services, developing their own methodolgy and obtaining licences from regulatory institutions.

1.4.1.5. DRC Rating Services Corporation

DRC Rating Services Corporation is the newest credit rating agencies in Turkey. It is established on January 10, 2018. DRC Rating Services Corporation performs services on the fields of corporate governance compliance rating and credit rating.

1.4.2. International Credit Rating Agencies

1.4.2.1. Standard and Poor's Global Ratings Europe Limited

Standard and Poor's Global Ratings Europe Limited was founded on 1860 in USA. It is one of the leading credit rating firms around the world. According to the statements of the company, S&P have 1 million credit ratings on government sector, corporate and financial institution, structured finance corporations and financial market securities. It continues its rating services in 128 countries around the world. More than $3.7 trillion debt was rated in 2016 by Standard & Poor's. Also, 1% of

corporate sector investment-grade ratings issued by S&P has defaulted in last five-year period.

Rating policy of S&P can be categorized in two parts: issue credit ratings and issuer credit ratings. Also, rating scales of both categories differ from each other in terms of time periods. Long-term issue credit ratings cover the obligations on securities that have more than one year maturity, while short-term ones cover obligations of the securities that have less than one year maturity. Issue rating is an opinion about the capacitiy of an issuer to meet the financial obligations related to a specific security on the maturity date. Issuer rating is a general evaluation of an issuer. It differs from issue rating to the extent that issuer rating does not depend on a specific security. It is an evaluation of the general creditworthiness of issuer.

Table 1.3 Rating scale of Standard and Poor's

Category	Definition
AAA	Extremely strong capacity to meet financial commitments. Highest rating
AA	Very strong capacity to meet financial commitments
A	Strong capacity to meet financial commitments, but somewhat susceptible to adverse economic conditions and changes in circumstances
BBB	Adequate capacity to meet financial commitments, but more subject to adverse economic conditions
BBB-	Considered lowest investment-grade by market participants
BB+	Considered highest speculative-grade by market participants

BB	Less vulnerable in the near-term but faces major ongoing uncertainties to adverse business, financial and economic conditions
B	More vulnerable to adverse business, financial and economic conditions but currently has the capacity to meet financial commitments
CCC	Currently vulnerable and dependent on favorable business, financial and economic conditions to meet financial commitments
CC	Highly vulnerable; default has not yet occurred, but is expected to be a virtual certainty
C	Currently highly vulnerable to non-payment, and ultimate recovery is expected to be lower than that of higher rated obligations
D	Payment default on a financial commitment or breach of an imputed promise; also used when a bankruptcy petition has been filed or similar action taken

Source: Guide to Credit Rating Essentials, S&P

1.4.2.2. Moody's Investors Services Inc.

Moody's Investors Services was founded on 1909 in USA. The firm continues its rating operations covering more than 135 sovereign rating of countries, 5000 non-financial issuers and 4000 financial issuers. It is a subsidiary of Moody's Corporation. Moreover, Moody's Corporation employs 13.100 people around the world and maintains its operations in 42 countries.

Moody's Investors Services Inc. mainly categorizes its credit rating serivces into eight classes: Long-term debt ratings, short-term ratings, issuer ratiıngs, corporate family ratings,bank ratings and insurance financial strength ratings, national scale

ratings and money market and bond fund ratings. Long-term and short-term ratings have similar characteristics with those of S&P. While long-term ratings are opinions about a credit risk of a fixed-income security that have more than one year maturity, short-term ratings are about the securities that have less than one year maturity. Issuer ratings are evaluations of the issuer's ability to meet its financial commitments on the short-term obligations. As distinct from S&P, Moody's introduces a new rating category, corporate family ratings. Moody's implements corporate family ratings for speculative grade corporate issuers. It is an opinion of a corporate family's capacity to meet all of its obligations and is assigned to a corporate family in two cases: it has a single class of debt and a single consolidated legal entity structure. Moody's emphasizes that corporate family rating is not for an obligation on a specific security. It is directed for all affiliates under management control of the entity that receives the rating (Moody's Rating Scales and Definitons). Moreover, it is a long-term rating. Another category is bank ratings. Bank ratings is divided into two sub-categories: Bank deposit ratings and bank financial strength ratings. Bank deposit ratings are the evaluations of banks' capacity and ability to repay their deposit obligations. These deposits can be composed of foreign currency or domestic currency. Another category, bank financial strength ratings, includes a bank's intrinsic safety and soundness (Moody's Rating Scales and Definitons). Insurance financial strength ratings are opinions about insurance companies' capacity to meet their financial commitments. National Scale ratings are opinions for the creditwothiness of an issue or an issuer within a country. Last category is money market and bond fund ratings. They include ratings of shares in mutual funds and investment vehicles in terms of opinions for their investment qualities. Investment vehicles consist of investments in short-term and long-term fixed-income securities (Moody's Rating Scales and Definitions)

Table 1.4 Rating Scale of Moody's

Ratings	Definition
Aaa	Obligations rated Aaa are judged to be of the highest quality, with minimal risk.
Aa	Obligations rated Aa are judged to be of high quality and are subject to very low credit risk
A	Obligations rated A are considered upper-medium-grade and are subject to low credit risk.
Baa	Obligations rated Baa are subject to moderate credit risk. They are considered medium-grade and as such may possess speculative characteristics.
Ba	Obligations rated Ba are judged to have speculative elements and are subject to substantial credit risk.
B	Obligations rated B are considered speculative and are subject to high credit risk.
Caa	Obligations rated Caa are judged to be of poor standing and are subject to very high credit risk.
Ca	Obligations rated Ca are highly speculative and are likely in, or very near, default with some prospect of recovery in principal and interest.
C	Obligations rated C are the lowest-rated class of bonds and are typically in default, with little prospect for recovery of principal and interest.

Source: Moody's Rating Scale and Definitons, www.moodys.com

1.4.2.3. Fitch Ratings Ltd.

Fitch Ratings Ltd. was established by John Knowles Fitch in 1914. Headquarters are in London and New York. Fitch Ratings belongs to Fitch Group, which gives services on the field of financial information services. Also it operates in more than 30 countries. Another affiliates of Fitch Group are Fitch Solutions, which provides

credit market data, analytical tools and risk services, and Fitch Learning, which is a preeminent training and professional development firm.

Fitch Ratings Ltd. uses the same long-term rating scales with Standard and Poor's. As similar with S&P, ratings are mainly divided into investment grades and non-investment grades. Letter notations under those main categories are same with S&P's grades. Fitch categorizes its rating policy into different classes: issuer default ratings, country ceilings, corporate finance obligations, recovery ratings, public finance and global infrastructure obligations, structured finance and short-term ratings assigned to issuers and obligations.

According to Fitch's explanations, issuer default ratings are related to entities from a number of sectors. Those sectors can vary from non-financial corporations to financial corporations. Also issuer default ratings can be assigned to corporations in global infrastructure, public finance and project finance.They include evaluation of vulnerability of entities to default. Country ceilings are the opinion about the sovereign authorities' capital and exchange controls riskiness. Corporate finance obligations involve corporate issuers' securities or financial obligations. Covered bonds are examples of this type of rating. Single obligations and securities are assigned in the same way with issuer default ratings. Recovery ratings are a type of ratings applied to mostly single obligations of corporate finance issuers that have speculative grades.

CHAPTER 2

LITERATURE REVIEW

The impact of credit rating on exchange rate for foreign countries is analyzed by several authors. For Turkey, the number of papers about this subject is limited. The papers for Turkey are generally focused on the relation between credit rating and stock market returns.

Kabadayı (2013) shows that rating upgrades and downgrades have statistically significant effects on Turkish stock market. In addition to the impacts of credit ratings, real interest rates and growth rate of GDP per capita are included in terms of control variables. The dataset covers the time period between 1995 and 2011. The empirical findings show that BIST 100 index reacts negatively to downgrading announcements and reacts positively to upgrading announcements. Moreover, while a significantly negative relation between real interest rates and stock markets in the short-term is found, real interest rates have a insignificantly negative effect on BIST 100 index. Another control variable, growth rate of GDP per capita, has significantly positive effect on BIST 100 index.

Harmancı (2013), in his master's thesis, focuses on the reaction of BIST 100 index to soveregin credit rating announcements of Moody's, Fitch and S&P. The dataset includes downgrades, upgrades and changes in rating outlook between 1992 and 2012. By using event-study method, 25 event is examined. The empirical results demonstrate that on the announcement day, BIST 100 index does not rapidly give a response to the credit rating change or rating outlook change. Also, before the announcement day, positive changes have a positive abnormal reutrns on the stock market. After the announcement, it is found that impacts before the announcement maintains.

