EFFECTS OF WAGE PAYMENT DAYS ON USD/TL FOREIGN EXCHANGE RATE IN TURKEY

A Thesis

by

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To my father and my beloved nieces İpek Su and Ayşe Deniz.

ABSTRACT

EFFECTS OF WAGE PAYMENT DAYS ON USD/TL

FOREIGN EXCHANGE RATE IN TURKEY

This paper examines and analyzes changes (increase, decrease otherwise) in US Dollar against Turkish Lira foreign exchange rate returns in some calendar days such as wage payment days in Turkish free foreign exchange market around turn of the month, beginning of the month, before holidays and mid-day of the month between years January 2003 and December 2018. It is an empirically proven fact by related literature that changes in foreign exchange rates steer foreign exchange deposits, overnight interest rates and outlook of Turkish economy. Dollarization in the Turkish economy directly affects the inflation expectations, thus causes a re-adjustment period for overall expectations on macroeconomic level. This paper focuses on the effect of wage payment days on dollarization behavior.

ÖZET

Bu makale 2003 yılı Ocak ayı ile 2018 yılı Aralık ayları arasında Türkiye serbest döviz piyasasında ay başı, ay sonu, ay ortası ve tatil öncesi maaş ödeme günleri gibi takvim günlerinde Türk Lirasının ABD doları karşısındaki değişimini (artan ya da azalan) inceler ve analiz eder. Döviz kurlarındaki değişimin döviz mevduatını, gecelik faiz oranlarını ve Türkiye ekonomisine bakış açısını yönlendirdiği ilgili literatür tarafından ampirik olarak kanıtlanmış bir gerçektir. Türkiye ekonomisindeki dolarizasyon, enflasyon beklentilerini doğrudan etkilemekte, dolayısıyla makroekonomik düzeyde genel beklentiler için yeniden ayarlama dönemine neden olmaktadır. Bu makale, maaş ödeme günlerinin dolarizasyon davranışına etkisine odaklanmıştır.

ACKNOWLEDGMENTS

I would like to thank my best wishes to my supervisor Dr. Muzaffer Akat for his enfolder, large- hearted, valuable encouragement and patience. Without him, this master's thesis would not be possible in this very short time.

I would like to thank my liquidity risk team whose are Cemile, Berk, Irmak and Sefa. They have provided and supported me to write this thesis paper. In this period, Berk was really helpful who corroborate me every step of analyzing and sharing his ideas about modelling.

Finally, I would like to show my deepest gratitude to my lovely family who encourage me to finish my master degree on Financial Engineering.

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CHAPTER I

INTRODUCTION

Turkey is labeled as an emerging country and its national currency is known as 22nd powerful currency on the world list. It has been mentioned in many researches about Turkish Lira currency depreciation and weakness against other countries' currency as well as US Dollar. Domestic and foreign investors, companies, agents have had a fair appetite on USD/TL returns, because of high volatility. In the era of high-risk appetite after 2008 GFC, many foreign and domestic investors reaped the benefits of this volatility. As the growth prospects of Turkey diminished and real activity slowed down, agents' tendency to resort to US dollar is resurfaced. For many years, residents of Turkey attempted to hedge themselves against high levels of inflation. Most residents do not have financial literacy to fathom the consequences of this tendency. External economic conditions, relationships between neighboring countries, terrorism, political discourse, threat of Turkey border security etc. have deterministic roles on USD/TL exchange rate, perceptively. Nevertheless, residents do not fully factor in these roles. Apart from all of these, inflation, dollarization, investment tools for resident people are other important guidance for USD/TL. It is indeed arguable in which one of those aforementioned factors matter on USD/TL foreign exchange currency increases and decrease. It may occur due to imposed economic sanctions or political issues. In Turkey, effects of wage payment days on foreign exchange currency as well as US Dollar against Turkish Lira (USD/TL) is spectacularly and intriguingly matter. Even if multiple studies have focused on return of some calendar anomalies on stock returns of Borsa Istanbul (BIST), different studies,

likewise, have focused on Turkish foreign exchange markets. Moreover, turn-of-month returns and beginning-of-month returns are mainly discussed and studied by researchers because it is historically gripping, but effect of wage payment days is generally touched upon in the papers which specifically focus on turn-of-month effect papers. It could be said that either dollarization or changes in inflation rates are main drivers for USD/TL exchange rate because of foreign currency asset and cash storing tendencies.

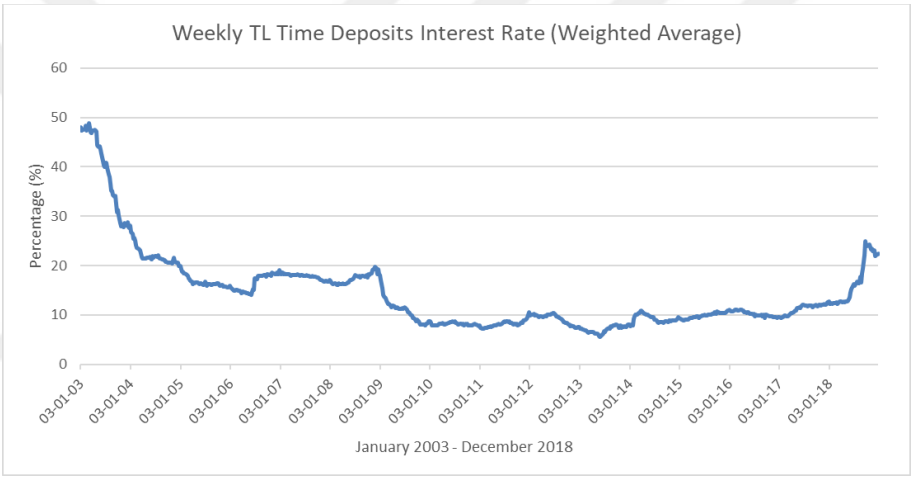
1.1 USD/TL Foreign Exchange Rate

Between January 2003 and December 2018, US Dollar against Turkish Lira exchange rate has changed to 5.29 from 1.66. In 16 years, Turkish Lira depreciated drastically and USD/TL foreign exchange currency had lots of rally time for investors because it has been highly volatile. It is important to consider the huge boost, numerically a boost of 217.9% change in log returns. As we mentioned it before, Turkey has a unique geographical location between Asia and Europe and also it has direct transfer points to Africa and Middle East i.e. MENA region. Political and strategical changes have directly affected USD/TL. However, trend of USD/TL exchange rate is far from being non-stationary. One can observe the direct effects of many occurrences in global economic stage as well as the effects of internal financial dynamics. Turkey has been subject to several institutional changes as well, thus combined effects render the trend of USD/TL exchange rate. Moreover, an interesting fact about USD/TL exchange rate is, it had higher and higher returns on long-term as the years passed on. As shown on Table 1.

1.2 Weekly Turkish Lira Time Deposits Interest Rates (Weighted Average)

It is known that households have had a tendency to invest their money on time

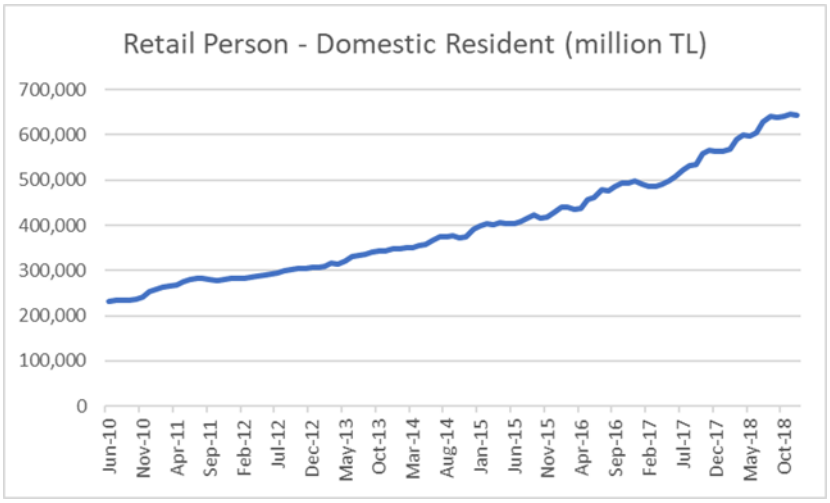
deposits mainly due to get a protection from inflation and get a fixed income rate year by year. For the fixed income investment instruments, Turkish Lira time deposits as an investment volume represents the vital percentage in Turkey, Coşkun and Ümit (2016)[19]. After ending high inflation time period in beginning of 2003, TL time deposit interest rates have decreased with inflation rates because CBRT has determined to achieve and maintain price stability as their primary objective. On 31 May 2013, TL time deposit interest rate achieved its minimum level which is 5.6%. After that both inflation and TL time deposit interest rates get an increase.



Source: Bloomberg (TURATOTL). Between January, 2003 and December, 2018 TL time deposit interest rates had lowered due to decrease in Turkish inflation rate. After second quarter of 2013, inflation and Turkish Lira time deposit interest rates increased slowly. It is 48.0% at the beginning of January, 2003 and it is 22.5% at the end of December, 2018. It is minimum on 31 May 2013 as realizes as 5.6% and after that both TL time deposits interest rates and inflation rates get an increase.

Figure 1: Weekly TL Time Deposit Interest Rate

Between January, 2003 and December, 2018 TL time deposit interest rate had lowered due to decrease in inflation rate. After second quarter of 2013, inflation and Turkish Lira time deposit interest rates increased slowly. Özcan, Berument and Neyaptı (2004) [30], mentions that inflation rate is a unique dynamic with its other prospects about Turkey. Civcir (2003) [18] touches on individual's behavior on saving deposits and demand deposits.



Source: CBRT. Data source is limited on Central Bank of Republic of Turkey (CBRT) and graph 2 shows that domestic residents – retail persons Turkish Lira time deposits increased nearly three times from June 2010 to December 2018. On June 2010, it is a little above of 200,000 million TL and end of December 2018, it is nearly 650,000 million TL. Due to protection from deterioration of inflation rate and high volatility on foreign exchange rates. Turkish domestic resident retail people have a tendency to invest their money on time deposits in variable terms.

Figure 2: Retail Person Domestic Resident TL Time Deposit (million TL)

Data source is limited on Central Bank of Republic of Turkey (CBRT) and graph 2 shows that domestic residents – retail persons Turkish Lira time deposits increased nearly three times from June 2010 to December 2018. On June 2010, it is a little above of 200,000 million TL and end of December 2018, it is nearly 650,000 million TL.

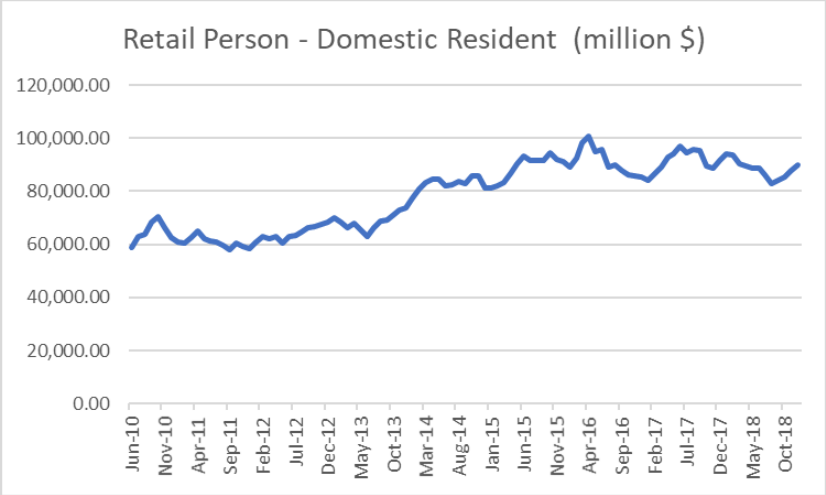
1.3 Dollarization in Turkey

Many papers focus on the direct relationship between inflation and dollarization in Turkish economy, however, Karacal and Basmani-Oskooee (2007) [27] examine this case from a different point of view, with different tools. They move on from the fundamental theoretical base which indicates continuous fiscal expansion in medium-term causes strong inflationary pressure in turn incurs an inflation tax on the agents in Turkish economy. In order to evade this incurrence, people opt for switching their assets to dollar nominated assets, which, in time, creates a wave of dollarization in the economy, Karacal and Basmani-Oskooee (2008) [27]. As their main aim is estimating the dollarization equation of Turkish economy, they utilize ARDL method. Their choice of

method mainly stems from common hardship of measuring these type of currency substition waves. ARDL method when combined with cointegration analysis brings a new perspective to the literature, from this point of view. With that being said, ARDL approach is most useful when utilized to examine long-term effects. Since this study focuses on short-term anomalies as well, ARDL method is not the best path to take.

Calvo and Végh (1992) [15] clearly summarizes that storing the foreign exchange money as domestic money is the first process of foreign money substituting for starting of dollarization. Calvo and Végh (1992) [15] mention about vulnerability of money, higher inflation of money in domestic countries and disappeared virtual of the storing of value function of domestic money. In its researches Calvo and Végh (1992) [15] touch on value of shopping and selling big- ticket items like real estate such as house, apartment and cars and other items to be in foreign currency. After that for almost all non-durable goods in medium of exchange money functions as unit of account are other issues for domestic money retain.

Civcir (2003) [18] mentions about dollarization and high inflation in his paper. The currency substitution is explained with storing of a value in developing countries.



Source: CBRT. Data source is limited on CBRT and graph 3 shows that domestic residents – retail persons foreign exchange time deposits increase from June 2010 to December 2018. On June 2010, it is approximately of USD 60,000 million and end of December 2018, it is nearly USD 95,000 million. Due to depreciation on USD/TL, Turkish domestic resident retail people have a tendency to invest their money as foreign exchange money.

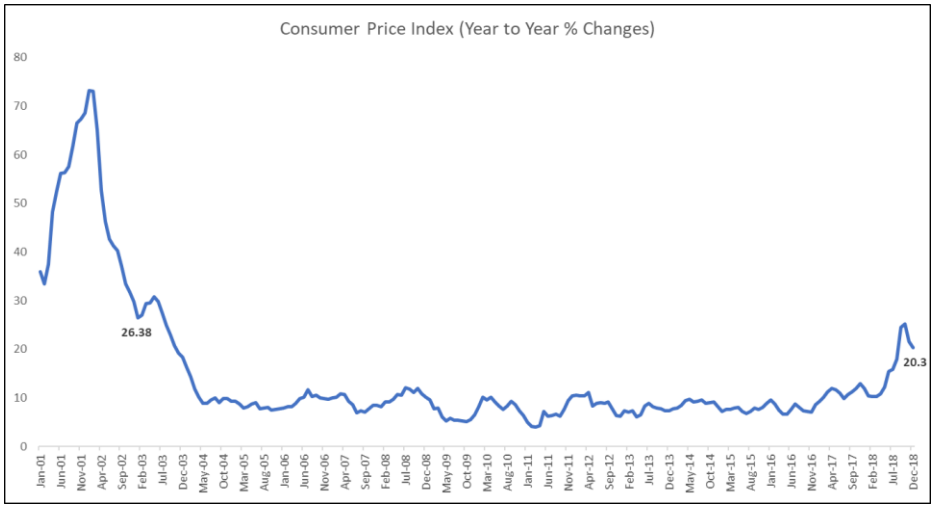
Figure 3: Retail Person – Domestic Resident FC Time Deposits (Million $)

Data source is limited on CBRT and graph 3 shows that domestic residents – retail persons foreign exchange time deposits increase from June 2010 to December 2018. On June 2010, it is approximately of USD 60,000 million and end of December 2018, it is nearly USD 95,000 million.