Yıldırım and Bayar (2014) examined the response of Borsa Istanbul 100 index to announcements of credit rating agencies for Turkey. Time period covers the announcements in 1990-2014. Using conditional heteroskedasticity models, the findings show that BIST 100 index does not give a response to the announcements in terms of volatility and average return. However, the authors demonstrated that at 10% significance level, average return is affected by the announcement of Fitch and at the same level, volatility responds to the sovereign credit rating announcements of Moody's.

Pirgaip (2017) investigates the connection between the sovereign rating changes of S&P, Moody's and Fitch, and abnormal returns on Borsa Istanbul (BIST) equity markey. Time period is between 1993 and 2016. The effects of credit rating decision is analyzed by the event study method. In the paper, the postive changes includes upgrading of sovereign rating, positive outlook and positive creditwatch. Accordingly, negative changes can be categorized into downgrading of sovereign rating, negative creditwatch and negative outlook. The findings show that the abnormal returns on BIST 100 index reacts to positive and negative sovereign rating announcements in accordance with the expectations beforehand. Also on the announcement date, the observed effects of the BIST 100 index is more explicit while the impacts on later days follows an adverse course. Lastly, the paper shows that the effect of negative rating change is stronger on the BIST equity market than positive rating change.

Avcı and Gürsoy (2017) focuses on the rating and outlook changes between 2007-2016. According to their findings, there is no significant impact in Turkish Stock Exchange on the announcement day. They show that a downgrading severely affects market after event day. The result is a negative abnormal return. Additionally, an upgrade does not lead to a significantly different returns in other days in the event period. Moreover, the equity market gives a more sensitive response to rating announcements of S&P.

Yıldırım, Yıldız and Aydemir (2018) analyze the relation between the announcements of Moody's, Fitch and S&P and six indexes on Borsa Istanbul.

Time period covers the years between 2012 and 2016. Indexes include BIST Bank, BIST Financials, BIST Investment Trusts, BIST Wholesale and Retail Trade, BIST Industrials and BIST SME Industrials. The reason for this choice of six indexes is the ability to react more rapidly to rating announcements and moreover those sectors are more rapidly afftected by capital flows. Findings of the paper show that these indexes do not fully respond to the sovereign rating announcements. They are partially affected within 10 days after and before the day of rating change announcements.

Coşkun (2018) focuses on the analysis of the three indexes on Borsa Istanbul. They are BIST Bank, BIST Holding and BIST Industrials. In the paper, rating changes made by Moody's and S&P in 2013-2016 and the changes of Fitch in 2012-2017 are analyzed. According to the findings, each of indexes responds differently to the announcements of credit rating agencies in short-term and long-term.

Korkmaz, Yaman and Metin (2017) investigates how two sovereign rating changes of Moody's in 2013 and 2016 affects the equity return on the corporations on BIST 30 index. In 2013, Moody's changed the grade of Turkey from Ba1 (non-investment grade) to Baa3 (investment grade). The findings show that the improvement in rating results in a statistically significant increase in cumulative abnormal returns of the firms in BIST 30 index. In 2016, Moody's downgraded from Baa3 (investment grade) to Ba1 (non-investment grade). This downgrade led to statistically insignificant increase in cumulative abnormal returns of the same corporations on BIST 30 index.

Çağlak, Küçükşahin and Kahraman (2018) focuses on the impacts of announcements of three big credit rating agencies for Turkey between 1992 and 2018. Impacts on 14 indexes in Borsa Istanbul are analyzed through event study method. Event window comprises of 20 days, which are 10 days before the event day and 10 days after the event day. Results are different for each sector. Some indexes enable investors to gain negative cumulative abnormal returns in the 20-day event window, such as BIST Bank index. Some indexes lead to positive cumulative abnormal returns in the same time period, such as BIST Industrial index.

Moreover, findings indicate that the investors' cumulative abnormal returns on some indexes, such as BIST Electricity, BIST Corporate Governance and BIST Telecommunication, are statistically insignificant. In addition, the reactions of the indexes are not vary across different credit rating agencies.

Tırnova (2018), in his master thesis, investigates the connection between sovereign credit rating change and credit outlook change, and abnormal returns of specific companies in BIST 30 index. His analysis is conducted for 21-day event window. Companies, that are the subject of the thesis, comprises of 11 corporations that get service of credit rating from S&P and Moody's. In the dataset, 32 credit rating and creditwatch updates in 2013-2018 are used. In total, 10 updates is positive and the remaining updates are negative. Also, 9 update are creditwatch change and the remaining part is credit rating change. Abnormal returns in 19 of 22 negative updates are not affected from these changes and the average abnormal returns are zero. Only 1 event is found as different from zero. For the remaining 2 events, the abnormal returns is in reverse direction from the negative rating announcement. The author claims that exogeneous factors have an impact in this situation. Furthermore, 7 positive updates of 10 are announced at the same day, however investors get negative abnormal returns in contrary to expectations. Other 3 updates lead to different abnormal returns from zero. The author claims that despite the small dataset, there is a statistically significant relation between credit rating and credit outlook announments, and equity returns. Also it is argued that different outcomes can result from some exogeneous factors, such as the terror events. Moreover, it is claimed that exogeneous factors, such as terror events, have an important role in unexpectedly different abnormal returns on some corporations.

Treepongkaruna, S., Wu, E. (2012) examine how the sovereign rating announcements of Standard and Poor's affect stock and currency markets of the countries in the Asia-Pacific region. The time period is the years between 1997 and 2001. They found that stock markets are statistically more responsive to the sovereign rating announcements than currency markets. Moreover, credit outlook changes result in more significant volatility in stock markets than the rating change.

According to the findings, correlation between stock market and foreign exchange increase after downgrading, while it decreases with upgrades. During the Asian Financial Crisis, this correlation has rating spillover effects over many countries: Indonesia, Philippines and Thailand.

Afonso, Furceri and Gomes (2011) focus on the relation of upgrading and downgrading announcements with sovereign bond yield spreads and CDS of the members of European Union. The dataset consists of daily data from January 1995 to October 2010. Events include sovereign credit rating changes and credit rating outlook changes of three major rating agencies. The results of the paper indicate that government bond yield spreads give significant response to changes in credit notations and in credit outlook. Furthermore, these responses are more severe in case of negative announcement than positive rating announcements. The authors show that CDS spreads react more severely to the negative rating announcements after the collapse of Lehman Brothers in 2008. Finally, it is demonstrated that rating announcemnets have spillover effects from lower rated countries to higher rated countries.

Alsakka and Gwilym (2013) demonstrate that sovereign credit signals affects foreign exchange market. Examining the sample of countries in Europe and Central Asia, it is evident that foreign exchange market gives different reactions to the announcemnents of the three credit rating agencies. In the paper, it is claimed that these reactions are stronger in crisis years than previous periods. During crisis, negative announcements from credit rating agencies affect own-country exchange rates and this situation leads to contagion. Lastly, exchange rates of higher-rated countries are more responsive to negative announcements during crisis. Exchange rates of lower-rated countries are responsive to the same announcements in the pre-crisis period.

Ismailescu and Kazemi (2010) examines how sovereign credit rating announcements influence CDS spreads of the event countries and the spillover effects on CDS premiums of other emerging countries. The authors argue that CDS markets are affected by positive rating announcements, while negative

announcements do not influence them. The reason is that negative event is absorbed by CDS market before the rating news released. Also in terms of spillover effects, the degree differs in cases of positive and negative events. Credit rating of the non-event country has an impact on the degree of the spillover effect of positive events. The degree of negative events is influenced by the credit rating of the event country.

Baum et al. (2014) focuses on the evalauation of the value of Euro, the sovereign bond yields of different countries in European Union and CRA announcements. During the Eurozone Debt Crisis (2011-2012), downgrading leads to decreasing the value of Euro and affecting the sovereign bond yields of Italy, France, Spain and Germany. These two main variables are estimated through event study method with a GARCH model. According to the findings, downgrades cause the value of Euro to decline against US dollar and other major countries' currencies. Also this situation leads to an increase in the sovereign bond yields of Italy, France and Spain during the downgrading event period. However, the authors find that the same downgrading event result in the decrease in the German sovereign bond yields. In the paper, it is agued that these results show the desire of investors to balance their portfolios across different countries in order to avoid their riskiness. Lower risky countries in the Eurozone region attract investors from surrounding higher risky countries of the region. Accordingly, the flow of funds within the same region does not permanently affect the value of Euro. However, countries that are subject to downgrading events face with relatively higher costs in issuing a new debt as compared to Germany. The reason for this situation is the movement of investors and thier funds from lower-rated countries to Germany.