1.4 Inflation Rates Changes Year by Year

Özcan, Berument and Neyaptı (2004) [30] analyze in their paper that depreciation on Turkish Lira against to US Dollar and inflation in housing rents are in positive correlation with the monthly consumer price index but they find a negative correlation between wages and price inflation.

Calvo and Végh (1992) [15] continue their topic about that there is no need higher inflation or more volatility on inflation to use foreign exchange money on transactions in domestic countries. They, however, mention about discouraging the use of foreign currencies and increasing inflation for several months can be extremely dangerous to pay attractive interest rates.



Source: CBRT. Graph 4 shows that consumer price index (year to year % changes) between beginning of 2001 and end of 2018. It is maximum level on January 2002 and it realizes as 73.2%. On January 2003, it is 26.4% and on December 2018, it is 20.3%.

Figure 4: Consumer Price Index (Year to Year % Changes)

CHAPTER II

LITERATURE REVIEW

In that research, Aydoğan with Booth (2003) [5] touches on the wage payment days in Turkey and mentions about changing in foreign exchange markets on those days that seems to be quite obvious.

Another research, Bildik (2004) [10] points out that one of the factors in calendar anomalies is payment systems at the end of month in private sector and 15^{th} of each month in state organizations.

There is a vast literature on the effects of specific calendar days on countries' financial systems. Various different approaches and perspectives as well as econometric models have been utilized, nevertheless, as a careful examiner can easily observe, some specific autoregressive models stand out in the literature. The mentioned effectiveness of these models has made a significant impact on the model choice for this study. While some models have stood out, there are also a number of studies which had paved the way for this work.

In their paper, Güler and Talaslı (2010) [23] attempt to forge a daily series model in order to provide an explanatory framework for daily circulation in Turkey. Their model aims to forecast the daily liquidity level of the Turkish banking system, while it shows that amount in circulation demonstrates significant characteristics in terms of its behavior in certain calendar days, seasonal moments and occasions. The pivotal factor which allowed them to properly identify these characteristics was their ARIMA-based model specification. In the light of this specification, they have utilized the daily time series data in the most accurate way possible. Consequently, Güler and Talaslı (2010) [23], their

results indicate that deploying an ARIMA-based approach provides better forecasting results than most judgements. ARIMA-GARCH model of Güler and Talaslı (2010) [23] has been influential fort his study's model selection, as the proven efficiency of the method presents a solid case for utilization in prospective works in the field. Their opinion on how the importance of experts' judgements, however, remains controversial.

Second work which I have to highlight its importance for this study is the work of Aydoğan and Booth on calendar anomalies in Turkish financial market. Aydoğan and Booth (1999) [5], The scope of their study includes data from the years between 1986 and 1994, while covering the exchange rates for German Mark, US Dollar and Turkish Lira. The time series data for these currencies has been examined in order to detect regularities. As a result, they detect robust regularities which they call "calendar anomalies" in the volume of trading for these currencies i.e. the demand for these currencies. The strongpoint of their work is they account for many external factors which have substantial effects on the volume of this currencies in the Turkish financial market. Moreover, they observed that exchange rates are prone to be lower in the week before the next month, Aydoğan and Booth (1999) [5]. As their final argument, they indicate that foreign currencies have long served as the true store of value for Turkish people, on the grounds of historical examples. Although their findings are crucial, financial system has changed rapidly since 1999 and many different factors came into play since then. These changes create an opportunity for a new study to examine the times series since then in order to check for altered dynamics in the Turkish financial market in the 21st century.

Another study which focuses on specific calendar day effects on stock markets is Lekpek and Kayacetin's work on turn-of-the-month effect on equity yields. Lekpek and Kayacetin (2014) [29], The importance of their work with respect to this study is the approach they have put into use in terms of analyzing the turn-of-month effect among

other calendar day effects. Their primary finding presents us the fact that turn-of-the-month effects is the most substantial effect among all calendar anomalies. In addition to this, they discovered which factors may amplify the turn-of-the-month effect, such as increasing information inflow to the financial markets and significant performance variations in the stock market. Once more, their econometric approach includes utilizing a GARCH model which serves as the most appropriate tool to analyze the question at their hand, regarding the nature of data they have collected. Last but not least, they put an emphasis on the liquidity aspect of turn-of-the-month effect, indicating that they have found that liquidity in the stock market increased after the information inflow slowed down. Lekpek and Kayacetin (2014) [29], They are also aware of the fact that in order to present a strong case for ToM effect on periodical basis, they must prove ToM effect persists over time and caused by systemic issues. In their study, for all subperiods, they find economically and statistically significant results which bluntly proves that ToM effect is not just an outlier point of data. Another finding of their study is, ToM returns mostly associated with market volatility in a counter intuitive way, which strengthens the position of ToM effect as a structural issue.

One of the most prominent works in the field of calendar anomalies is the work of Bildik, which makes an analysis of empirical evidences of calendar anomalies in Istanbul Stock Exchange. Bildik (2004) [10], His work goes after the question of whether calendar anomalies still have a notable effect on stock markets. His results show the ongoing validity of calendar anomalies. Interestingly, he came up with a similar pattern of turn-of-the-month effect with Lekpek and Kayacetin, Lekpek and Kayacetin (2014) [10] Different from other papers mentioned in this section, Bildik's work touches upon the institutional aspect of financial markets as well. Moreover, it demonstrates that regulators' choices have the power of altering the magnitude of calendar anomalies.

Another work that specialized on the dollarization-inflation relationship is Civcir's work. Civcir (2003) [18], aims to empirically investigate the dollarization process in his article while accounting for macroeconomic credibility and real interest rates. His work focuses on explaining magnitude of dollarization through a modified portfolio model, factoring in relative rates of return both for foreign currency and domestic currency denominated assets. His approach involves employing a common simple structural model. Beyond the specification and variable selection, he first tests for the possible presence of univariate unit roots and adapts his model into an ADF regression model thus eliminates the threat of having a non-stationary trend. After that, he utilizes a vector autoregressive model to identify cointegration between variables and conduct the Johansen process. As the result of econometric tests conducted, he found that: (i) Even though relative returns of Turkish lira denominated assets have increased significantly, economic agents still opted for foreign currency denominated assets, (ii) there is a positive long run correlation between dollarization and expected exchange rate, (iii) expected exchange and interest differential are the main drivers of dollarization.

Also, his empirical findings show that inflation expectations directly alter the dollarization level in the economy, thus inflationary pressures felt by households translate into more dollar nominated asset keeping tendency by individuals, Civcir (2003) [18].

Final work, which deserves an emphasis here, is the work of De Nicolo et al (2005) [20]. Their study examines the benefits and perils of dollarization in the financial system. Empirical evidence of their work suggests that financial instability is substantially higher in dollarized economies. Moreover, they find that if inflation rate in the subject country is above a certain threshold, dollarization does not instigate financial deepening, whereas in countries which have meager levels of inflation, dollarization promotes financial deepening in every intermediation effort. De Nicolo et al (2005) [20], This work is crucial

in terms of understanding the relationship between financial instability and dollar nominated asset keeping.

These six works lay down the technical foundations needed in this work, as they all focus on the calendar anomalies from different perspectives. Specification of econometric models are subject to variation; however, autoregressive models seem to be the workhorse models. Regarding this literature review, this work's choice of model has a strong support from the past works in the field.

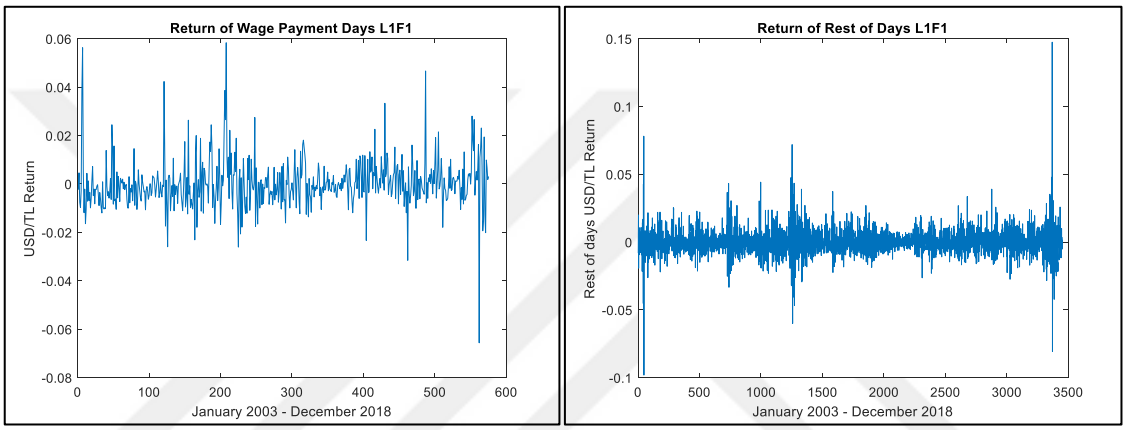
CHAPTER III

METHODOLOGY

In this research, January 2003 - December 2018 US Dollar against Turkish Lira in free foreign exchange market (Bloomberg daily data bid-ask average) daily data is used. It is adjusted to cover only workdays, hence weekends, national and religious holidays are extracted from data. With this content, all wage payment days are flagged. If wage payment days are in weekend or holidays then either next business day or previous business day is counted as wage payment day, because Turkish market is closed and bid – ask gap is automatically extended on those days. Private companies usually pay the salary of their employees at the end of month or first day of next month (pre-paid). On public sector side, civil servants and public office workers' wages are paid on the 15^{th} of each month. If 15^{th} of each month is on holiday or weekend then either next business day or previous business day is used as wage payment days. Same methodology is adopted here. That being said, some occasional days to pay wage for public sector can be changed before religious holidays, thus wages are paid in advance. Due to low number of payment-in-advance days, this study disregards those pre-paid days for public sector salary payments. In addition to that, consideration of starvation (TL 1,941) and poverty line (TL 6,323), wage payment days as of 17^{th} or 18^{th} of month for retired people are not included in dataset, since the prospective inclusion of those days might disrupt the data and lead this study to false results. First, this paper looks asymmetric and symmetric days of months in 16 years in order to present the strong relationship between changes in USD/TL and wage payment days.

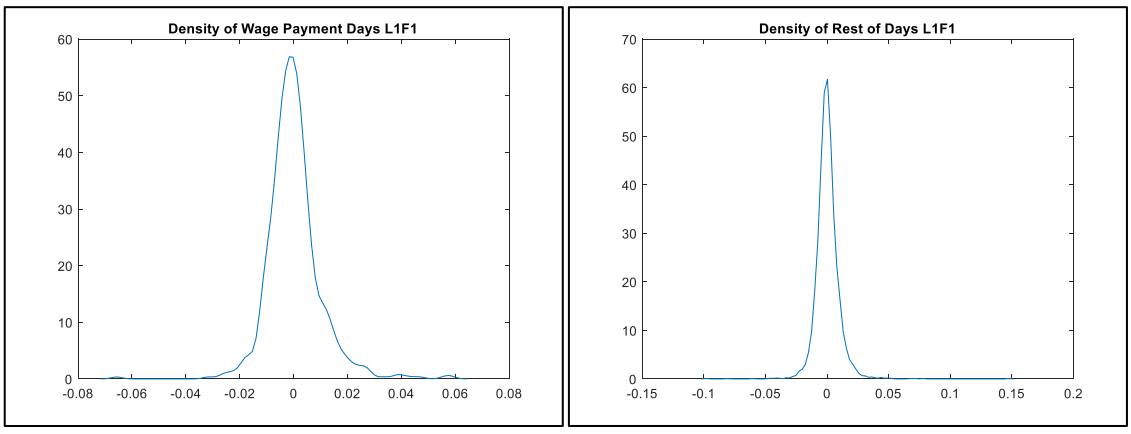
3.1 L1F1

Between January 2003 and December 2018 last day of month, first day of month and 15th day of month are used as wage payment days and results are listed on tables. Rest of business days are grouped as rest of days. 4,026 days are figured out and 575 days are grouped as wage payment days and 3,451 days are grouped as rest of days.



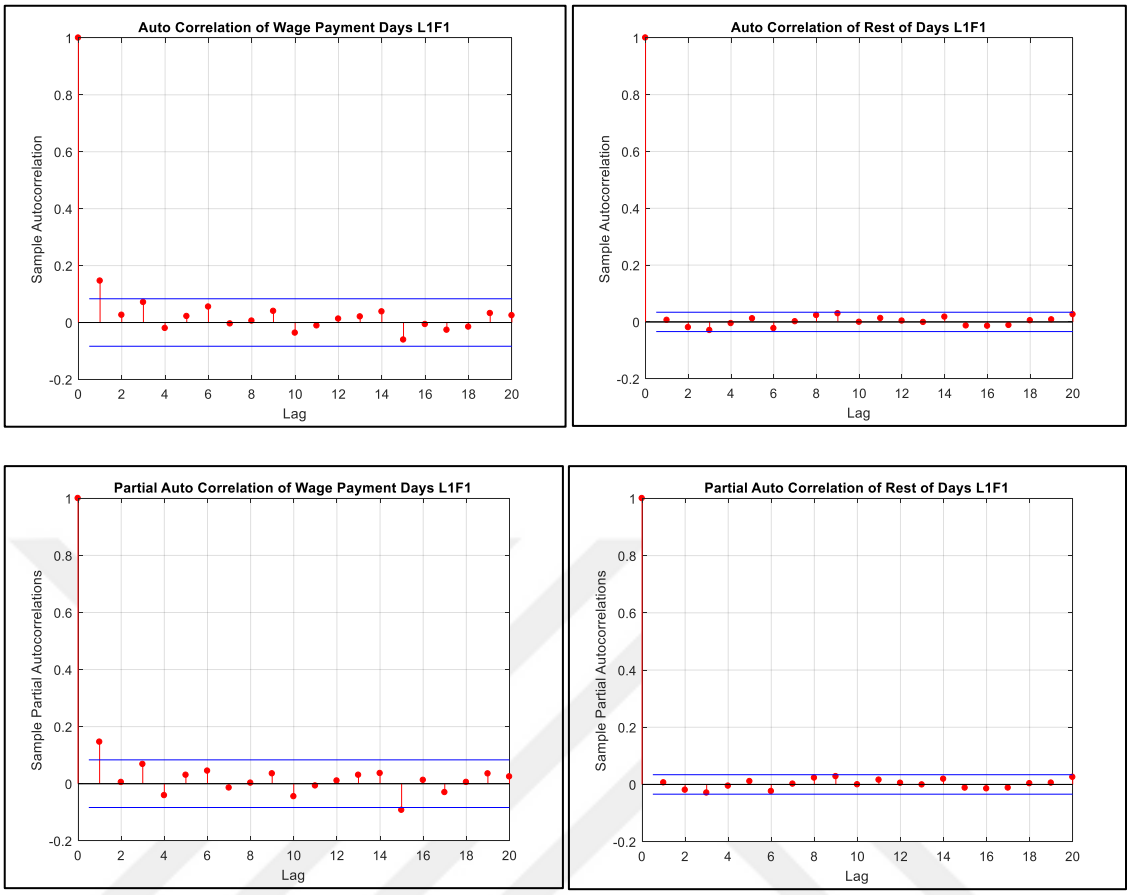
Between January 2003 and December 2018, returns of USD/TL for L1F1 wage payment days and rest of days are shown on figure 5. Average of WPD for L1F1 is 1.8385e-04 and average of RoD for L1F1 is 3.0213e-04.