Arezki et al. (2011) examine the relationship between sovereign credit rating and financial markets of a sample of European countries. The dataset covers daily data on CDS spreads, stock market indices and sub-indices for the sectors of banking and insurance from 2007 to 2010. Empiricial findings show that the significance of spillover effect is related to the rating type, the counry that is subject to rating annoucement and the rating agency that made announcement. Also downgrading from investment-grade to speculative grade has a systematic spillover effects on the

different countries in Eurozone. In this context, the authors argue that downgrading of Greece's notation from A- to BBB+ on December 8, 2009 by Fitch results in the increase of CDS spreads of Greece and Ireland by 17 and 5 basis points respectively.

Taşöz (2013) analyze the relationship and causality between dowgrade events and currency crises. The countries included in the paper are 45 countries rated by Fitch from 1994-2011. The author investigates whether currency crisis leads to downgrade in sovereign credit rating, or reverse. In order to determine the causality between those two varibles, Granger causality test is used. In this analysis, sovereign credit rating variables are firstly used as independent variable in the literature. Granger causality test indicates that depreciation of a currency does not cause a downgrade in sovereign credit rating, while a downgrade results in the depreciation of currency. At the second step, the probability of having a currency crisis is estimated through logit model. By transforming sovereign credit rating into numerical values and including them as independent variable, it is found that downgrading event has a significant effect on currency crises when other macroeconomic variables are significant. Furthermore, as a dummy variable, sovereign credit rating is not a significant variable in logit estimations.

Bannier et al. (2019) study the impact of changes in sovereign credit and outlook on the portfolio flows of mutual funds to emerging countries. In the paper, 54 emerging countries are taken into consideration. Also mutual funds is divided into daily bond and equity portfolio flows. The dataset covers daily data from January 2012 to February 2017. According to findings, while only negative rating announcements affect active funds, passive funds are sensitive to both negative and positive rating events.

Erarslan (2016) studies the interaction between exchange rates and sovereign credit rating announcements. Using data from 2002 to 2015, exchange rate co-movmements in emerging market economies are analyzed through Dynamic Conditional Correlation (cDCC) modeling which is a class of multivariate GARCH models. The author finds that changes in rating and outlook influence the exhange

rates of emerging countries to co-move. Moreover, reaction to the rating announcements differs accross type of agency and announcements. Upgrades of Moody's not only affects the event-country, but also the other emerging markets. Also, downgrades of Fitch have similar effects for both the experiencing country and other countries. Lastly, according to findings, it is more likely that European countries that have high external debt, high current account deficit and average rating score under investment are affected by soverign rating announcement of other countries

CHAPTER 3

DATA

In this thesis, effects of sovereign rating changes of Turkey on USD/TL exchange rate volatility is analyzed. Turkey received first rating in May 4, 1992. From this date until August 17, 2018, Turkey's credit rating and outlook were changed 95 times by those agencies in total.

The dataset includes two dummy variables. I considered one group as "positive dummy variable" for positive announcements. Between May 4, 1992, and August 17, 2018, for the days, on which Turkey's rating is upgraded or its outlok is improved, positive dummy variable takes 1 while on other days, it takes 0. Other type of dummy variable is named as "negative dummy variable" for negative announcements. For the days, on which Turkey's sovereign rating is downgraded or its outlook is worsened, negative dummy variable take 1 while on other days, it takes 0.

Our dataset includes only workdays in Turkey. Since the headquarters of S&P, Moody's and Fitch are located in USA, the days or hours on which they make rating and outlook announcements could coincide with official holidays or the hours on which Turkish financial markets are closed. As a consequence, the real effect of announcement often occur on following workdays. Therefore, in those cases, we have solved this problem by attaching dummy variable 1 to the next workday after the announcement day in USA. Moreover, if two or more credit agencies made announcements on the same day, the dummy variable takes 1 for this date.

3.1. S&P Announcements

Since May 4, 1992, Turkey have received credit rating from those agencies. First agency that evaluated and attached a rating is S&P. The first rating was BBB and outlook was stable. Also, it is the same agency that first alters Turkey's outlook

from its initial rating, BBB stable, to BBB negative approximately one year later after assigning the former.

In time period of our analysis, S&P changed Turkey's rating and outlook 45 times. 14 announcements of this number are rating changes and the remaining 31 announcements are outlook changes. Moreover, S&P upgraded Turkey's rating 6 times, while it downgraded 8 times. As for outlook changes, positive and negative announcements are close to each other. Turkey received improvements in outlook 16 times and however, it encountered negative evaluations 15 times.

Among other credit rating agencies, S&P is the company that makes evaluations most frequently. From its inital announcement day to last announcement day in August 18, 2018, S&P did not rate Turkey on high and upper medium grade. In other words, Turkey did not receive any grade that start with A.

Furthermore, Turkey was graded only 3 times in investment-grade category by S&P. After announcing first grade, which is in investment category, the following two grades were still in investment-grade category. Since January 14, 1994, Turkey has been assessed in non-investment grades category by this agency.

Table 3.1 Sovereign Ratings of Turkey by S&P

Date	**Rating**	**Outlook**
May 4, 1992	BBB	Stable
May 3, 1993	BBB	Negative
January 14, 1994	BBB-	Negative
March 22, 1994	BB	Watch negative
April 29, 1994	B+	Watch negative
August 16, 1994	B+	Stable
July 24, 1995	B+	Positive
October 18, 1995	B+	Stable
July 17, 1996	B+	Watch negative
December 13, 1996	B	Stable

August 11, 1998	B	Positive
January 21, 1999	B	Stable
December 10, 1999	B	Positive
April 25, 2000	B+	Positive
December 5, 2000	B+	Stable
February 21, 2001	B+	Watch Negative
February 23, 2001	B	Watch Negative
April 17, 2001	B-	Watch Negative
April 27, 2001	B-	Stable
July 11, 2001	B-	Negative
November 30, 2001	B-	Stable
January 29, 2002	B-	Positive
June 26, 2002	B-	Stable
July 9, 2002	B-	Negative
November 7, 2002	B-	Stable
July 28, 2003	B	Stable
October 16, 2003	B+	Stable
March 8, 2004	B+	Positive
August 17, 2004	BB-	Stable
January 23, 2006	BB-	Positive
June 27, 2006	BB-	Stable
April 3, 2008	BB-	Negative
June 31, 2008	BB-	Stable
November 13, 2008	BB-	Negative
September 17, 2009	BB-	Stable
February 19, 2010	BB	Positive
May 1, 2012	BB	Stable
March 27, 2013	BB+	Stable
February 7, 2014	BB+	Negative
May 6, 2016	BB+	Stable

July 20, 2016	BB	Negative
November 4, 2016	BB	Stable
January 27, 2017	BB	Negative
May 1, 2018	BB-	Stable
Aug 17, 2018	B+	Stable

Source: tr.tradingeconomics.com/turkey/rating

As can be seen from the table, Turkey was under close investigation on the years of economic crisis. One of the most devastating economic crisis occurred in 1994 as a consequence to the prime minister's forceful attempt to lower interest rates in treasury auctions in a high inflation environment. This attempt resulted in GDP's shrinking by 5.5% and the increase in inflation rate to a three digit level. In 1994, S&P made 4 announcements about Turkey credit rating. After assigining BBB- and watch-negative as outlook in January 1994, Turkey encountered with a downgrading to BB watch-negative in March. Nearly one month later S&P downgraded Turkey's rating to B+ watch-negative in April 29, 1994. Last announcement of the same year was made in August 16. In contrast to previous three negative evalauations, this assessment included an improvement by turning rating outlook from watch negative to stable without changing the previous grade which is B+.

Another periood of economic crisis in Turkey prevails over the years beginning from 1998 to 2001. Throughout this period, S&P made 11 announcements consisting of rating and outlook changes. During 1997, Asian countries experienced severe financial and economic crisis. As a result of this severe economic turbulence in Asian emerging countries, such as Thailand, Indonesia and Singapore, the decrease in demand in crude oil and nonferrous metals negatively affected Russia's foreign exchange reserves and caused a currency crisis in Russia in 1998. Gradual increase in risks on emerging countries, and the deterioration in world trade caused fragile Turkish economy to enter into a new negative economic crisis. Capital outflow reached 3.9 percent of GDP in 1998. Although a cuurency crisis did not occur, eight banks went bankrupt (Boratav and Yeldan 2001). Making last

announcement on December 13, 1996, S&P revised its assessment on August 11, 1998. In contrast to negative developments in financial and economic environment in Turkey, the agency altered the outlook of rating from stable to positive without changing the grade, which is BB.

On the following years, Turkish governments implemented various disinflation and stabilization programs with the help IMF in otder to deal with high inflation and currency problems. Between last half of 1999 and first months of 2000, those programs led to a temporary improvement in economy (Zürcher, 2018). However, political instability, high current account deficit, unsustainable implementation of economic programs and loss of confidence in Turkish Lira created another devastating economic crisis in 2001. The liquidity shortage in interbank markets led to the collapse of big banks and to a bounce in interest rates. Through following months, GDP of Turkey decreased by 9.3%, inflation rate rose to 66.5% and Turkish Lira was devaluated (Boratav and Yeldan, 2001).

S&P made only 2 announcements in 1999. First announcement was a change from B positive to B stable. Another change was the reverse of this evaluation from B stable to B positive. Similar to 1994 evaluations, S&P upgraded Turkey's rating from B positive to B+ positive in a worsening economic and financial environment in 2000. Last announcement of 2000 was a change in outlook from positive to stable. In 2001, S&P responded to economic turmoil by making 6 six announcements. Starting the year with B+ stable, Turkey's rating was downgraded to B- stable. After 2001, economic and financial variables improved in response to successful implementation of economic rules and programs. S&P assessed rating and outlook in a more positive way through this period. On 2008 crisis, the agency altered only outlook.

3.2. Moody's announcements

After one day on which S&P announced its initial rating and outlook for Turkey, Moody's announced its rating and outlook in May 5, 1992 by assigning Baa3 stable.

First change in rating by Moody's happened in January 13, 1994. The agency downgraded Turkey's rating from Baa3 stable to Ba1 stable.

In our analysis period, Moody's altered Turkey's grade and its outlook 26 times. 15 change is negative evaluation, while remaining 11 announcements are positive . In total, Moody's altered Turkey's rating 10 times and altered outlook 16 times. Also, there were 4 upgrading and 6 downgrading. As for oıutlook changes, there were 9 negative change and 7 improvement throughout our anaylsis period.

Moody's started assessment of Turkey on its investment grades category by assigining Baa3. On 1994, Turkey fell into non-investment category after receiving Ba1, Until May 16, 2013, Turkey was evaluated in the non-investment category by the same agency. On that date, rating was upgraded from Ba1 positive to Baa3 positive. In contrast to S&P, Moody's attached an investment-grade category rating after it downgraded to non-investment category in 1994. From May 16, 2013, to July 18, 2016, rating grade continued to stay on investment-level category. On the latter date, the country's rating downgraded to a non-investment category and rating was updated as Ba1.

Table 3.2 Sovereign Rating of Turkey by Moody's

Date	Rating	Outlook
May 5, 1992	Baa3	Stable
January 13, 1994	Ba1	Stable
June 2, 1994	Ba3	Stable
January 9, 1997	Ba3	Watch Negative
March 13, 1997	B1	Stable
November 30, 1999	B1	Positive
July 24, 2000	B1	Watch Negative
February 21, 2000	B1	Stable
April 6, 2001	B1	Negative
January 15, 2002	B1	Stable
July 10, 2002	B1	Negative

October 21, 2003	B1	Stable
February 11, 2005	B1	Stable
December 14, 2005	Ba3	Stable
September 18, 2009	Ba3	Positive
January 8, 2010	Ba2	Stable
October 5, 2010	Ba2	Positive
June 20, 2012	Ba1	Positive
May 16, 2013	Baa3	Stable
April 11, 2014	Baa3	Negative
July 18, 2016	Baa3	Watch Negative
September 23, 2016	Ba1	Stable
March 17, 2017	Ba1	Negative
March 7, 2018	Ba2	Stable

Source: tr.tradingeconomics.com/turkey/rating

From the table, it can be understood that Moody's did not make frequent announcements in years of economic and financial crises. During 1994 crisis, the agency downgraded Turkey's rating by two levels from Ba1 to Ba3. Through the period of 1998-2001, it kept rating at B1 by changing only the rating's outlook. Similar to S&P, it upgraded rating to a higher level after 2001 crisis. Starting from December 14, 2005, Moody's did not change Turkey's rating and outlook for 4 years.

3.3. Fitch Announcements

After the announcements of S&P and Moody's in 1992, Fitch made its first rating announcement in August 10, 1994. In an environment of economic crisis of 1994, Fitch stated Turkey's rating as B. Unlike other credit rating agencies, S&P and Moody's, Fitch did not specify rating's outlook. First change was an upgrading of rating. Fitch upgraded Turkey's initial rating, which is B, to BB-. Similar to first announcement, it did not announce the outlook of grade. Turkey received first outlook, which is watch-negative, in July 29, 1996. In total, Fitch did not state outlook in its announcements 4 times.

The agency made 24 announcements for Turkey. In 12 announcements, Turkey's rating was changed. The number of upgrading is 7, while downgrading count is 5. The remaining, 14 of total announcements involves changes of rating outlook. Fitch improved Turkey's rating outlook 7 times and worsened it 5 times.

Unlike S&P and Moody's, Fitch altered Turkey's rating and outlook less frequently during the period of economic crisis in 1990s. It firstly announced rating in 1994 and did not make any further announcement on the same year. Moreover, from 1996 to 2000, Fitch did not announce Turkey's sovereign rating. In 2000 and 2001, there were totally 6 rating and outlook changes. Starting from August 2001 until August 19, 2016, Turkey did not encounter with downgrading from Fitch although outlook was negatively changed several times. Furthermore, Fitch evaluated Turkey's rating in its non-investment grades category until November 5, 2012. On that date, there were an upgrade from BB+ stable to BBB- Stable, which is in investment-grade category. Staying at investment-grade category for 4 years, Turkey enountered with a downgrading to BB+ stable, which is in the non-investment grade category.

Table 3.3 Fitch's Sovereign Rating of Turkey

Date	Rating	Outlook
August 10, 1994	B	-
September 26, 1995	BB-	-
June 29, 1996	BB-	Watch Negative
December 20, 1996	B+	-
April 20, 2000	B+	Watch Positive
April 27, 2000	BB-	-
September, 21, 2000	BB-	Stable
February 22, 2001	BB-	Watch Negative
April 2, 2001	B	Watch Negative
August 2, 2001	B	Negative
February 5, 2002	B	Stable
March 25, 2003	B-	Negative

August 6, 2003	B-	Positive
September 25, 2003	B	Positive
February 9, 2004	B+	Stable
August 25, 2004	B+	Positive
January 13, 2005	BB-	Stable
December 6, 2005	BB-	Positive
May 9, 2007	BB-	Stable
October 27, 2009	BB-	Watch Positive
December 3, 2009	BB+	Positive
November 24, 2010	BB+	Positive
November 23, 2011	BB+	Srable
November 5, 2012	BBB-	Stable
August 19, 2016	BBB-	Negative
January 27, 2017	BB+	Stable
July 13, 2018	BB	Negative

Source: tr.tradingeconomics.com/turkey/rating

Similar to other credit rating agencies, Fitch did not assign a rating that starts with A to Turkey. On the economic crisis years of 1998,2000-2001 and 2008, it did not frequently downgraded Turkey's rating as compared to others.

3.4. Dollar Exchange Rate

In this thesis, the dependent variable is the variance of Dollar/TL indicative bid rate of Central Bank of the Republic of Turkey (CBRT). The dataset covers the period starting from 03/01/1992, which is the first workday of 1992. The data source is EVDS, that is the electronic data distribution channel of CBRT.

CBRT started to announce indicative exchange rate in April 5, 1994 (Arat, 2003). Government's cancelling domestic borrowing auctions increased lira liquidity in domestic market in 1993 and put pressure on foreign exchange rates. Precautions taken by government to lift the pressure did not prevent the negative outcomes and the government have decided to implement new precautions. One of them was the

announcement of indicative exchange rates by CBRT. According to this new regulation, 1 US dollar was determined based on the average bid-offer rates of 10 selected banks that have given quotation in interbank exchange rates sections of Reuters on 15:00 (Arat, 2003). Until April 2002, the number of banks giving quotations for US dollar was increased in different years.