Figure 5: Return of WPD and RoD for L1F1



Density of WPD and RoD for L1F1 are shown on figure 6.

Figure 6: Density of WPD and RoD for L1F1

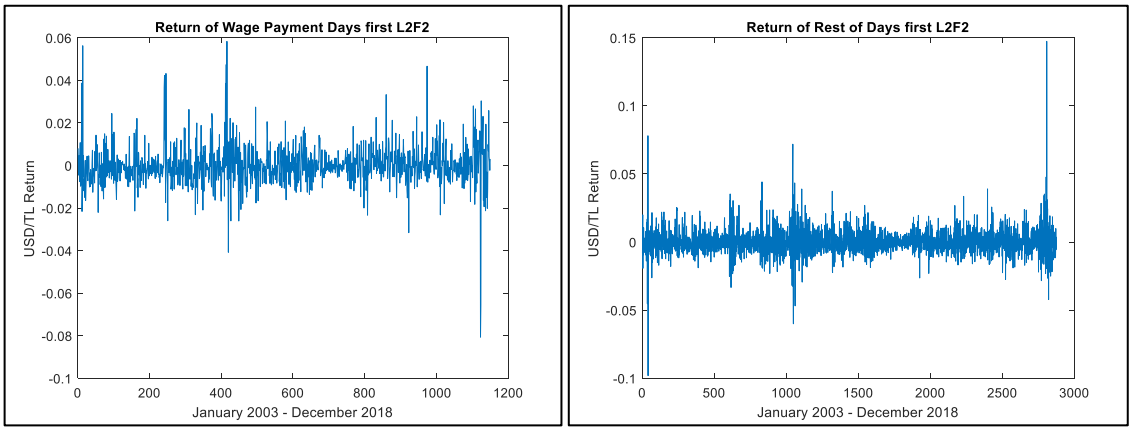


Lag 1 for WPD and Lag 1 and Lag 15 for RoD are seen as cut-off on auto correlation graphs.

Figure 7: Auto Corr. and Partial Auto Corr. of WPD and RoD for L1F1

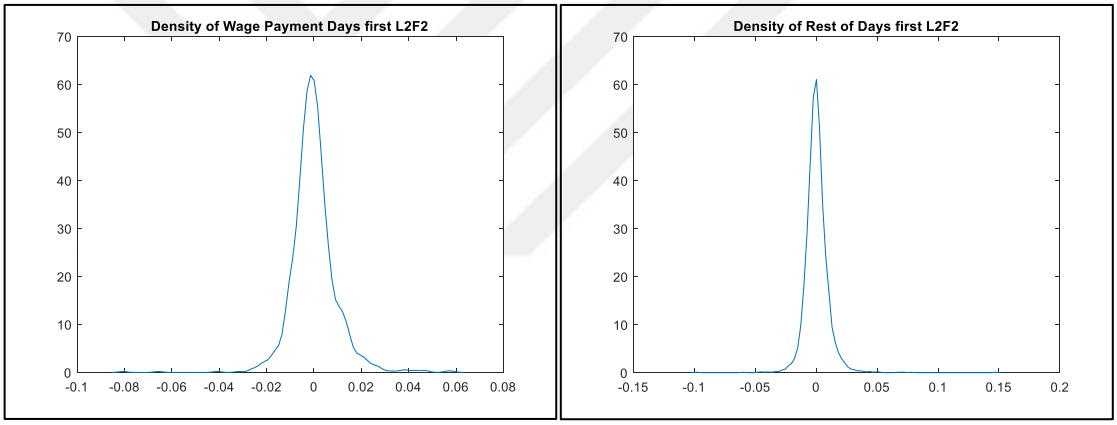
3.2 First L2F2

Between January, 2003 and December, 2018, last two business days, first two business days, mid-day of that month and previous business day of mid-day of that month data are used as wage payment days. The rest of business days are grouped as rest of days. For example, 14-01-03 and 15-01-03 days are listed as mid-days of that month. 4,026 days are figured out and 1,150 days are grouped as wage payment days and 2,876 days are grouped as rest of days.



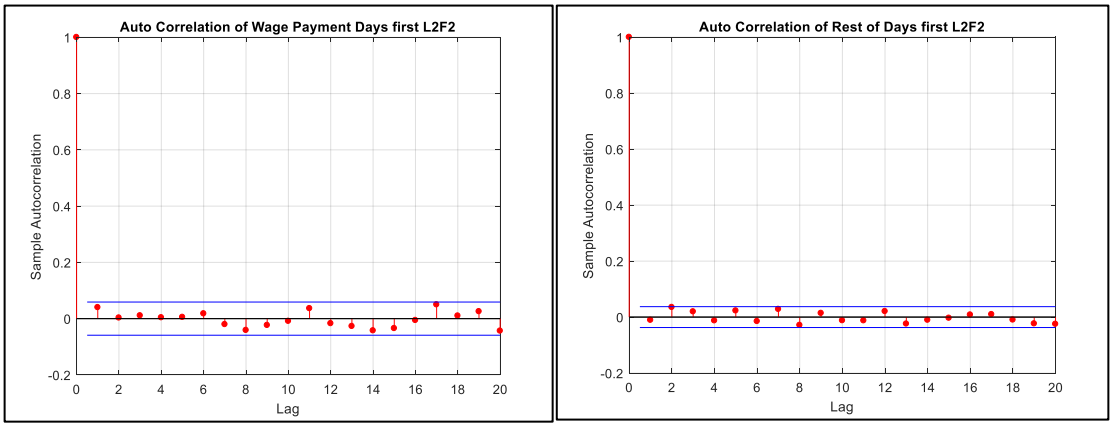
Between January 2003 and December 2018, returns of USD/TL for first L2F2 wage payment days and rest of days are shown on graph 8. Average of WPD for first L2F2 is -2.3631e-05 and average of RoD for first L2F2 is 4.0874e-04.

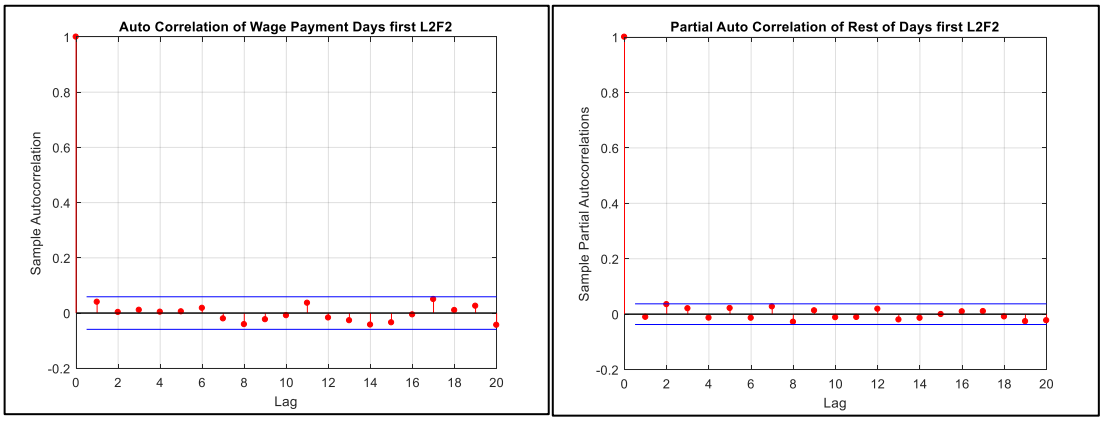
Figure 8: Returns of WPD and RoD for first L2F2



Density of WPD and RoD for first L2F2 are shown on graph 9.

Figure 9: Density of WPD and RoD for first L2F2



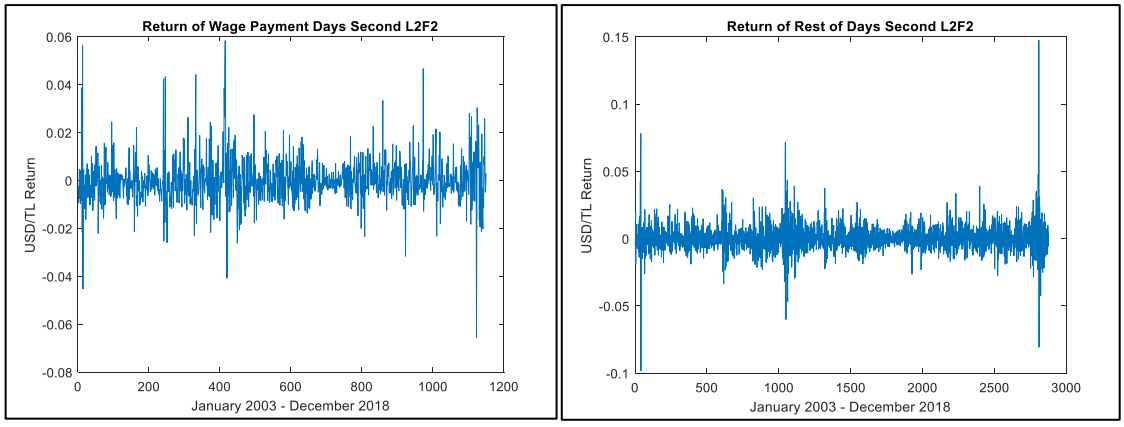


Lags for WPD and Lags for RoD are seen on auto correlation graphs.

Figure 10: Auto Corr. and Partial Auto Corr. of WPD and RoD for first L2F2

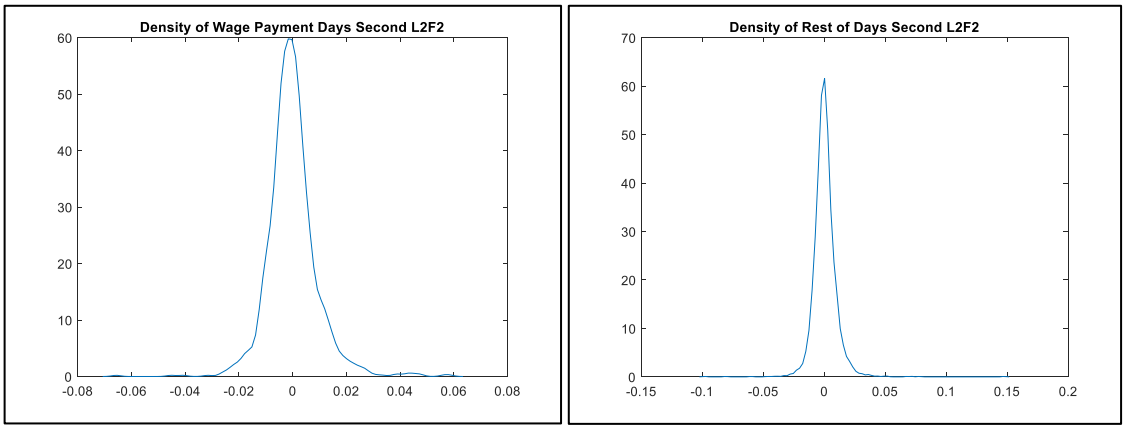
3.3 Second L2F2

Between January, 2003 and December, 2018, last two business days, first two business days, mid-day of that month and next business day of mid-day of that month data are used as wage payment days. The rest of business days are grouped as rest of days. For example, 15-01-03 and 16-01-03 days are listed as mid-days of that month. 4,026 days are figured out and 1,150 days are grouped as wage payment days and 2,876 days are grouped as rest of days.



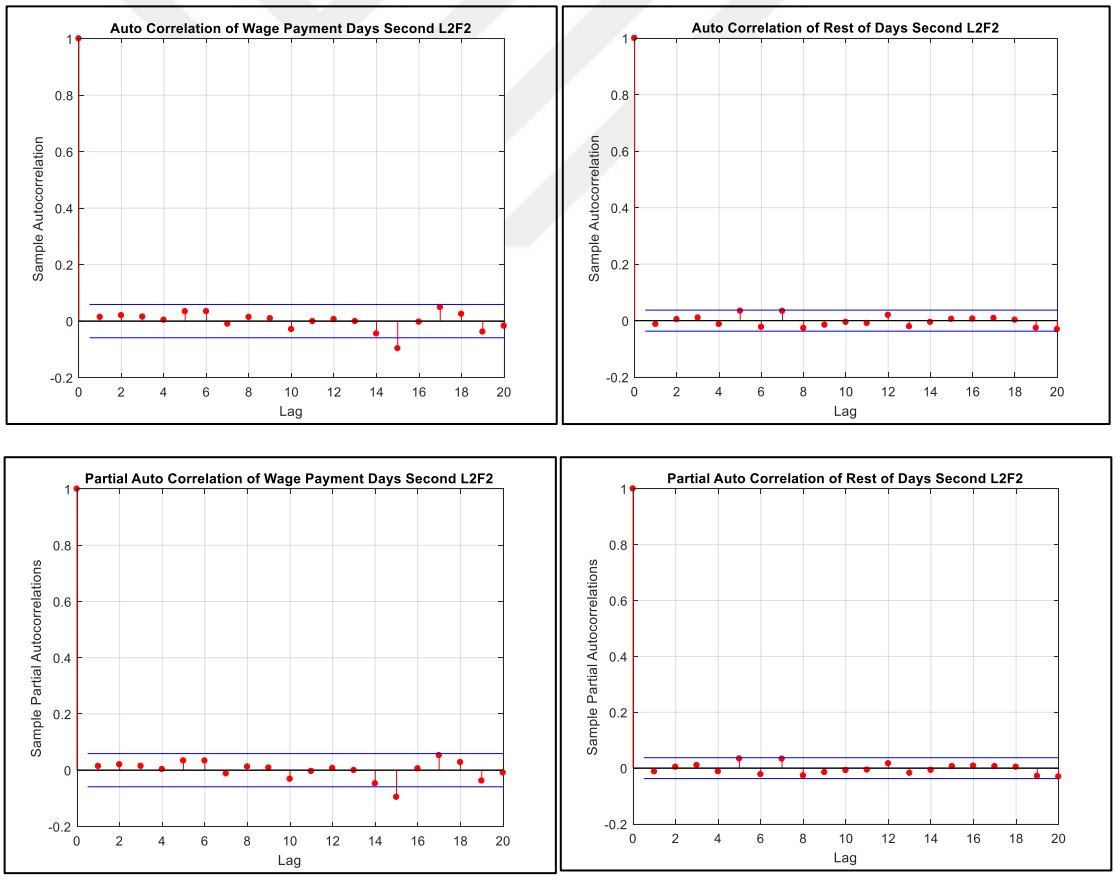
Between January 2003 and December 2018, returns of USD/TL for second L2F2 wage payment days and rest of days are shown on graph 11. Average of WPD for second L2F2 is -1.4000e-04 and average of RoD for second L2F2 is 4.5527e-04.

Figure 11: Returns of WPD and RoD for second L2F2



Density of WPD and RoD for second L2F2 are shown on graph 9.

Figure 12: Density of WPD and RoD for second L2F2

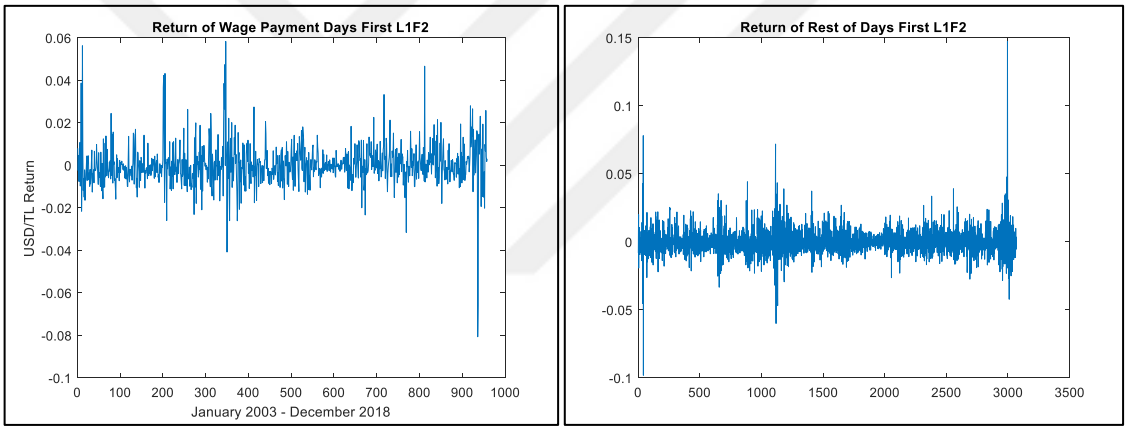


Lags for WPD and Lags for RoD are seen on auto correlation graphs.

Figure 13: Auto Corr. and Partial Auto Corr. of WPD and RoD for second L2F2

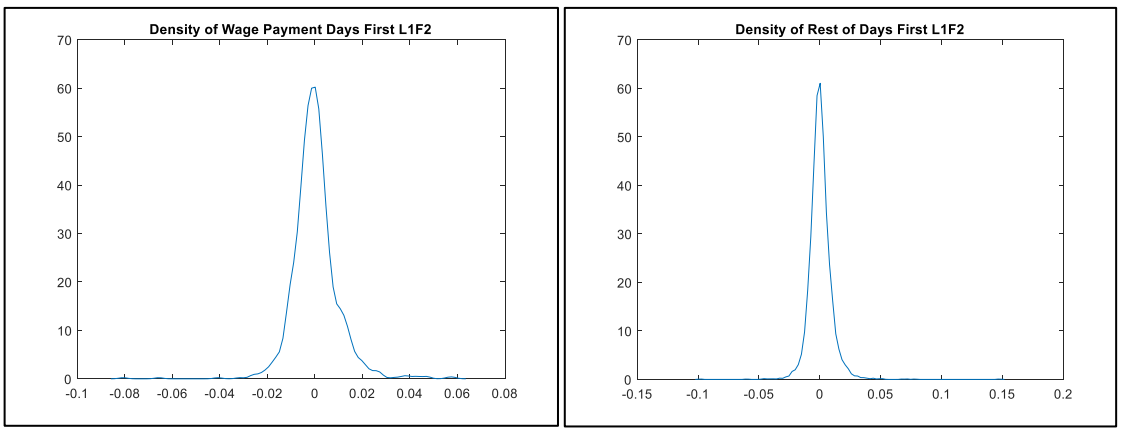
3.4 First L1F2

Between January, 2003 and December, 2018, last business days, first two business days, mid-day of that month and previous business day of mid-day of that month data are used as wage payment days. The rest of business days are grouped as rest of days. For example, 14-01-03 and 15-01-03 days are listed as mid-days of that month. 4,026 days are figured out and 958 days are grouped as wage payment days and 3,068 days are grouped as rest of days.



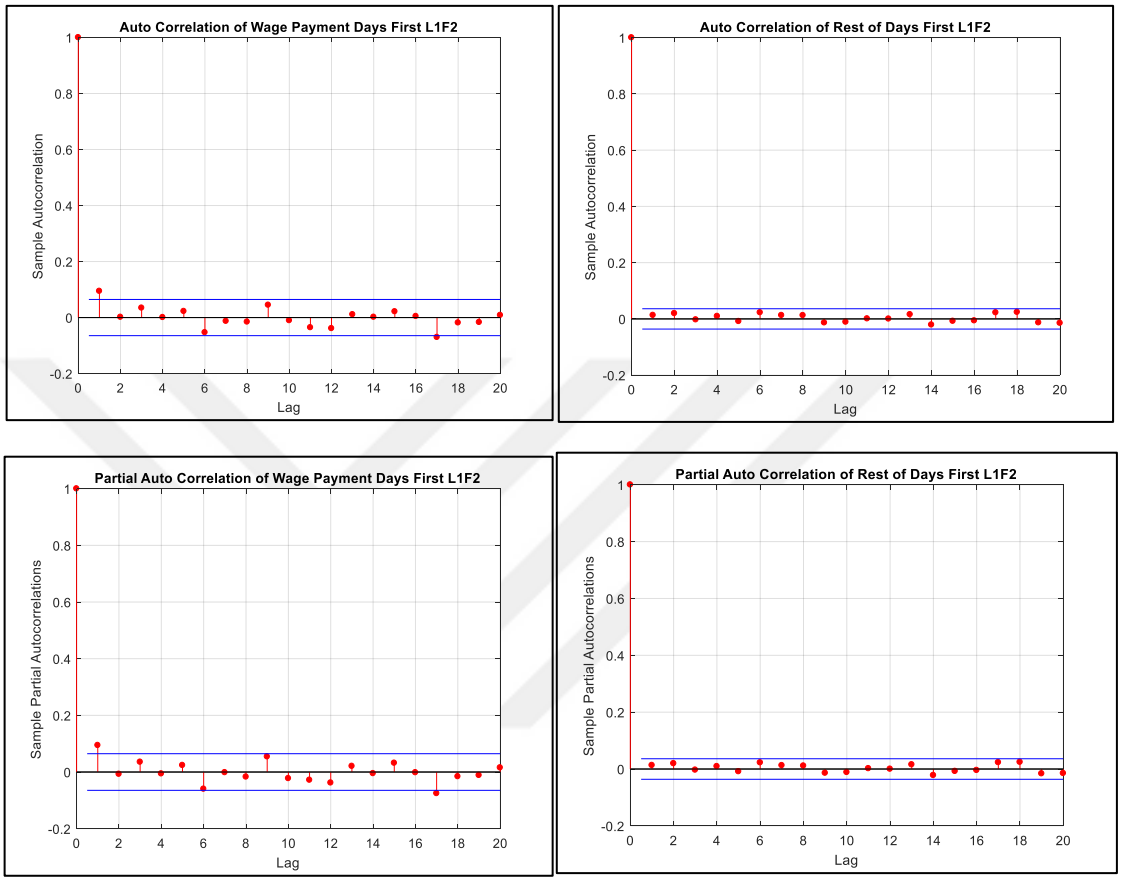
Between January 2003 and December 2018, returns of USD/TL for first L1F2 wage payment days and rest of days are shown on graph 14. Average of WPD for first L1F2 is 1.2935e-04 and average of RoD for first L1F2 is 3.3392e-04.

Figure 14: Returns of WPD and RoD for first L1F2



Density of WPD and RoD for first L1F2 are shown on graph 15.

Figure 15: Density of WPD and RoD for first L1F2



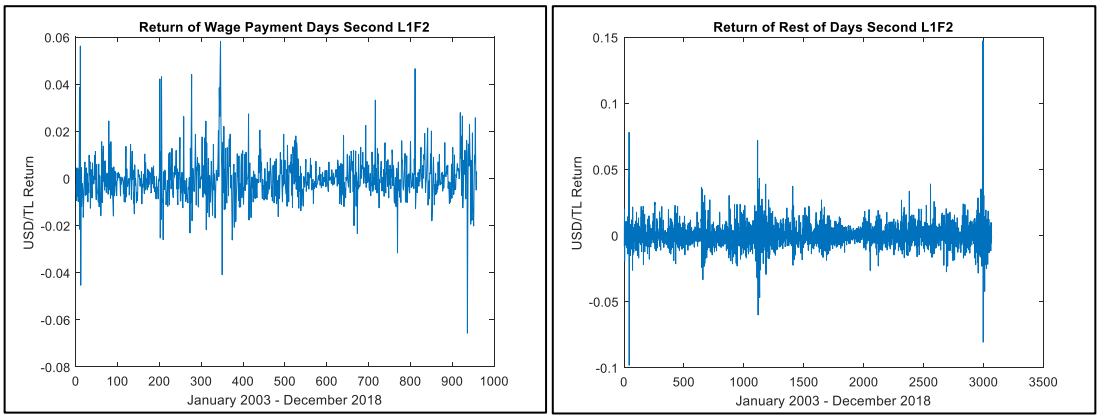
Lags for WPD and Lags for RoD are seen on auto correlation graphs.

Figure 16: Auto Corr. and Partial Auto Corr. of WPD and RoD for first L1F2

3.5 Second L1F2

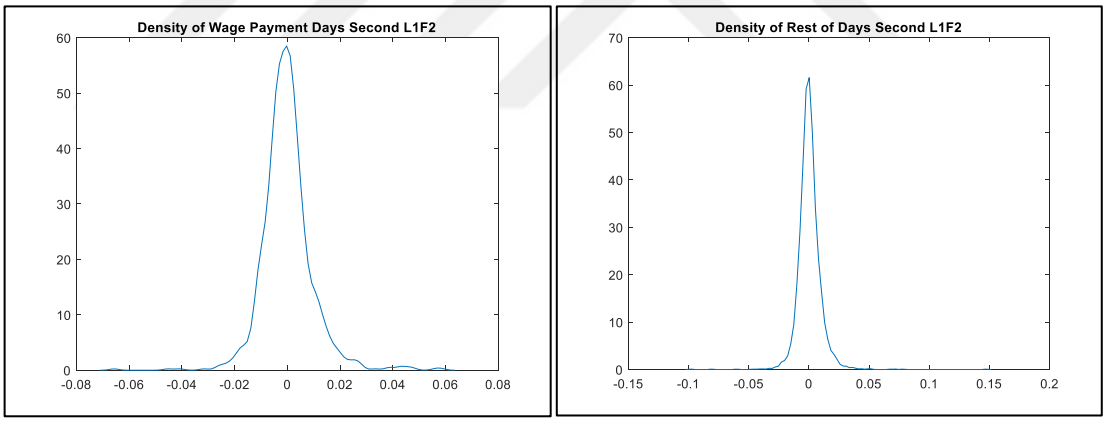
Between January, 2003 and December, 2018, last business days, first two business days, mid-day of that month and next business day of mid-day of that month data are used as wage payment days. The rest of business days are grouped as rest of days. For example, 15-01-03 and 16-01-03 days are listed as mid-days of that month. 4,026 days are figured out and 958 days are grouped as wage payment days and 3,068 days are grouped as rest

of days.



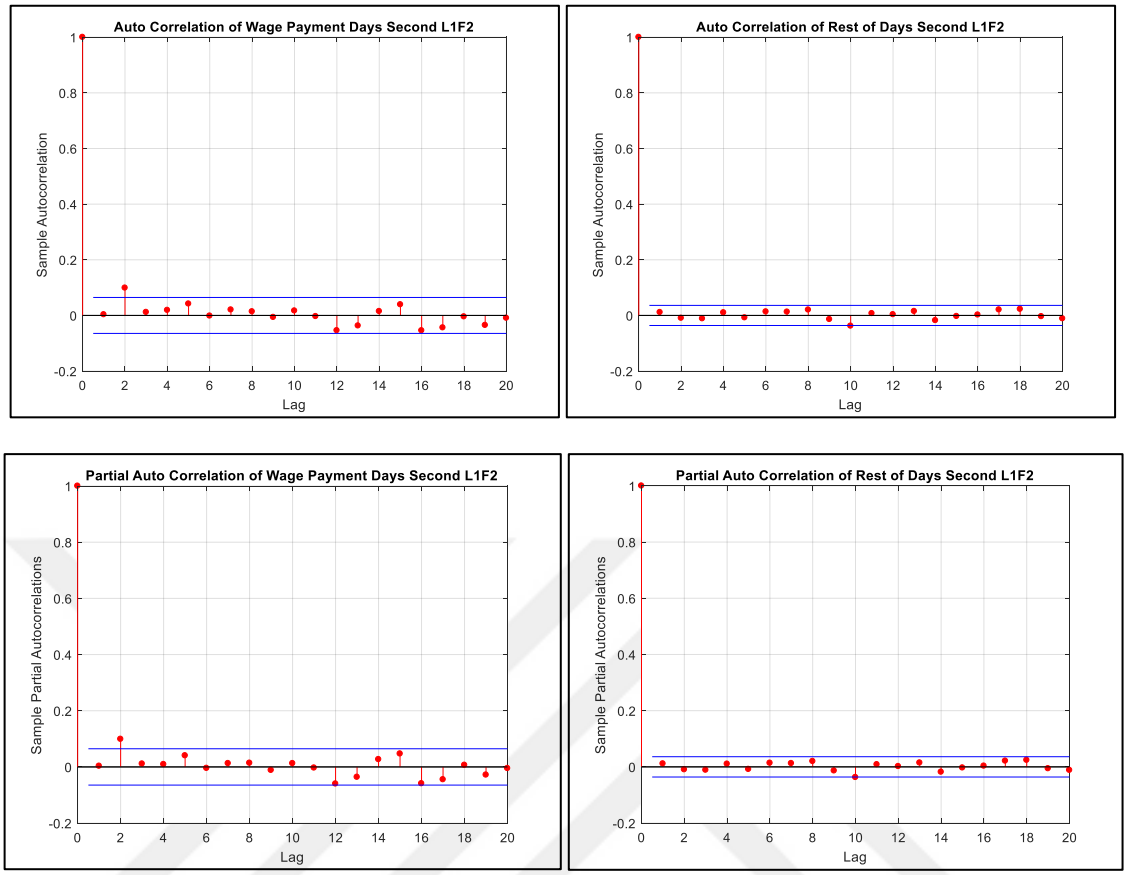
Between January 2003 and December 2018, returns of USD/TL for second L1F2 wage payment days and rest of days are shown on graph 17. Average of WPD for second L1F2 is -1.0342e-05 and average of RoD for second L1F2 is 3.7754e-04.

Figure 17: Returns of WPD and RoD for second L1F2



Density of WPD and RoD for first L1F2 are shown on graph 18.