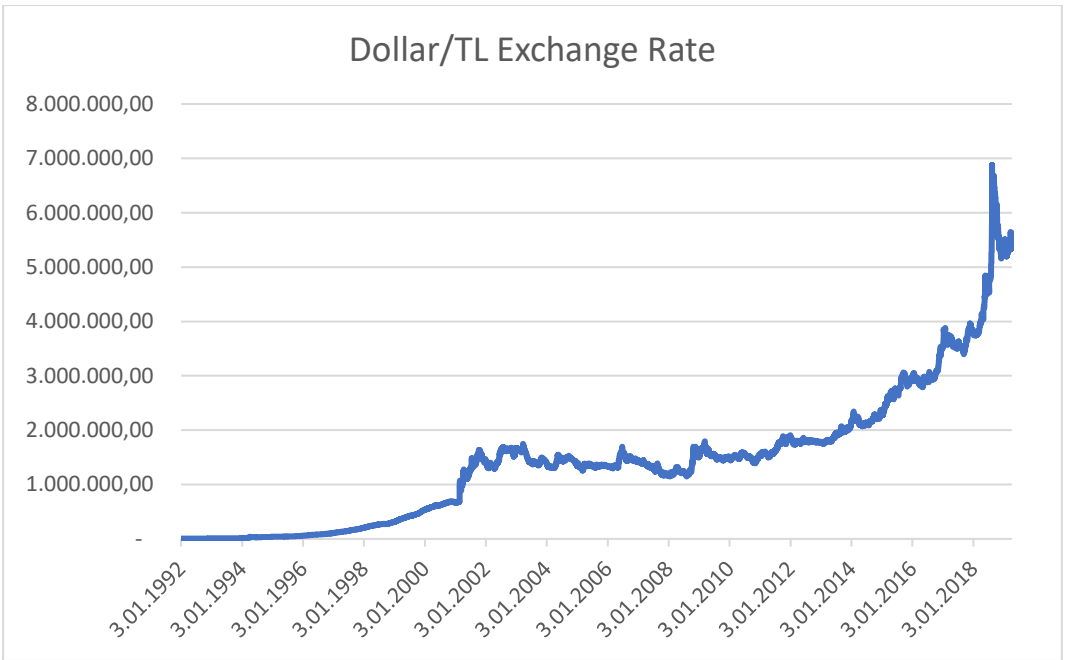
In the first years of 2000s, the TL and USD liquidity problems of banking sector led Turkish governments to implement new regulations for injecting foreign exchange into the banking system. In April 2002, foreign exchange purchasing auctions was initiated. Moreover, calculation of indicative exchange rates was changed (Arat, 2003). According to the new rule, CBRT announced the arithmetical average bid and ask prices given by banks that give quotations for TL in exchange of 1 Million USD. Those banks give TL quotations in interbank foreign exchange market in each 1 hour between 10:30-15:30 (10:30, 11:30, 12:30, 13:30, 14:30, 15:30). The arithmetical average of 6 bid and offer prices in these hours is determined by CBRT and the outcome becomes the indicative offer price for 1 USD (Capital Market Licensing Study Notes, 2019).

In order to analyze the effects of credit rating announcements on USD/TL exchange rate volatility, I take logarithmic return of the daily bid TL price of 1 USD

$$\ln(S_t)-\ln(S_{t-1}) = Return_t$$

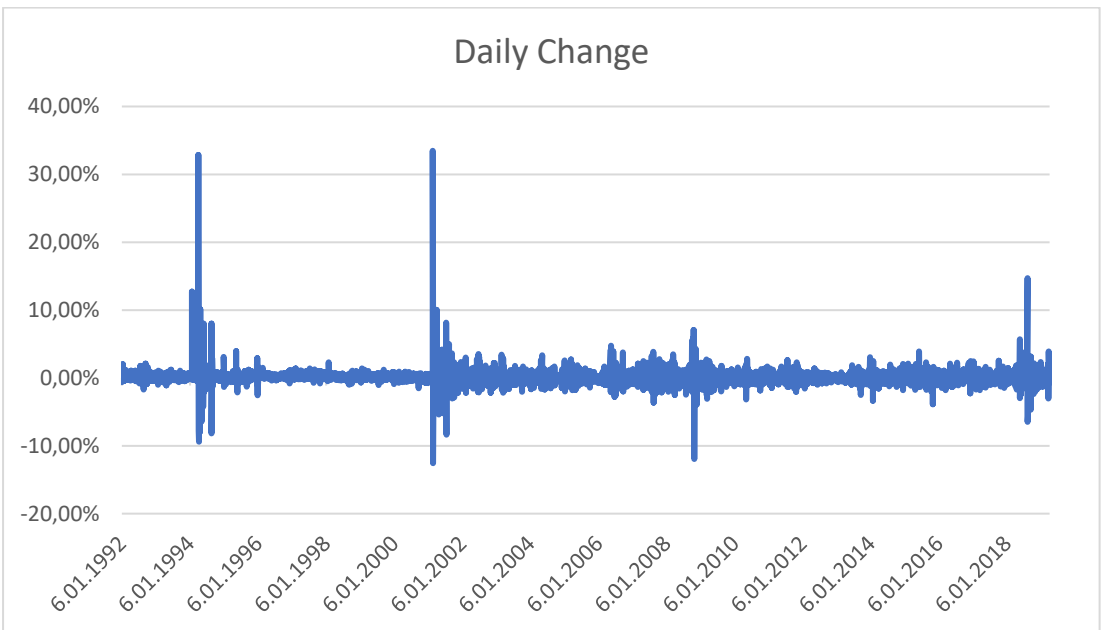
In the equation, S_t corresponds to USD/TL bid rate on day t and $Return_t$ corresponds to the logarithmic daily return on day t. On table 3.4, the exchange rate is given between January 03, 1992 and April 8, 2018 and the logarithmic returns for these days are given in table 3.5

Table 3.4 US Dollar/TL Exchange Rate



Source: Electronic Data Distribution System (EVDS), Central Bank of Republic of Turkey

Table 3.5 Daily Change of US Dollar/TL Exchange Rate



Source: Electronic Data Distribution System (EVDS), Central Bank of Republic of Turke

CHAPTER 4

METHODOLOGY

Most of economic and financial variables exhibit different levels of volatility over time. In other words, most of economic and financial variables does not have constant mean and variance. Nonstationarity of sample means implies heteroskedasticity of error terms (Enders, 2014). Walter Enders (2014) explains some stylized facts about heteroskedasticity:

1) Many of the series contain a clear trend
2) The volatility of many series is not constant over time
3) Shocks to a series can display a high degree of persistence
4) Some series seem to meander
5) Some series share comovements with other series
6) Some of the series exhibit breaks

Those features summarized above necessitates the estimation of conditional variance of disturbance terms. Engle (1982) introduced Autoregressive Conditional Heteroskedasticity (ARCH) model to estimate the variance of disturbance terms.

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_2 x_{t-1} + \varepsilon_t$$

In the ADL equation given above, the nonconstant variance of disturbance term ε_t, which is σ^2, is estimated via an ARCH model:

$$\sigma^2_t = \theta_0 + \theta_1 \varepsilon^2_{t-1} + \theta_2 \varepsilon^2_{t-2} + \theta_3 \varepsilon^2_{t-3} + \ldots\ldots + \theta_q \varepsilon^2_{t-q}$$

In this equation, all coeficients of θ_0, θ_1, θ_2, θ_3,...., θ_q are unknown. Also if it is assumed that θ_1, θ_2, θ_3,...., θ_q are equal to 0, then the conclusion becomes:

$$\sigma^2_t = \theta_0$$

Under the condition that, except θ_0, all coefficients, θ_1, $\theta 2$, $\theta 3$,...., θq, are equal to 0, the variance of disturbance term, σ^2_t, is constant and equal to θ_0. As a result, the varience term exhibit the feature of homoskedasticity. However, when at least one of $\theta 1$, $\theta 2$, $\theta 3$,...., θq is not equal to zero, the variance of disturbance term is not constant and depends on the past values of disturbance term. As a conclusion, an ARCH model is useful for estimation of the variance, σ^2_t in this case. Over time, ARCH model was developed by several econometricians. One of them is Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model, which is explained in section 4.1.

4.1. GARCH model

GARCH model was introduced by Tim Bollerslev in 1986. This model is an extension of ARCH model. As explained in the previous section, ARCH model is based on the estimation of variance of disturbance term by regressing its lagged terms. GARCH model extends this technique by incorporating the lagged values of variance of disturbance term. The equation below is an example of a typical GARCH (q,p) model:

$$\sigma^2_t = \theta_0 + \theta_1\varepsilon^2_{t-1} + \theta_2\,\varepsilon^2_{t-2} + \ldots + \theta_q\,\varepsilon^2_{t-q} + \varphi_1\sigma^2_{t-1} + \varphi_2\sigma^2_{t-2} + \ldots + \varphi_p\sigma^2_{t-p}$$

When, except θ_0, all coefficients, $\theta 1$, $\theta 2$, $\theta 3$,...., θq, φ_1, φ_2, φ_3,..., φ_p, are equal to 0, the variance term is equal to nonconstant θ_0 and it is inferred that the disturbance terms exhibit homoskedasticity feature. However, if one of those coefficients is different from zero, homoskedasticity of disturbance terms is violated. Furthermore, in the case that coefficients of φ_1, φ_2, φ_3,..., φ_p are equal to 0, GARCH (q,p) model is equal to an ARCH (q) model. Since lagged values of variance term of disturbance term is incorporated in to this model, GARCH model is similar to autoregressive distributed lag (ADL) model, which includes lagged values of independent variable as dependent variables in the model. ARCH model is similar to distributed lag model, which include past values of variables other than the independent variable of model.