Figure 18: Density of WPD and RoD for second L1F2

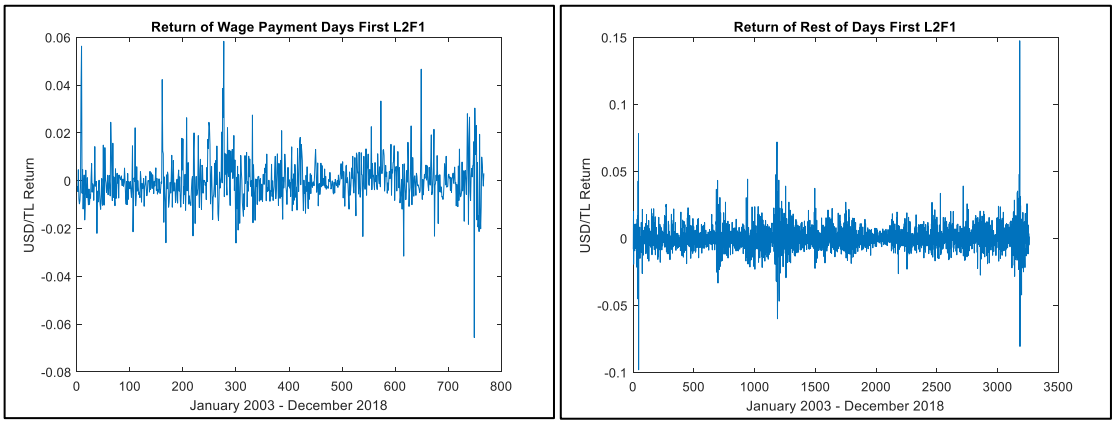


Lags for WPD and Lags for RoD are seen on auto correlation graphs.

Figure 19: Auto Corr. and Partial Auto Corr. of WPD and RoD for second L1F2

3.6 First L2F1

Between January, 2003 and December, 2018, last two business days, first business days, mid-day of that month and previous business day of mid-day of that month data are used as wage payment days. The rest of business days are grouped as rest of days. For example, 14-01-03 and 15-01-03 days are listed as mid-days of that month. 4,026 days are figured out and 767 days are grouped as wage payment days and 3,259 days are grouped as rest of days.



Between January 2003 and December 2018, returns of USD/TL for first L2F1 wage payment days and rest of days are shown on graph 14. Average of WPD for first L2F1 is -5.9158e-05 and average of RoD for first L2F1 is 3.6629e-04.

Figure 20: Returns of WPD and RoD for first L2F1

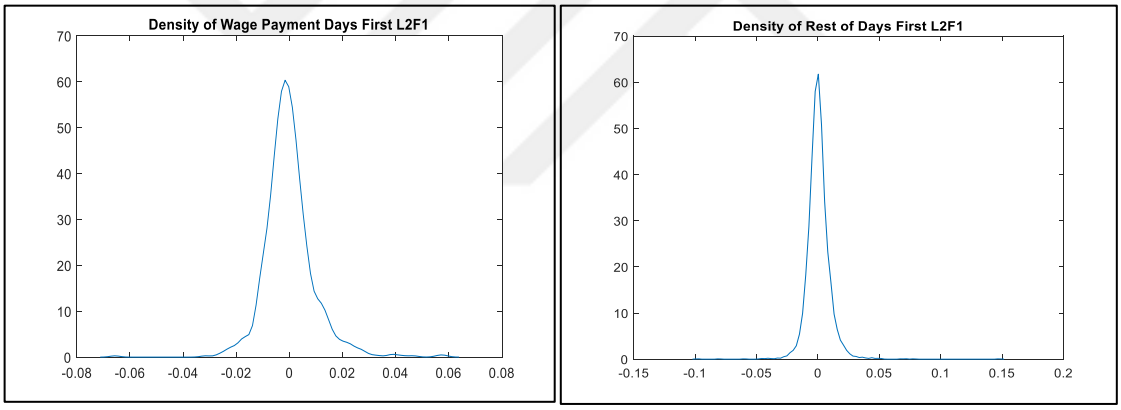
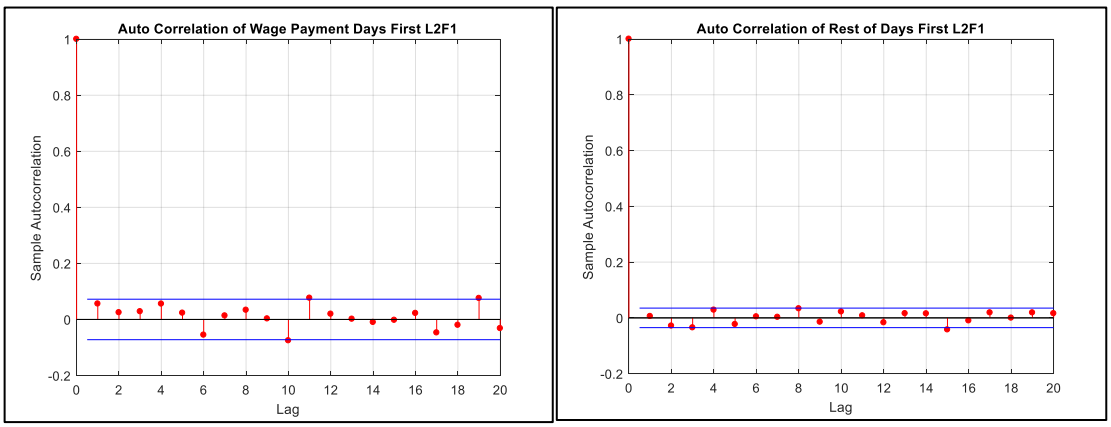


Figure 21: Density of WPD and RoD for first L2F1



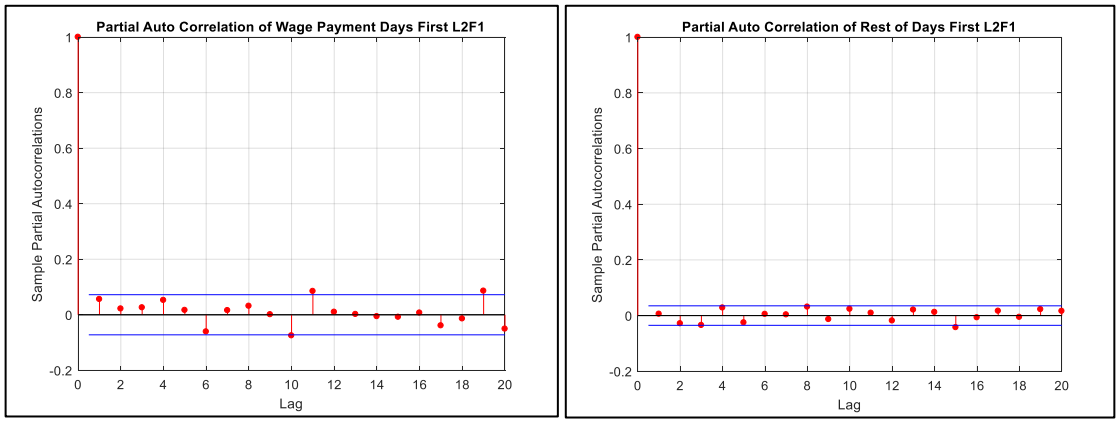
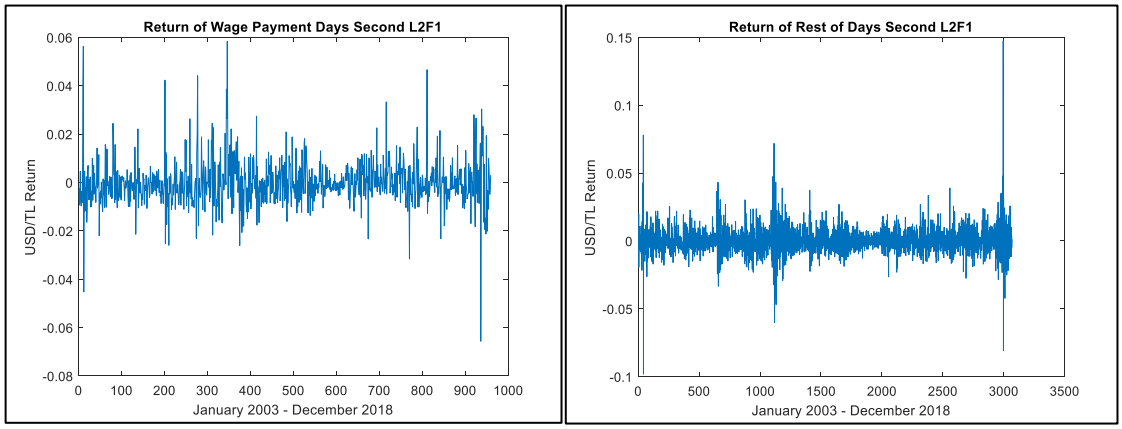


Figure 22: Auto Corr. and Partial Auto Corr. of WPD and RoD for first L2F1

3.7 Second L2F1

Between January, 2003 and December, 2018, last two business days, first business days, mid-day of that month and next business day of mid-day of that month data are used as wage payment days. The rest of business days are grouped as rest of days. For example, 15-01-03 and 16-01-03 days are listed as mid-days of that month. 4,026 days are figured out and 959 days are grouped as wage payment days and 3,067 days are grouped as rest of days.



Between January 2003 and December 2018, returns of USD/TL for second L2F1 wage payment days and rest of days are shown on graph 23. Average of WPD for second L2F1 is -2.0065e-04 and average of RoD for second L2F1 is 4.3717e-04.

Figure 23: Returns of WPD and RoD for second L2F1

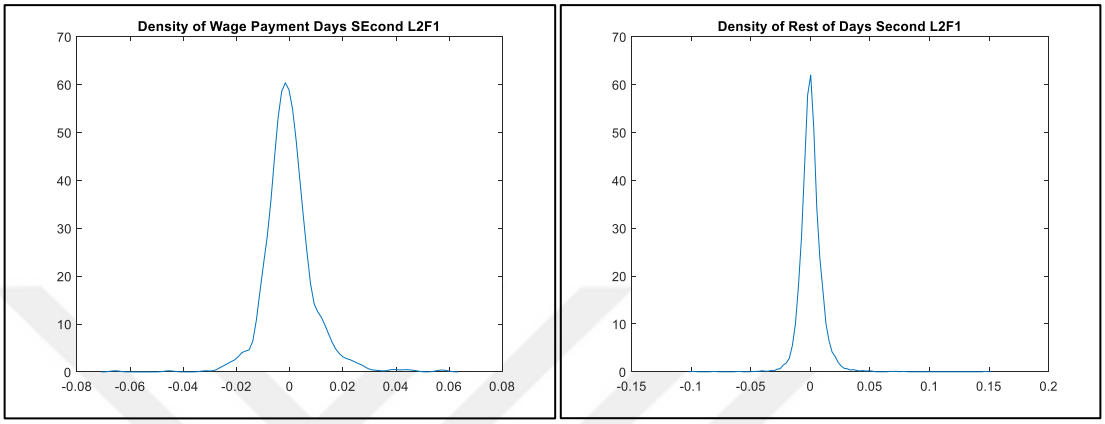


Figure 24: Density of WPD and RoD for second L2F1

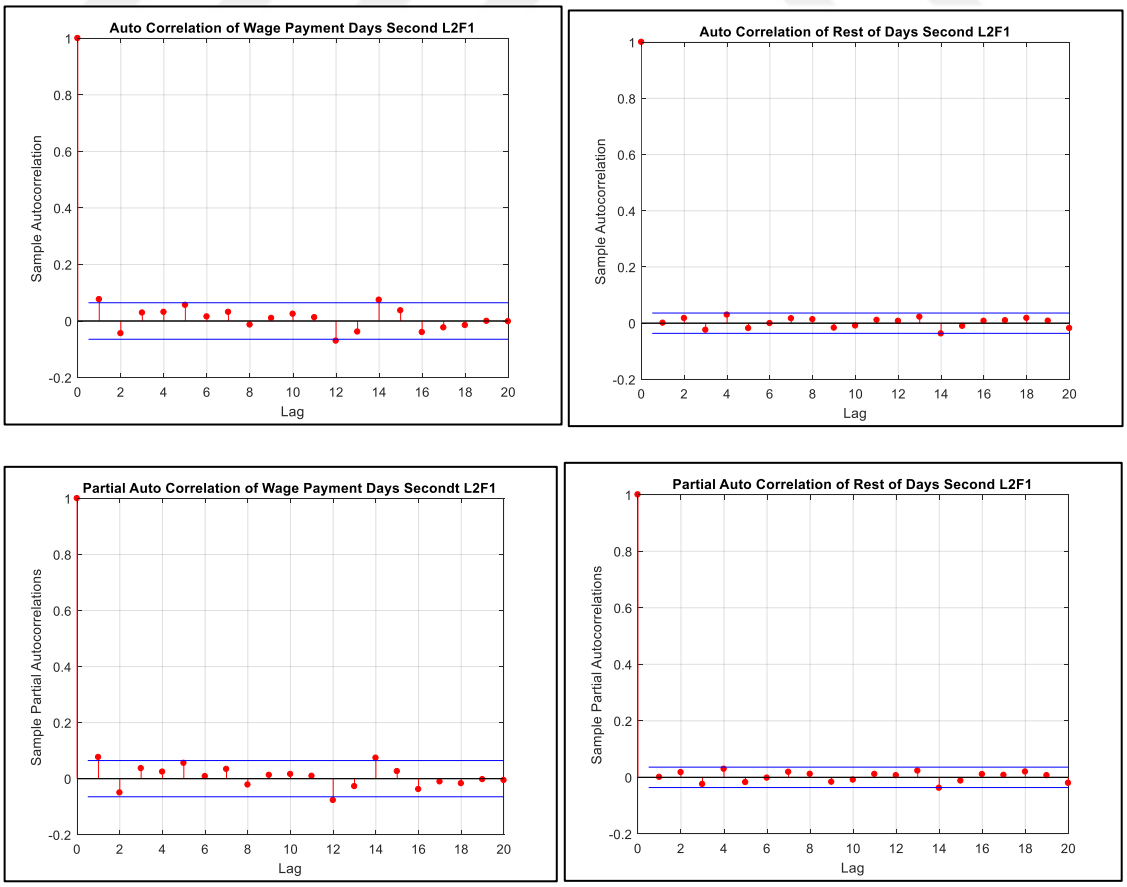


Figure 25: Auto Corr. and Partial Auto Corr. of WPD and RoD for second L2F1

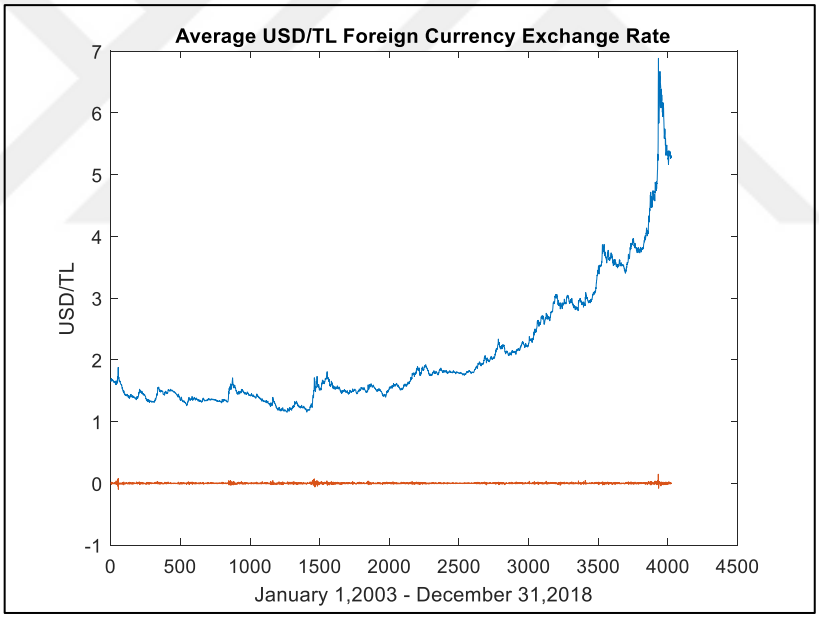
CHAPTER IV

MODEL

4.1 Data Usage

USD/TL average price is used. Data is downloaded via Bloomberg.

$$P_t = \frac{USDTL_t(bid)+USDTL_t(ask)}{2} \quad (1)$$



This graph shows USD/TL business days average of bid - ask trend from January 2003 to December 2018. Data is not stationary as shown above in graph 26. As of beginning of January, 2003, USD/TL is nearly 1.66 and end of December, 2018 is 5.29. There is huge volatility and large expected return is assumed. Minimum USD/TL is 1.15 as of 14 January 2008, maximum USD/TL is 6.88 as of 13 August 2018.

Figure 26: USD/TL trend of January, 2003 – December, 2018.

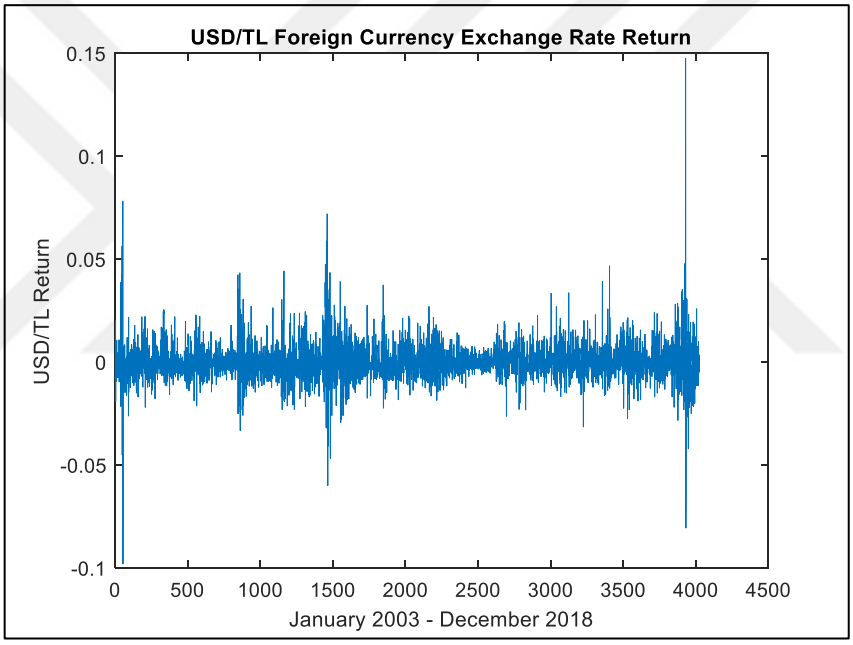
Data is not stationary as shown above in Graph 26. As of beginning of January, 2003, USD/TL is nearly 1.66 and end of December, 2018 is 5.29. There is huge volatility

and large expected return is assumed. Minimum USD/TL is 1.15 as of 14 January 2008, maximum USD/TL is 6.88 as of 13 August 2018.

Let us look to return of USD/TL between 2003 and 2018.

$$r_t = \ln(\frac{P_t}{P_{t-1}}) \quad (2)$$

Where P_t and P_{t-1} are average prices of USD/TL in adjusted open market days and r_t is log returns of USD/TL average prices.



In range of 16 years, to December, 2018 from January, 2003, USD/TL foreign currency exchange rate return table are shown on above. Minimum USD/TL is -9.81% as of 25 March 2003 and maximum USD/TL is 14.74% as of 10 August 2018.

Figure 27: USD/TL return of January, 2003 – December, 2018.

In range of 16 years, to December, 2018 from January, 2003, USD/TL foreign currency exchange rate return table are figured above. Minimum USD/TL is -9.81% as of 25 March 2003 and maximum USD/TL is 14.74% as of 10 August 2018.

4.2 Descriptive Statistics

Last business days, 15th of the day and beginning of the day of that month are assumed as wage payment days. If national and religious holidays are in week day, then those days are extracted from data. 15th of a month is known that it is governmental office wage payment days and before religious holidays payment are not adjusted as payment day. Therefore, those days assumed next first trading week day. Dummy vectors are created as if wage payment days are 1, otherwise 0 for L1F1, First L2F2, Second L2F2, First L1F2, Second L1F2, First L2F1 and Second L2F1 as explained on chapter 3.

Table 1: Average Returns of WPD and RoD

	Avg. Returns of Wage Payment Days	*Avg. Returns of Rest of Days*
L1F1	1.8385e-04	3.0213e-04
First L2F2	-2.3631e-05	4.0874e-04
Second L2F2	-1.4000e-04	4.5527e-04
First L1F2	1.2935e-04	3.3392e-04
Second L1F2	-1.0342e-05	3.7754e-04
First L2F1	-5.9158e-05	3.6629e-04
Second L2F1	-2.0065e-04	4.3717e-04

This table shows average returns of L1F1, first L2F2, second L2F2, first L1F2, second L1F2, first L2F1, second L2F1 on dates between January 2003 and December 2018. Rest of Days returns are much higher than Wage Payment Days returns. L1F1 and First L1F2 average returns for WPD are positive and the rest of average return for WPD are negative. RoD returns for 7 cases are positive and give better return result than WPD cases.

Average returns of L1F1, first L2F2, second L2F2, first L1F2, second L1F2, first L2F1, second L2F1 on dates between January 2003 and December 2018. Rest of Days returns are much higher than Wage Payment Days returns. L1F1 and First L1F2 average

returns for WPD are positive and the rest of average return for WPD are negative. RoD returns for 7 cases are positive and give better return result than WPD cases.

Table 2: Std Dev., Skewness and Kurtosis of WPD and RoD

		Standard Deviation	*Skewness*	*Kurtosis*
Wage Payment Days	L1F1	0.010089	0.82022	11
	First L2F2	0.0095961	0.20644	13.318
	Second L2F2	0.0094375	0.70245	10.318
	First L1F2	0.0098749	0.16254	13.831
	Second L1F2	0.0096917	0.71418	10.648
	First L2F1	0.0096217	0.79779	10.617
	Second L2F1	0.0094325	0.69741	10.596
Rest of Days	L1F1	0.0095003	1.2321	29.688
	First L2F2	0.00958	1.5496	31.728
	Second L2F2	0.0096403	1.3364	32.396
	First L1F2	0.0094943	1.5161	31.03
	Second L1F2	0.0095517	1.3119	31.701
	First L2F1	0.0095765	1.2521	30.277
	Second L2F1	0.0096292	1.3006	31.041

This table shows standard deviation, skewness and kurtosis results of 7 cases which are L1F1, first L2F2, second L2F2, first L1F2, second L1F2, first L2F1, second L2F1 on dates between January 2003 and December 2018. Rest of Days results are better than Wage Payment Days results in 7 cases.

Standard deviation, skewness and kurtosis results of 7 cases which are L1F1, first L2F2, second L2F2, first L1F2, second L1F2, first L2F1, second L2F1 on dates between

January 2003 and December 2018. Rest of Days results are better than Wage Payment Days results in 7 cases.

4.3 Augmented Dickey Fuller Test for Trend Stationary

Applying Augmented Dickey Fuller Test to find trend stationary, then results reflect that all 7 situations H's are 1 and p-value's are less than zero. It means all situations which are L1F1, First L2F2, Second L2F2, First L1F2, Second L1F2, First L2F1 and Second L2F1 are stationary.

Table 3: Std Dev., Skewness and Kurtosis of WPD and RoD

L1F1	First_L2F2	Second_L2F2	First_L1F2	Second_L1F2	First_L2F1	Second_L2F1
h8 =	h9 =	h10 =	h11 =	h12 =	h13 =	h14 =
logical	logical	logical	logical	logical	logical	logical
1	1	1	1	1	1	1
p8 =	p9 =	p10 =	p11 =	p12 =	p13 =	p14 =
1.00E-03	1.00E-03	1.00E-03	1.00E-03	1.00E-03	1.00E-03	1.00E-03

L1F1 H_1: 1 and p-value < 0, First L2F2 H_1: 1 and p-value < 0, Second L2F2 H_1: 1 and p-value < 0, First L1F2 H_1: 1, and p-value < 0, Second L1F2 H_1: 1, and p-value < 0, First L2F1 H_1: 1, and p-value < 0 and Second L2F1 H_1: 1, and p-value < 0. Augmented Dickey Fuller (ADF) test does not reject stationary.

L1F1 H_1: 1 and p-value < 0, First L2F2 H_1: 1 and p-value < 0, Second L2F2 H_1: 1 and p-value < 0, First L1F2 H_1: 1, and p-value < 0, Second L1F2 H_1: 1, and p-value < 0, First L2F1 H_1: 1, and p-value < 0 and Second L2F1 H_1: 1, and p-value < 0. Augmented Dickey Fuller (ADF) test does not reject stationary.

4.4 Arima - Garch Model

4.4.1 L1F1

After fitting and adjusting residual squares of lag 1 of returns of wage payment days for L1F1 and lag 9 of returns of rest of days for L1F1, ARIMA- GARCH model is shown on table in appendix A. Yearly and quarterly returns for wage payment days are not purely significant because Arch (1,1) t statistics results for returns of wage payment days are not better than returns of rest of days. Returns of wage payment days for L1F1 are maximum in Q4 2008 (93.9%) and minimum in Q4 2015 (-67.6%). Returns of rest of days for L1F1 are maximum in Q3 2011 (27.4%) and minimum in Q4 2004 (-29.8%).

4.4.2 First L2F2

After fitting and adjusting residual squares of lag 1 of returns of wage payment days for first L2F2 and lag 2 of returns of rest of days for first L2F2, ARIMA- GARCH model is shown on table in appendix A. Yearly and quarterly returns for wage payment days are not purely significant because Arch (1,1) t statistics results for returns of wage payment days are not better than returns of rest of days. Returns of wage payment days for first L2F2 are maximum in Q4 2016 (51.5%) and minimum in Q4 2015 (-46.5%). Returns of rest of days for first L2F2 are maximum in Q3 2011 (29.1%) and minimum in Q4 2004 (-28.4%).

4.4.3 Second L2F2

After fitting and adjusting residual squares of lag 15 of returns of wage payment days for second L2F2 and lag 5 of returns of rest of days for second L2F2, ARIMA-GARCH model is shown on table in appendix A. Yearly and quarterly returns for wage

payment days are not purely significant because Arch (1,1) t statistics results for returns of wage payment days are not better than returns of rest of days. Returns of wage payment days for second L2F2 are maximum in Q4 2008 (46.1%) and minimum in Q2 2009 (-45.8%). Returns of rest of days for second L2F2 are maximum in Q2 2006 (29.0%) and minimum in Q4 2004 (-32.4%).

4.4.4 First L1F2

After fitting and adjusting residual squares of lag 1 of returns of wage payment days for first L1F2 and lag 1 of returns of rest of days for first L1F2, ARIMA- GARCH model is shown on table in appendix A. Yearly and quarterly returns for wage payment days are not purely significant because Arch (1,1) t statistics results for returns of wage payment days are not better than returns of rest of days. Returns of wage payment days for first L1F2 are maximum in Q2 2018 (77.4%) and minimum in Q4 2015 (-61.9%). Returns of rest of days for first L1F2 are maximum in Q3 2015 (28.1%) and minimum in Q4 2018 (-28.5%).

4.4.5 Second L1F2

After fitting and adjusting residual squares of lag 2 of returns of wage payment days for second L1F2 and lag 10 of returns of rest of days for second L1F2, ARIMA-GARCH model is shown on table in appendix A. Yearly and quarterly returns for wage payment days are not purely significant because Arch (1,1) t statistics results for returns of wage payment days are not better than returns of rest of days. Returns of wage payment days for second L1F2 are maximum in Q4 2018 (70.9%) and minimum in Q4 2015 (-

61.7%). Returns of rest of days for second L1F2 are maximum in Q2 2006 (26.2%) and minimum in Q4 2004 (-29.0%).

4.4.6 First L2F1

After fitting and adjusting residual squares of lag 19 of returns of wage payment days for first L2F1 and lag 15 of returns of rest of days for first L2F1, ARIMA- GARCH model is shown on table in appendix A. Yearly and quarterly returns for wage payment days are not purely significant because Arch (1,1) t statistics results for returns of wage payment days are not better than returns of rest of days. Returns of wage payment days for first L2F1 are maximum in Q4 2008 (83.6%) and minimum in Q4 2003 (-61.4%). Returns of rest of days for first L2F1 are maximum in Q3 2011 (34.1%) and minimum in Q4 2004 (-33.5%).

4.4.7 Second L2F1

After fitting and adjusting residual squares of lag 14 of returns of wage payment days for second L2F1 and lag 14 of returns of rest of days for second L2F1, ARIMA-GARCH model is shown on table in appendix A. Yearly and quarterly returns for wage payment days are not purely significant because Arch (1,1) t statistics results for returns of wage payment days are not better than returns of rest of days. Returns of wage payment days for second L2F1 are maximum in Q4 2008 (77.2%) and minimum in Q2 2009 (-49.7%). Returns of rest of days for second L2F1 are maximum in Q2 2006 (33.6%) and minimum in Q4 2004 (-32.2%).