In this thesis, first model of my analysis is GARCH model. The model is given below:

$$\sigma^2_t = \beta_0 + \beta_1\varepsilon^2_{t-1} + \beta_2\varepsilon^2_{t-2} + \beta_3\sigma^2_{t-1} + \beta_4 PD_{t-1} + \beta_5 ND_{t-1}$$

β_1, β_2, β_3, β_4 and β_5 denote the estimators, and β_0 is the constant term. Dummy variables for sovereign credit rating announcements are ND and PD. Since there is a time difference between USD and Turkey, the real effect of credit rating announcement on USA is observed on the next day in Turkish financial markets. As a conclusion, in order to estimate the variance of logarithmic return of USD/TRY exchange rate on the day t, I have taken t-1 values of dummy variables, PD and ND, into consideration in the model.

In my analysis, PD denotes the dummy variable for positive announcements of three credit rating agencies. Positive announcements mean upgrading of sovereign credit rating and improvement in rating outlook. On the days of positive anouncementes, the dummy variable, PD, takes 1 and it takes 0 on other days. Similarly, ND denotes the dummy variable for negative announcements. Those announcements include downgrading of sovereign credit rating and worsening of ratings outlook. On days of negative announcements, this variable takes 1, otherwise takes 0. These dummy variables are summarized below:

$$PD = \begin{cases} 1, If\ there\ is\ a\ positive\ announcement \\ 0, Otherwise \end{cases}$$

$$ND = \begin{cases} 1, If\ there\ is\ a\ negative\ announcement \\ 0, Otherwise \end{cases}$$

In addition to dummy variables for positive and negative announcements, the variances of logarithmic return of USD/TRY exchange on the day of t-1, $\sigma^2_{t-1,}$ is included in my model.

4.2. EGARCH Model

Daniel B. Nelson criticized GARCH models in several aspects in his paper (1991). According to Nelson (1991), first point is that since all estimated coefficients on a GARCH model is positive, the variance of disturbance term is always found to be positive. As stated in Bollerslev (1986), all coefficients of independent variables are assumed to be greater than 0.

Another criticism for GARCH models is related to the asymmetric effects of bad news and good news on volatility. Black (1976) implies that stock returns give response to changes in return volatility in a negatively correlated manner. In other words, increase in volaility resulting from bad news leads to lower excess returns, while decrease in volatility due to good news leads to higher excess returns. At this point, Nelson (1991) emphasizes that GARCH models provide researchers with only a magnitude related to the effects of bad news and good news. By the assumptions of Bollerslev (1986), those magnitudes are positive coefficients. As a result, GARCH model is silent on the effect of negative and positive excess returns on variance.

The last drawback of GARCH models is about the persistence of shocks. According to Nelson (1991), if shocks indefinitely affect the conditional variance, it can affect also another variables.

A typical exponential GARCH (EGARCH) model is given

$$\ln(\sigma^2_t) = \beta_0 + \beta_1 \left| \frac{\varepsilon^2_{t-1}}{\sigma^2_{t-1}} \right| + \beta_2 \left(\frac{\varepsilon^2_{t-1}}{\sigma^2_{t-1}}\right) + \beta_3 \ln(\sigma^2_{t-1})$$

According to Enders (2014), this model implies that log-linear form of variance, $\ln(\sigma^2_t)$, enable coefficients to be negative and the magnitude of $\ln(\sigma^2_{t-1})$ is irrelevant for analysis. Moreover, by dividing ε^2_{t-1} by σ^2_{t-1} , the effect of disturbance term becomes unit-free and provides more standard measure for size and persistence of shocks. Lastly, for different levels of $\frac{\varepsilon^2_{t-1}}{\sigma^2_{t-1}}$, shocks affect the log-normal conditional

variance differently. For example, if this term is greater than 0, the impact of shock is the sum $\beta_1 + \beta_2$. The total impact on conditional log-normal variance is $\beta_1 - \beta_2$ if this term is less than 0.

In my thesis, the second methodology for analysis is EGARCH model. My model is given below:

$$\ln(\sigma^2_t) = \alpha_0 + \alpha_1 \left| \frac{\varepsilon^2_{t-1}}{\sigma^2_{t-1}} \right| + \alpha_2 \left(\frac{\varepsilon^2_{t-1}}{\sigma^2_{t-1}}\right) + \alpha_3 \ln(\sigma^2_{t-1}) + \alpha_4 PD_{t-1} + \alpha_5 ND_{t-1}$$

In the equation, $\alpha_1, \alpha_2, \alpha_3, \alpha_4$ and α_5 are coefficients and α_0 is constant term. PD_{t-1} and ND_{t-1} are the same dummy variables similar to GARCH model. PD denotes positive dummy variable while ND denotes negative dummy variable. Also σ^2_t is the variance of logartihmic return of USD/TRY exchange rate. $\ln(\sigma^2_t)$ is the logarithmic transformation of σ^2_t.

4.3. Stochastic Volatility Model

The basic stochastic volatility model is first introduced by Taylor (1982, 1986). In our case, we have just added the announcement dummy variables to the volaility function. The model proposed is as follows:

$$r_t = \exp\left(\frac{\sigma_t}{2}\right) \epsilon_t \qquad (4.3.1)$$

$$\sigma_t = \gamma + \delta\sigma_{t-1} + \beta pos.dummy_{t-1} + \theta neg.dummy_{t-1} + \nu\eta_t \qquad (4.3.2)$$

where r_t is the observed returns, σ_t is the observed volatility, *pos.dummy* and *neg.dummy* are the same dummy variables in GARCH model and (ϵ_t, η_t) are independent $N(0,1)$ random variables. Furthermore, $|\delta| < 1$.

4.3.1. Efficient Importance Sampling

Equations (4.3.1) and (4.3.2) characterize a Gaussian nonlinear dynamic state-space model. The nonlinear dependence of r_t on the latent factor σ_t in equation 4.3.1 prevents application of the Kalman Filter. Instead we shall apply sequential Efficient Importance Sampling (EIS) to evaluate the likelihood function of our model, as well as Likelihood Ratio (LR) test-statistics for the nul hypotheses of

interest. EIS was introduced by Richard and Zhang (2007) and has been shown to produce highly accurate MC estimates of likelihood functions for a wide range of SV models – see e.g. Liesenfeld and Richard (2003, 2006).

With reference to the standard characterization o state-space models. Equation (4.3.1) defines a measurement density $f(r_t \mid \sigma_t)$ and a state transition density $f(\sigma_t \mid \sigma_{t-1})$ respectively. Let $\Lambda_t = \{ \sigma_s \}_{s=0}^{t}$ and $R_t = \{ r_s \}_{s=1}^{t}$. Since Λ_t is not observed evaluation of the likelihood function requires high-dimensional MC nuemerical integration of with respect to Λ_T:

$$f (R_t \mid \varkappa_0) = \int f (\sigma_0) \prod_{t=1}^{T} [f (r_t \mid \sigma_t) f(\sigma_t \mid \sigma_{t-1})] d\Lambda_T \qquad (4.3.3)$$

where $f (\sigma_0)$ denotes the stationary density of σ_0. EIS aims at constructing a numerically efficient parametric sequential importance sampling process $\{m(\sigma_t \mid \sigma_{t-1};\ \alpha_t);\ \alpha_t \in A \}_{t=1}^{T}$. Specifically it starts with the preselection of a parametric class of auxiliary density kernels $K = \{ k(\sigma_t,\sigma_{t-1};\ \alpha_t \in A\}$. Kernels differ from densities in that they ignore normalizing factors. Within the present sequential context, the relationship between kernels and densities is given by

$$m(\sigma_t \mid \sigma_{t-1} , \alpha_t) = \frac{k(\sigma_t, \sigma_{t-1}:a_t)}{\varkappa(\sigma_{t-1};a_t)}, \qquad (4.3.4)$$

$$\varkappa(\sigma_{t-1}, \alpha_t) = \int \kappa(\sigma_t, \sigma_{t-1};\ \alpha_t)d\sigma_t \qquad (4.3.5)$$

For any given set $\{\alpha_t\}_{t-1}^{T}$ the likelihood integral in 4.3.3 is then approximated by

$$\hat{f}_N (R_T \mid \varkappa_0) = \frac{1}{N} \sum_{d=i}^{N} \omega(\sigma_t^j , \sigma_{t-1}^j ; \alpha_t) \qquad (4.3.6)$$

$$\omega(\sigma_t, \sigma_{t-1};\ \alpha_t) = \frac{f(r_t|\sigma_t) f(\sigma_t|\sigma_{t-1},x_{t-1})}{m(\sigma_t|\sigma_{t-1},a_t)} \qquad (4.3.7)$$

and $\{\{\sigma_t^j\}_{t=0}^{T}\}_{j=1}^{N}$ denotes *N i.i.d.* trajectories drawn from the sequential IS sampler.

$(f (\sigma_0).\{m (\sigma_t \mid \sigma_{t-1};\ \alpha_t\}_{t=1}^{T})$. EIS aims at selecting the auxiliary IS parameters $\{\alpha_t\}_{t=1}^{T}$ in a way which (approximately) minimizes the MC sampling variance of the

likelihood estimate in equation 4.3.7. In order to do so while accounting for the Markovian dynamics of the state transitions EIS first transforms the IS ratios in (4.3.7) by transfering the IS normalizing factor χ (σ_t; α_{t+1}) back by one period in order to regroup in the period -t numerator all factors depending on σ_t. Accordingly, the transformed IS ratios are given by

$$\omega_*(\sigma_t, \sigma_{t-1}\,;\, \alpha_t, \alpha_{t+1}) = \frac{\varphi_t(\sigma_t,\sigma_{t-1};a_{t+1})}{K(\sigma_t,\sigma_{t-1};a_t)}, \qquad (4.3.8)$$

where $\varphi_t(.)$ denotes the IS target kernel

$$\varphi_t(\sigma_t, \sigma_{t-1};\, \alpha_{t+1}) = [\, f(r_t \mid \sigma_t)\, .\, f(\sigma_t \mid \sigma_{t-1}, \varkappa_{t-1})\,]\, \chi(\sigma_t, \alpha_{t+1}) \qquad (4.3.9)$$

Next approximate optimal values for $\{\alpha_t\}_{t=1}^{\tau}$ obtain by solving the following backward recursive sequence of auxiliary least square (LS) problems

$$(\hat{\alpha}_t, \hat{c}_t) = \text{Arg Min}_{\alpha\,\epsilon\,A,\, c\epsilon R} \sum_{j=1}^{S} [\ln \varphi_t(\sigma^j_t, \sigma^j_{t-1};\, \hat{\alpha}_{t+1}) - c - \ln k\,(\sigma^j_t, \sigma^j_{t-1};\, \alpha)]^2 \qquad (4.3.10)$$

Where the S i.i.d trajectories $\{\{\ \sigma^j_t\ \}_{t=1}^{\tau}\}_{j=1}^{S}$ should best be drawn from the EIS sampler itself. In practice, this can ben achieved by embedding the sequential LS minimization problem in (4.3.10), within a fixed-point search for $\{\{\hat{a}_t\}_{t=1}^{\tau}$whereby step-$l$ solutions to (4.3.7) are based upon draws from the sequential IS sampler obtained in step-($l-1$). Under additional implementation details discussed in Richard and Zhang (2007), convergence to a fixed-point solution is usually fast (4 to 5 steps) for well-behaved applications as SV models.

CHAPTER 5

RESULTS

In this study, we used three models in order to test this effect. First model is GARCH, second model is EGARCH and the last model is Stochastic Volatility Model as stated in the previous chapter.

5.1. Results of GARCH model

Table 5.1 shows the empirical findings of our GARCH moel. This model comprises of one lagged values of the variance of logarithmic return of USD/TRY exchange rate, σ^2_{t-1} and two lagged values of disturbance term, ε^2_{t-1} and ε^2_{t-2}. Also in order to analyze the volatility at time t, we have taken t-1 values of positive and negative dummy variables of positive and negative credit rating announcements. Since the headquarters of Moody's, Fitch and S&P are located in USA and there is a time difference between USA and Turkey, the real effect of their announcements are experienced in the following workday in Turkey financial markets. As a result, our GARCH model includes 5 variables in total: two moving average components, one autoregressive component and two dummy variables.

Table 5.1 Results of GARCH model

Variable	Coefficient	Std. Error
β_0	0.008671	0.000426
β_1	0.288274***	0.012555
β_2	-0.132597***	0.010791
β_3	0.841260***	0.002870
β_4	0.050393***	0.010021
β_5	5.417476***	0.122271

Note: ***, ** and * indicate significance at 1%,5% and 10%, respectively

From the table, it can be concluded that positive and negative credit rating announcements at day t-1 increase the USD/TRT exchange rate volatility at day t. Thus, coefficient for negative dummy variable is greater than the coefficient for positive dummy variable. This situation implies that negative rating announcements have more impact on the exchange rate volatility than positive announemcements.

Hypthesis testing for significance of coefficients of positive and negative dummy variables show that both coefficients are statistically significant at the confidence levels of 95%, 99% and 90%.

$$H_0: \beta_4 = 0$$

$$H_1: \beta_4 \neq 0$$

For the coefficient of positive dummy variable, the null hypothesis implying that β_4 is equal to 0 can be rejected at 90%, 95% and 99% confidence levels. Z-Statistics for this coefficient is 5.028472 and this number is greater than critical values of 1.645 (confidence level of 90%), of 1.96 (confidence level of 95%) and of 2.576. As a result, H_1 can be accepted and the cofficient for positive dummy variable is statistically significant.

$$H_0: \beta_5 = 0$$

$$H_1: \beta_5 \neq 0$$

Similarly, the null hypothesis that the cofficient for negative dummy variable, ND_{t-1} is statistically significant. We can draw this conclusion by comparing Z-Statistics for $\beta_{5,}$ which is 44.30714, with critical values at confidence levels of 90%, 95% and 99%.

5.2.Results of EGARCH model

Table 5.2 shows the empirical findings of EGARCH model. As stated in model, the dependent variable is the logarithmic transformation of the dependent variable in our GARCH model. Independent variables include the absolute value of t-1 and

t-2 values of disturbance term divided by square root of, respectively, t-1 and t-2 values of variances of USD/TRY exchange rate logaritmic return. Another independent variable is t-1 value of disturbance term divided by the square root of variance of logarithmic return of USD/TRY exchange rate. Moreover, logartihmic transformation of t-1 values of variance term and t-1 values of dummy variables are included in our EGARCH model.

Table 5.2 Results of EGARCH Model

Variable	Coefficient	Std. Error
α_0	-0.219261	0.003932
α_1	0.344175***	0.012697
α_2	-0.095423***	0.012830
α_3	0.058884***	0.004371
α_4	0.968587***	0.001051
α_5	0.185315***	0.042081
α_6	2.360862***	0.019966

Note: ***, ** and * indicate significance at 1%,5% and 10%, respectively

Table 5.2 gives the results of exponential GARCH model. According to this model, both positive and negative credit rating announcements lead to an increase in USD/TRY exchange rate volatility. Moreover, since coefficient for negative dummy variable is greater than coefficient for positive dummy variable, it can be inferred that negative announcements at day t-1 have more increasing impact on USD/TRY exhcange rate at day t than positie credit rating announcements. In those respects, EGARCH model provides consistent empirical results with GARCH model, as stated in the previous section.

Hypothesis testing implies that coeffiicents for both positive and negative dummy variables in exponential GARCH model are statistically significant at 95% confidence level:

$$H_{0::} \alpha_5 = 0$$

$$H_{1:} \alpha_5 \neq 0$$

Z-Statitics for α_5 is 4.403801 and this number is greater than the criticial values at 90%, 95% and 99% confidence level.. As a result, null hyphothesis that claims α_5 is equal to 0 can be rejected at this confidence level.

$$H_{0::} \alpha_6 = 0$$

$$H_{1:} \alpha_6 \neq 0$$

For the coefficient of negative dummy variable, $\alpha_{6,}$ Z-statistics is greater than critical values at 90%, 95% and 99% confidence levels and the null hypothesis can be rejeceted at these levels. So we can conclude that this coefficient is statistically significant at three levels.

5.3. Results of Stochastic Volatility model

Last model of my anaylsis is stochastic volatility model. As explained in previous section, our stochastic volatility model comprises of two equations. One of those equations take unobserved volatility as independent variable and observed returns as dependent variable. Other equation relates dummy variables to the variance of USD/TRY exchange rate volatility. According to this model, positive and negative credit rating announcements increase the volaility of exchange rate. Also the effect of negative annoucements is greater than positive announcements since estimated coefficient of negative dummy variables, θ, is higher than the estimated value for positive dummy variables, β. Empirical findings of stochastic volatility model is summarized in table 5.3.

Table 5.3 Results of Stochastic Volatility Model

Variable	Coeffiicient	Standard Error
γ	-0.061485596***	0.0083779177
δ	0.095614219**	0.0052954326
β	0.1510267	0.1483945

θ	0.38890276***	0.05003878
ν	0.31659447***	0.01729629

Note: ***, ** and * indicate significance at 1%,5% and 10%, respectively

Hypothesis test for coefficient of positive dummy variable is given below:

$$H_0: \beta = 0$$

$$H_1: \beta \neq 0$$

Z-statistics for this coefficient is equal to 1.0177. Since this number is lower than critical values at 90%, 95% and 99% confidence levels, null hypothesis can be accepted. It can be inferred that this coefficient is not statistically significant at those levels.