4.5 Arch – Test for WPD and RoD

Table 4: Arch Test for WPD

Second_L1F2	Second_L2F2	Second_L2F1	First_L1F2	First_L2F1	First_L2F2	L1F1
h38 = logical 0	h34 = logical 0	h42 = logical 0	h36 = logical 0	h40 = logical 0	h32 = logical 0	h30 = logical 0
p38 = 6.54E-01	p34 = 6.87E-01	p42 = 9.23E-01	p36 = 0.9287	p40 = 9.63E-01	p32 = 9.74E-01	p30 = 9.77E-01

Table 5: Arch Test for RoD

First_L2F1	L1F1	Second_L1F2	Second_L2F1	First_L2F2	Second_L2F2	First_L1F2
h54 = logical 0	h44 = logical 0	h52 = logical 0	h56 = logical 0	h46 = logical 0	h48 = logical 0	h50 = logical 0
p54 = 1.12E-01	p44 = 1.30E-01	p52 = 2.42E-01	p56 = 3.62E-01	p46 = 3.91E-01	p48 = 5.46E-01	p50 = 0.6512

CHAPTER V

CONCLUSION

This paper analyzes the effect of wage payment days on USD/TL foreign exchange rate in Turkey in all 7 cases which are grouped to eliminate symmetric and asymmetric situations such as L1F1, first L2F2, second L2F2, first L1F2, second L1F2, first L2F1 and second L2F1 on dates between January 2003 and December 2018. Firstly, return averages of wage payment days on USD/TL in all 7 cases are not better than return averages of rest of days. Moreover, only in L1F1 case for wage payment days returns is positive and in other 6 cases wage payment days returns are negative. Secondly, we did not find any significant relationship between their t-statistics for all 7 cases after readjusting and fitting lags with GARCH model which are seen on appendix. In our literature review and literature research for turn of month and rest of month effects, most of papers analyze and search for Borsa Istanbul stock exchange and they find strongly significant inertia with their hypothesis. This shows that people invest their money at Borsa Istanbul on wage payment days and then terminate their stock accounts and trade on USD/TL.

Based on the author's practical experience, even if there is a mass group who has a tendency to invest their savings on USD/TL in wage payment days, they do not have any effect in increase on USD/TL because if somebody has not got greater than USD 100,000 savings by himself / herself, he / she cannot directly affect USD/TL foreign exchange rate.

APPENDIX A

SOME ANCILLARY STUFF

Figure of Wage Payment Days Arima- Garch Model

L1F1	First_L2F2	Second_L2F2	First_L1F2	Second_L1F2	First_L2F1	Second_L2F1
ARIMA(1,0,0) Model:	ARIMA(1,0,0) Model:	ARIMA(15,0,0) Model:	ARIMA(1,0,0) Model:	ARIMA(2,0,0) Model:	ARIMA(19,0,0) Model:	ARIMA(14,0,0) Model:
--------------------	--------------------	--------------------	--------------------	--------------------	--------------------	--------------------
Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian
Standard t	Standard t	Standard t	Standard t	Standard t	Standard t	Standard t
Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic
----------- ----------- ----------- -----------	----------- ----------- ----------- -----------	----------- ----------- ----------- -----------	----------- ----------- ----------- -----------	----------- ----------- ----------- -----------	----------- ----------- ----------- -----------	----------- ----------- ----------- -----------
Constant -0.000445016 0.000394812 -1.12716	Constant -0.00022681 0.000221956 -1.02187	Constant -0.000354636 0.000243172 -1.45838	Constant -9.37057e-05 0.00025762 -0.363736	Constant -0.000225261 0.000279387 -0.806269	Constant -0.000454501 0.000321968 -1.41163	Constant -0.00050751 0.000288909 -1.75665
AR{1} 0.0748317 0.0466425 1.60437	AR{1} -0.0182956 0.0313756 -0.583116	AR{15} -0.0526869 0.0267944 -1.96634	AR{1} 0.00648006 0.0354528 0.18278	AR{2} 0.00210105 0.0340323 0.0617369	AR{19} 0.0752105 0.030815 2.44071	AR{14} 0.0255878 0.030376 0.842367
GARCH(1,1) Conditional Variance Model:	GARCH(1,1) Conditional Variance Model:	GARCH(1,1) Conditional Variance Model:	GARCH(1,1) Conditional Variance Model:	GARCH(1,1) Conditional Variance Model:	GARCH(1,1) Conditional Variance Model:	GARCH(1,1) Conditional Variance Model:
--	--	--	--	--	--	--
Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian
Standard t	Standard t	Standard t	Standard t	Standard t	Standard t	Standard t
Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic
----------- ----------- ----------- -----------	----------- ----------- ----------- -----------	----------- ----------- ----------- -----------	----------- ----------- ----------- -----------	----------- ----------- ----------- -----------	----------- ----------- ----------- -----------	----------- ----------- ----------- -----------
Constant 4.43191e-05 6.40205e-06 6.92265	Constant 1.44226e-05 1.58522e-06 9.09818	Constant 1.58845e-05 2.03638e-06 7.80034	Constant 1.7539e-05 2.10039e-06 8.35037	Constant 1.77021e-05 2.87981e-06 6.14698	Constant 4.0879e-05 5.41973e-06 7.54263	Constant 3.95242e-05 5.16324e-06 7.65491
GARCH{1} 0.251926 0.0896374 2.8105	GARCH{1} 0.607057 0.040231 15.0893	GARCH{1} 0.627297 0.0449652 13.9507	GARCH{1} 0.543184 0.0507636 10.7003	GARCH{1} 0.602864 0.0591047 10.1999	GARCH{1} 0.292854 0.0806859 3.62955	GARCH{1} 0.266609 0.0773789 3.4455
ARCH{1} 0.339657 0.0448653 7.57059	ARCH{1} 0.246993 0.0280087 8.81843	ARCH{1} 0.188901 0.0235602 8.01781	ARCH{1} 0.293826 0.0367216 8.00145	ARCH{1} 0.20344 0.0278123 7.31476	ARCH{1} 0.268268 0.0350568 7.65239	ARCH{1} 0.277947 0.0311641 8.91881
Fit3 =	Fit4 =	Fit5 =	Fit6 =	Fit7 =	Fit8 =	Fit9 =
ARIMA(1,0,0) Model:	ARIMA(1,0,0) Model:	ARIMA(15,0,0) Model:	ARIMA(1,0,0) Model:	ARIMA(2,0,0) Model:	ARIMA(19,0,0) Model:	ARIMA(14,0,0) Model:
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Distribution: Name = 'Gaussian'	Distribution: Name = 'Gaussian'	Distribution: Name = 'Gaussian'	Distribution: Name = 'Gaussian'	Distribution: Name = 'Gaussian'	Distribution: Name = 'Gaussian'	Distribution: Name = 'Gaussian'
P: 1	P: 1	P: 15	P: 1	P: 2	P: 19	P: 14
D: 0	D: 0	D: 0	D: 0	D: 0	D: 0	D: 0
Q: 0	Q: 0	Q: 0	Q: 0	Q: 0	Q: 0	Q: 0
Constant: -0.000445016	Constant: -0.00022681	Constant: -0.000354636	Constant: -9.37057e-05	Constant: -0.000225261	Constant: -0.000454501	Constant: -0.00050751
AR: {0.0748317} at Lags [1]	AR: {-0.0182956} at Lags [1]	AR: {-0.0526869} at Lags [15]	AR: {0.00648006} at Lags [1]	AR: {0.00210105} at Lags [2]	AR: {0.0752105} at Lags [19]	AR: {0.0255878} at Lags [14]
SAR: {}	SAR: {}	SAR: {}	SAR: {}	SAR: {}	SAR: {}	SAR: {}
MA: {}	MA: {}	MA: {}	MA: {}	MA: {}	MA: {}	MA: {}
SMA: {}	SMA: {}	SMA: {}	SMA: {}	SMA: {}	SMA: {}	SMA: {}
Variance: [GARCH(1,1) Model]	Variance: [GARCH(1,1) Model]	Variance: [GARCH(1,1) Mode	Variance: [GARCH(1,1) Model]	Variance: [GARCH(1,1) Model]	Variance: [GARCH(1,1) Model]	Variance: [GARCH(1,1) Model]

Figure of Rest of Days Arima – Garch Model

L1F1	First_L2F2	Second_L2F2	First_L1F2	Second_L1F2	First_L2F1	Second_L2F1
ARIMA(9,0,0) Model:	ARIMA(2,0,0) Model:	ARIMA(5,0,0) Model:	ARIMA(1,0,0) Model:	ARIMA(10,0,0) Model:	ARIMA(15,0,0) Model:	ARIMA(14,0,0) Model:
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Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian
Standard t	Standard t	Standard t	Standard t	Standard t	Standard t	Standard t
Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic
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Constant 0.000152959 0.000117581 1.30089	Constant 9.0012e-05 0.000131656 0.683692	Constant 0.000274297 0.000128597 2.133	Constant 0.000134608 0.000127673 1.05432	Constant 0.000280238 0.000130126 2.15359	Constant 0.000178875 0.000119171 1.50099	Constant 0.000253779 0.000123915 2.048
AR{9} 0.0208817 0.0162044 1.28865	AR{2} 0.0162321 0.0196111 0.8277	AR{5} 0.00900965 0.0185791 0.484935	AR{1} -0.00457473 0.0197203 -0.231981	AR{10} 0.0267 0.0180806 1.47672	AR{15} -0.0235705 0.016034 -1.47003	AR{14} -0.0173003 0.0162805 -1.06264
GARCH(1,1) Conditional Variance Model:	GARCH(1,1) Conditional Variance Model:	GARCH(1,1) Conditional Variance Model:	GARCH(1,1) Conditional Variance Model:	GARCH(1,1) Conditional Variance Model:	GARCH(1,1) Conditional Variance Model:	GARCH(1,1) Conditional Variance Model:
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Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian	Conditional Probability Distribution: Gaussian
Standard t	Standard t	Standard t	Standard t	Standard t	Standard t	Standard t
Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic	Parameter Value Error Statistic
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Constant 1.9901e-06 4.91802e-07 4.04654	Constant 4.61392e-06 7.88081e-07 5.85462	Constant 3.21709e-06 6.54521e-07 4.91518	Constant 4.69686e-06 7.86726e-07 5.97014	Constant 3.31497e-06 6.48111e-07 5.11483	Constant 2.19556e-06 5.28267e-07 4.15615	Constant 2.96617e-06 6.42634e-07 4.61565
GARCH{1} 0.84228 0.0085016 99.0731	GARCH{1} 0.76544 0.0159107 48.1085	GARCH{1} 0.79601 0.0131006 60.7615	GARCH{1} 0.75554 0.0159005 47.5169	GARCH{1} 0.810217 0.0122446 66.1695	GARCH{1} 0.832884 0.00931145 89.4472	GARCH{1} 0.79903 0.0121793 65.6054
ARCH{1} 0.138742 0.00720714 19.2507	ARCH{1} 0.179915 0.0114572 15.7032	ARCH{1} 0.172654 0.0102171 16.8985	ARCH{1} 0.195186 0.0124805 15.6392	ARCH{1} 0.154362 0.00891109 17.3224	ARCH{1} 0.144621 0.00766198 18.8752	ARCH{1} 0.177064 0.0101866 17.382
Fit10 =	Fit11 =	Fit12 =	Fit13 =	Fit14 =	Fit15 =	Fit16 =
ARIMA(9,0,0) Model:	ARIMA(2,0,0) Model:	ARIMA(5,0,0) Model:	ARIMA(1,0,0) Model:	ARIMA(10,0,0) Model:	ARIMA(15,0,0) Model:	ARIMA(14,0,0) Model:
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Distribution: Name = 'Gaussian'	Distribution: Name = 'Gaussian'	Distribution: Name = 'Gaussian'	Distribution: Name = 'Gaussian'	Distribution: Name = 'Gaussian'	Distribution: Name = 'Gaussian'	Distribution: Name = 'Gaussian'
P: 9	P: 2	P: 5	P: 1	P: 10	P: 15	P: 14
D: 0	D: 0	D: 0	D: 0	D: 0	D: 0	D: 0
Q: 0	Q: 0	Q: 0	Q: 0	Q: 0	Q: 0	Q: 0
Constant: 0.000152959	Constant: 9.0012e-05	Constant: 0.000274297	Constant: 0.000134608	Constant: 0.000280238	Constant: 0.000178875	Constant: 0.000253779
AR: {0.0208817} at Lags [9]	AR: {0.0162321} at Lags [2]	AR: {0.00900965} at Lags [5]	AR: {-0.00457473} at Lags [1]	AR: {0.0267} at Lags [10]	AR: {-0.0235705} at Lags [15]	AR: {-0.0173003} at Lags [14]
SAR: {}	SAR: {}	SAR: {}	SAR: {}	SAR: {}	SAR: {}	SAR: {}
MA: {}	MA: {}	MA: {}	MA: {}	MA: {}	MA: {}	MA: {}
SMA: {}	SMA: {}	SMA: {}	SMA: {}	SMA: {}	SMA: {}	SMA: {}
Variance: [GARCH(1,1) Model]	Variance: [GARCH(1,1) Model]	Variance: [GARCH(1,1) Model]	Variance: [GARCH(1,1) Model]	Variance: [GARCH(1,1) Model]	Variance: [GARCH(1,1) Model]	Variance: [GARCH(1,1) Model]