Hypothesis test for negative dummy variable coefficient is given:

$$H_0: \theta = 0$$

$$H_1: \theta \neq 0$$

Z-statistics for θ is 7.772. Since this number is greater than critical values at three selected confidence levels, null hypothesis can be rejected in favour of alternative hypothesis. As a result, negative dummy variable has statistically significant effect on exchange rate volatility.

5.4. Likelihood Ratio Test and Model Selection

In order to define the best model that fits well into data, several testing methodologies are used. I use Likelihood Ratio (LR) test for selecting the best model among GARCH, EGARCH and stochastic volatility in analysis of the relationship between credit rating announcements and USD/TRY exchange rate volatility.

Likelihood ratio test implies that LR statistics can be found by multiplying the absolute value of log-likelihoods of two models by 2. This statistics is distributed chi-squared with the number of excess explanatory variables among two models compared. The null hypothesis claiming that the more restrictive model is better

than less restrictive model is tested againt the alternative hypothesis. If p-value at a certain critical value and a certain degree of freedom indicated by LR statistic is lower than a specified probaility level, we can conclude that null hypohesis can be rejected and alternative hypothesis can be accepted at this probability level.

First pairwise test is between GARCH and EGARCH models. LR test statistics is equal to:

$$LR = 2.(-6546.133-(-6632.638)) = 173.01$$

The likelihood ratio test statistics for testing GARCH and EGARCH models is 173.01 and is distributed chi-squared with 1 degree of freedom. The reason for 1 degree of freedom is that EGARCH model has one more variable than GARCH model. Since p-value at this critical value and 1 degree of freedom is 0.00001 ,the null hypothesis claiming that less restrictive model (GARCH in this thesis) is the better model can be rejected at 0.05 and EGARCH model fits well into data.

Second pairwise test is between EGARCH and stochastic volatility model.

$$LR = 2.(-6016.0626-(-6546.133)) = 1060.1408$$

P-Value for critical value of 1060.1408 and 2 degree of freedom is 0.0001. Null hypothesis can be rejected at 0.05 and it can be concluded that EGARCH model is better than stochastic volatility model in explaining the relationship between dependent variable and independent variables.

In pairwise likelihood ratio tests, EGARCH model is the best model in estimating the effect of credit rating announcements on USD/TRY exchange rate volatility.

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CHAPTER 6

CONCLUSION

Credit rating agencies provide rating services in several areas around the world. Most creditworthy internetional rating agencies are Fitch, S&P and Moody's around the world. In this thesis, these agencies' announcements are taken into consideration.

Rating services of these three agencies include issuer ratings, debt securities ratings, bank ratings and sovereign ratings. Rating grades generally consist of two parts. One part is the letter grade and second part is the outlook of this grade. Scales of letter grades vary accross credit rating agencies, however the implications of those grades are almost same for credit rating agencies. Outlooks of letter grades give an idea on path of current letter grade in future announcements.

Ratings of issuers and securities are neither advice for profitable investments nor a certain expression for default risk of a subject rated. The aim of credit rating agencies is to provide a common language for the evaluation of creditworthiness for an issuer or a security. This common language helps savers and lenders acquire information on the financial condition of issuer or security. Higher rating grades facilitate issuers to borrow at a lower cost, because lower grades implicate higher default risk and in turn, lenders demand more return for funds transferred from lenders to borrowers.

Another category for credit rating is the evaluation of sovereign government. This category is a general assessment of a governing body of a country. According to Guide to Credit Rating Essentials of S&P, sovereign rating differs from analysis corporate and security ratings. The reason for such differentiation is the concentration of analysis on economic and fiscal performance of a government, effectiveness of government and state institutions, and monetary and financial

stability as a whole. In this respect, sovereign rating gives information on country risk. Level of country risk determines level of risk-free rate. Lower rating grades can be translated into higher country risk and in turn, into higher interest rates. As a result, lower sovereign rating grades increases the cost of borrowing for a country by increasing the risk-free rate relatively.

Furthermore, sovereign credit rating announcements affect other macroeconomic variables in different channels. Since sovereign letter grades are upper limit for corporate and security grades, announcements for sovereign rating affect capital and money market transactions. In response to these effects, macroeconomic variables fluctuate in different levels after credit rating announcements of three big credit rating agencies. In this thesis, I concentrate on the relationship between USD/TRY exchange rate volatility and rating announcements. On literature, several papers analyze the impacts of corporate and sovereign rating announcements on different financial variables, such as equity returns, various BIST indexes and eurobond yields in Turkey. This paper contributes to literature by taking USD/TRY exchange rate volatility as dependent variables.

In order to investigate the relationship between exchange rate volatility and sovereign rating announcements, three models are used, GARCH, EGARCH and stochastic volatility models. The analysis covers the time period between January 1, 1992 and April 8, 2019. In all models, two separate dummy variables are incorporated into the equations for rating announcements.Negative dummy variables are created for downgrading and worsening of rating outlooks, positive dummy variables are created for upgrading and improvements of rating outlooks. Negative dummy variables takes 1 for negative announcement days, on other days it takes 0. Similarly, positive dummy variables takes 1 positive announcement days, on other days it takes 0. If a credit rating agency does not make any change in rating grade and outlook, both dummy variables take 0. Exchange rate volatility enters into the models as the variance of loagarithmic returns of daily exchange rates.

Empirical findings of three models show that positive and negative sovereign credit rating announcements have statistically significant impacts on exhcange rate

volatility at different confidence levels. Also in all models, the volatility-increasing effect of negative announcements are higher than positive announcements.

In order to select the best model that fits on the data, likelihood ratio test is conducted. In pairwise evaluations, EGARCH model is found to be best model that fits on the data among all models.

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APPENDIX

A) Regression Results of GARCH Model

Dependent Variable: RETURN
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 04/21/19 Time: 17:50
Sample (adjusted): 1/06/1992 4/08/2019
Included observations: 6869 after adjustments
Convergence achieved after 53 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*RESID(-2)^2 + C(6)*GARCH(-1)
+ C(7)*POSITIVE DUMMY(-1) + C(8)*NEGATIVE DUMMY(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.092236	0.005064	18.21340	0.0000
RETURN(-1)	0.064706	0.012926	5.005951	0.0000
Variance Equation				
C	0.008671	0.000426	20.34270	0.0000
RESID(-1)^2	0.288274	0.012555	22.96042	0.0000
RESID(-2)^2	-0.132597	0.010791	-12.28750	0.0000
GARCH(-1)	0.841260	0.002870	293.0786	0.0000
POSITIVE DUMMY(-1)	0.050393	0.010021	5.028472	0.0000
NEGATIVE DUMMY(-1)	5.417476	0.122271	44.30714	0.0000

R-squared	0.015952	Mean dependent var	0.092673
Adjusted R-squared	0.015809	S.D. dependent var	1.031751
S.E. of regression	1.023564	Akaike info criterion	1.933509
Sum squared resid	7194.434	Schwarz criterion	1.941469
Log likelihood	-6632.638	Hannan-Quinn criter.	1.936255
Durbin-Watson stat	1.795213		

B) Regression Results of EGARCH Model

Dependent Variable: RETURN
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 04/21/19 Time: 18:50
Sample (adjusted): 1/06/1992 4/08/2019
Included observations: 6869 after adjustments
Convergence achieved after 37 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
LOG(GARCH) = C(3) + C(4)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(5)
*ABS(RESID(-2)/@SQRT(GARCH(-2))) + C(6)*RESID(-1)
/@SQRT(GARCH(-1)) + C(7)*LOG(GARCH(-1)) + C(8)
*POSITIVE DUMMY(-1) + C(9)*NEGATIVE DUMMY(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.104402	0.005043	20.70112	0.0000
RETURN(-1)	0.050862	0.011669	4.358794	0.0000
Variance Equation				
C(3)	-0.219261	0.003932	-55.76907	0.0000
C(4)	0.344175	0.012697	27.10743	0.0000
C(5)	-0.095423	0.012830	-7.437258	0.0000
C(6)	0.058884	0.004371	13.47272	0.0000
C(7)	0.968587	0.001051	921.2786	0.0000
C(8)	0.185315	0.042081	4.403801	0.0000
C(9)	2.360862	0.019966	118.2419	0.0000

R-squared	0.013012	Mean dependent var	0.092673
Adjusted R-squared	0.012868	S.D. dependent var	1.031751
S.E. of regression	1.025092	Akaike info criterion	1.908614
Sum squared resid	7215.930	Schwarz criterion	1.917569
Log likelihood	-6546.133	Hannan-Quinn criter.	1.911702
Durbin-Watson stat	1.771641		