Figure of Quarter Reports

Row Labels	Avg. of WPD L1F1	Avg. of RoD L1F1	Avg. of WPD First_L2F2	Avg. of RoD First_L2F2	Avg. of WPD Second_L2F2	Avg. of RoD Second_L2F2	Avg. of WPD First_L1F2	Avg. of RoD First_L1F2	Avg. of WPD Second_L1F2	Avg. of RoD Second_L1F2	Avg. of WPD First_L2F1	Avg. of RoD First_L2F1	Avg. of WPD Second_L2F1	Avg. of RoD Second_L2F1
2003	**-16.2%**	**-7.1%**	**-17.8%**	**-2.4%**	**-13.6%**	**-1.6%**	**-12.3%**	**-6.9%**	**-7.5%**	**-5.4%**	**-24.7%**	**-4.3%**	**-16.9%**	**-2.6%**
Qtr1	67.7%	-16.0%	39.6%	-12.0%	7.0%	12.1%	58.4%	-16.6%	20.8%	6.8%	40.1%	-13.5%	12.0%	5.3%
Qtr2	-46.3%	-20.8%	-39.8%	-20.4%	-31.4%	-23.2%	-32.1%	-25.4%	-23.2%	-26.5%	-53.8%	-18.8%	-40.7%	-23.5%
Qtr3	-27.3%	0.8%	-27.1%	7.8%	-6.6%	-3.4%	-41.0%	7.0%	-14.7%	-3.1%	-18.1%	-0.2%	3.7%	-4.7%
Qtr4	-49.7%	7.2%	-37.5%	14.2%	-21.2%	9.1%	-25.2%	6.4%	-9.3%	1.7%	-61.4%	14.7%	-40.7%	13.4%
2004	**-13.0%**	**-2.8%**	**-12.5%**	**-1.0%**	**-8.7%**	**-4.0%**	**-19.2%**	**0.0%**	**-14.7%**	**-2.1%**	**-4.2%**	**-4.9%**	**-4.3%**	**-5.3%**
Qtr1	-43.1%	-9.3%	-9.8%	-18.7%	-5.9%	-26.0%	-23.8%	-12.0%	-15.6%	-17.4%	-15.1%	-16.2%	-1.8%	-22.8%
Qtr2	31.7%	23.2%	17.0%	25.3%	21.7%	24.3%	16.5%	24.4%	19.5%	23.5%	32.5%	23.5%	23.4%	23.1%
Qtr3	-10.1%	4.3%	-29.2%	16.2%	-27.3%	16.1%	-32.7%	13.6%	-31.1%	13.4%	-12.9%	5.9%	-17.4%	9.3%
Qtr4	-30.7%	-29.8%	-27.8%	-28.4%	-23.1%	-32.4%	-36.9%	-27.1%	-31.6%	-29.0%	-21.1%	-33.5%	-21.4%	-32.2%
2005	**-15.9%**	**2.4%**	**-5.6%**	**2.4%**	**-7.5%**	**0.9%**	**-4.9%**	**0.9%**	**-7.8%**	**-0.5%**	**-12.4%**	**3.3%**	**-6.4%**	**0.9%**
Qtr1	-6.9%	-0.5%	-5.9%	2.3%	-6.1%	-1.3%	6.9%	-4.2%	10.6%	-6.5%	-25.2%	3.9%	-16.1%	1.0%
Qtr2	-27.8%	-0.2%	-3.5%	-5.6%	-17.7%	2.8%	-14.1%	-1.3%	-37.3%	5.0%	-0.6%	-3.4%	-6.6%	-1.7%
Qtr3	-20.9%	8.2%	-9.5%	10.2%	-13.6%	7.6%	-5.6%	7.3%	-11.4%	4.6%	-20.6%	10.4%	-10.9%	7.6%
Qtr4	-8.2%	2.0%	-3.6%	2.3%	7.3%	-5.9%	-6.9%	1.6%	6.9%	-5.7%	-3.0%	2.1%	7.9%	-3.4%
2006	**-6.2%**	**1.7%**	**-1.8%**	**1.7%**	**-9.5%**	**5.3%**	**2.8%**	**-1.9%**	**-6.0%**	**1.9%**	**-12.2%**	**4.3%**	**-16.7%**	**6.5%**
Qtr1	-7.1%	-2.0%	-24.9%	9.0%	-22.9%	6.3%	-22.5%	4.0%	-21.2%	2.1%	-11.9%	0.8%	-16.7%	1.8%
Qtr2	33.7%	23.5%	43.4%	11.1%	20.6%	29.0%	49.8%	9.5%	23.4%	26.2%	22.7%	25.6%	-0.3%	33.6%
Qtr3	-28.1%	0.2%	-19.0%	4.5%	-35.5%	8.4%	-15.8%	1.0%	-35.1%	4.8%	-30.1%	2.1%	-33.0%	4.2%
Qtr4	-23.3%	-15.3%	-6.7%	-18.0%	0.0%	-23.0%	-0.2%	-22.5%	8.8%	-26.1%	-29.6%	-11.9%	-16.8%	-14.4%
2007	**-7.2%**	**-9.8%**	**-12.3%**	**-6.5%**	**-1.6%**	**-13.8%**	**-13.8%**	**-7.4%**	**-2.0%**	**-13.4%**	**-6.3%**	**-11.3%**	**-1.4%**	**-14.0%**
Qtr1	-8.3%	-0.3%	5.5%	-6.9%	14.6%	-12.6%	-3.3%	-1.7%	4.5%	-6.4%	7.7%	-7.8%	11.3%	-9.9%
Qtr2	-25.1%	-13.8%	-38.5%	1.5%	-36.1%	-3.2%	-45.9%	-1.5%	-41.0%	-5.3%	-15.8%	-14.0%	-27.5%	-8.5%
Qtr3	-25.7%	-15.8%	-23.1%	-15.3%	-3.6%	-26.8%	-22.3%	-17.2%	-0.2%	-26.9%	-32.0%	-15.8%	0.0%	-27.8%
Qtr4	30.3%	-8.9%	7.0%	-4.8%	18.8%	-12.0%	16.4%	-8.7%	28.7%	-14.4%	14.8%	-7.6%	10.8%	-9.5%
2008	**44.4%**	**3.2%**	**11.6%**	**7.2%**	**22.6%**	**3.9%**	**9.5%**	**6.2%**	**21.9%**	**3.4%**	**42.1%**	**3.4%**	**35.4%**	**3.8%**
Qtr1	61.7%	12.8%	28.8%	16.5%	46.0%	13.4%	22.8%	20.0%	43.2%	17.2%	63.7%	9.3%	55.1%	11.6%
Qtr2	-39.0%	-11.0%	-19.2%	-13.8%	-33.4%	-10.4%	-32.3%	-11.7%	-47.2%	-7.5%	-20.3%	-14.4%	-32.4%	-12.2%
Qtr3	61.2%	-2.2%	12.2%	10.1%	31.5%	3.2%	19.8%	0.8%	44.8%	-5.2%	41.2%	4.7%	41.6%	4.1%
Qtr4	93.9%	13.5%	24.5%	16.0%	46.1%	9.3%	27.5%	15.9%	46.9%	9.6%	83.6%	14.2%	77.2%	11.8%
2009	**-3.3%**	**0.3%**	**-1.6%**	**3.8%**	**-2.5%**	**0.5%**	**-3.0%**	**2.7%**	**-3.3%**	**-0.4%**	**-5.3%**	**0.7%**	**0.0%**	**-0.5%**
Qtr1	23.4%	13.9%	38.5%	11.2%	38.4%	7.0%	26.0%	14.9%	25.6%	10.7%	31.2%	10.9%	52.6%	5.6%
Qtr2	-47.8%	-1.8%	-38.1%	4.3%	-45.8%	5.4%	-38.9%	2.5%	-49.4%	3.0%	-53.2%	-0.8%	-49.7%	1.8%
Qtr3	-28.5%	-3.6%	-13.6%	-3.5%	-29.5%	0.6%	-7.3%	-8.5%	-22.5%	-4.3%	-33.4%	0.1%	-38.7%	3.1%
Qtr4	39.7%	-7.2%	6.6%	3.5%	26.9%	-10.8%	8.3%	1.9%	33.2%	-10.8%	34.3%	-7.3%	36.0%	-12.6%
2010	**-20.1%**	**4.8%**	**-10.1%**	**6.3%**	**-7.1%**	**3.6%**	**-17.4%**	**6.8%**	**-14.4%**	**4.3%**	**-10.9%**	**3.8%**	**-4.8%**	**3.0%**
Qtr1	-43.3%	13.2%	-26.1%	14.7%	-36.5%	19.7%	-32.1%	13.5%	-44.3%	17.7%	-37.2%	14.2%	-41.8%	19.6%
Qtr2	5.1%	7.6%	16.8%	7.1%	32.2%	-1.9%	14.2%	8.8%	31.5%	0.6%	12.1%	5.7%	31.9%	-0.4%
Qtr3	-28.8%	-21.6%	-45.3%	-13.3%	-35.9%	-18.5%	-43.1%	-16.9%	-35.5%	-20.5%	-34.0%	-20.7%	-28.9%	-21.9%
Qtr4	-13.4%	20.7%	14.2%	17.3%	11.6%	15.8%	-8.6%	22.3%	-9.3%	20.1%	15.7%	16.4%	19.8%	15.1%
2011	**7.5%**	**8.7%**	**9.8%**	**11.4%**	**12.3%**	**7.9%**	**10.8%**	**8.8%**	**13.3%**	**5.4%**	**6.3%**	**11.1%**	**11.9%**	**7.7%**
Qtr1	-2.6%	-2.4%	5.3%	0.4%	8.1%	-3.2%	-13.1%	3.2%	-10.9%	-0.7%	19.8%	-4.8%	17.2%	-6.0%
Qtr2	-2.0%	13.9%	4.7%	16.7%	2.3%	10.6%	7.4%	12.2%	7.6%	6.8%	-8.1%	17.5%	6.0%	9.1%
Qtr3	3.5%	27.4%	11.8%	29.1%	17.3%	27.1%	25.3%	22.8%	30.0%	20.8%	-11.0%	34.1%	-1.4%	32.0%
Qtr4	31.0%	-4.3%	17.4%	-0.7%	21.6%	-2.8%	23.6%	-3.0%	26.5%	-5.4%	24.5%	-2.5%	25.9%	-4.3%
2012	**-6.5%**	**-4.0%**	**1.5%**	**-5.6%**	**-6.9%**	**-4.1%**	**-2.5%**	**-5.2%**	**-12.7%**	**-3.4%**	**-1.5%**	**-5.3%**	**-5.3%**	**-4.0%**
Qtr1	-26.5%	-11.1%	-4.5%	-16.3%	-24.1%	-9.1%	-5.6%	-17.6%	-28.6%	-10.2%	-24.4%	-10.4%	-25.8%	-8.1%
Qtr2	-3.9%	4.5%	23.7%	-6.4%	12.1%	-3.8%	7.6%	1.2%	-6.2%	3.7%	21.8%	-3.4%	15.4%	-3.1%
Qtr3	10.8%	-6.6%	-2.3%	-1.4%	-2.9%	-4.0%	-3.3%	-2.4%	-4.9%	-4.5%	8.1%	-7.0%	2.7%	-6.3%
Qtr4	-6.5%	-2.7%	-11.0%	2.3%	-12.7%	0.9%	-8.7%	-1.4%	-11.2%	-2.3%	-11.6%	-0.4%	-13.4%	1.5%
2013	**4.7%**	**12.2%**	**1.5%**	**15.1%**	**3.8%**	**12.8%**	**5.2%**	**12.1%**	**7.7%**	**9.7%**	**-0.6%**	**14.4%**	**2.1%**	**13.3%**
Qtr1	-15.2%	8.1%	-7.9%	8.4%	-5.3%	5.0%	-4.3%	4.2%	-0.9%	1.2%	-19.4%	11.5%	-12.9%	9.9%
Qtr2	28.7%	14.0%	18.5%	15.4%	18.9%	14.1%	19.8%	13.8%	21.1%	12.2%	24.9%	14.6%	25.5%	12.3%
Qtr3	-32.1%	15.3%	-4.7%	17.0%	-3.2%	16.0%	-9.3%	15.5%	-8.5%	14.3%	-20.7%	16.6%	-17.4%	16.9%
Qtr4	37.5%	11.2%	-0.1%	19.8%	4.6%	16.0%	14.7%	14.8%	19.1%	11.2%	12.7%	14.8%	13.2%	14.1%
2014	**43.1%**	**-4.0%**	**24.8%**	**-2.8%**	**20.7%**	**-2.9%**	**27.6%**	**-3.6%**	**22.2%**	**-3.3%**	**35.5%**	**-4.3%**	**28.7%**	**-4.0%**
Qtr1	5.6%	1.1%	-16.6%	10.2%	-5.8%	4.6%	-18.0%	8.5%	-7.5%	2.5%	6.7%	2.8%	11.5%	0.0%
Qtr2	46.4%	-17.8%	27.4%	-16.2%	19.5%	-16.5%	37.4%	-20.1%	30.3%	-18.9%	29.1%	-16.0%	25.5%	-17.0%
Qtr3	43.9%	10.6%	48.8%	5.9%	36.5%	7.8%	44.5%	8.3%	29.1%	10.5%	50.0%	7.3%	34.7%	9.3%
Qtr4	76.4%	-10.1%	39.8%	-11.4%	32.7%	-7.8%	46.4%	-11.3%	37.0%	-7.7%	56.1%	-11.4%	43.1%	-8.7%
2015	**4.1%**	**12.7%**	**9.3%**	**15.2%**	**6.8%**	**12.6%**	**-1.2%**	**17.7%**	**-6.4%**	**15.0%**	**14.4%**	**10.0%**	**12.7%**	**10.1%**
Qtr1	21.6%	16.7%	33.8%	16.6%	21.1%	17.1%	24.9%	19.0%	6.6%	20.0%	35.4%	13.0%	31.9%	11.1%
Qtr2	42.7%	2.6%	31.7%	5.2%	30.3%	1.0%	16.3%	10.3%	12.9%	5.7%	51.1%	-2.3%	44.5%	-1.4%
Qtr3	19.5%	26.4%	18.2%	28.9%	19.9%	27.0%	15.9%	28.1%	16.7%	25.9%	17.8%	27.2%	19.0%	26.7%
Qtr4	-67.6%	5.3%	-46.5%	10.2%	-44.2%	5.1%	-61.9%	13.4%	-61.7%	8.3%	-46.8%	2.1%	-44.4%	3.9%
2016	**30.0%**	**4.2%**	**32.7%**	**0.9%**	**25.3%**	**1.9%**	**33.8%**	**1.1%**	**26.7%**	**2.9%**	**25.8%**	**3.2%**	**19.5%**	**3.7%**
Qtr1	12.0%	-12.2%	27.5%	-21.4%	22.1%	-25.5%	12.1%	-13.8%	10.9%	-15.9%	30.6%	-21.0%	20.2%	-22.8%
Qtr2	-8.0%	5.3%	6.3%	5.3%	-4.3%	7.9%	13.5%	2.7%	1.0%	5.7%	-15.0%	7.1%	-16.9%	8.4%
Qtr3	70.7%	-3.9%	45.6%	-4.9%	42.8%	-0.5%	46.5%	-4.4%	42.8%	1.0%	59.9%	-6.0%	42.4%	-1.4%
Qtr4	45.6%	26.4%	51.5%	23.2%	40.8%	24.5%	63.1%	18.7%	52.3%	20.0%	27.8%	31.1%	32.3%	29.4%
2017	**8.7%**	**3.3%**	**-2.0%**	**6.7%**	**-2.7%**	**6.0%**	**2.7%**	**2.9%**	**2.9%**	**2.8%**	**-2.5%**	**5.8%**	**-6.2%**	**7.6%**
Qtr1	27.4%	6.9%	19.0%	7.2%	20.2%	7.2%	28.9%	2.5%	30.8%	3.2%	9.8%	9.8%	-3.9%	13.6%
Qtr2	-15.7%	-4.4%	-12.8%	-5.4%	-22.8%	-3.0%	-10.9%	-7.2%	-20.9%	-4.9%	-22.1%	-3.4%	-28.4%	-0.2%
Qtr3	19.3%	-4.4%	-10.2%	5.9%	12.4%	-5.4%	-8.3%	3.0%	18.4%	-6.8%	11.4%	-3.8%	19.5%	-5.8%
Qtr4	3.7%	14.2%	-4.2%	17.9%	-20.8%	23.7%	1.3%	12.4%	-16.6%	18.3%	-9.2%	19.2%	-12.2%	21.3%
2018	**21.7%**	**7.1%**	**7.8%**	**8.6%**	**10.4%**	**8.2%**	**20.0%**	**3.5%**	**22.9%**	**3.8%**	**4.2%**	**11.3%**	**0.8%**	**11.9%**
Qtr1	-1.8%	12.9%	-9.9%	18.2%	0.0%	12.0%	1.1%	14.5%	11.3%	7.9%	-16.1%	16.4%	-9.3%	15.5%
Qtr2	92.7%	11.3%	48.8%	14.6%	40.7%	17.7%	77.4%	6.3%	70.9%	9.7%	55.3%	19.3%	43.9%	19.3%
Qtr3	10.7%	25.8%	11.0%	26.0%	25.8%	25.0%	7.1%	24.1%	21.4%	24.0%	20.2%	27.3%	15.2%	27.9%
Qtr4	-14.9%	-19.5%	-18.8%	-22.1%	-24.9%	-19.3%	-5.7%	-28.5%	-12.1%	-24.0%	-42.7%	-15.7%	-46.6%	-12.9%
Grand Total	**4.8%**	**2.1%**	**2.2%**	**3.8%**	**2.6%**	**2.3%**	**2.4%**	**2.3%**	**2.7%**	**1.3%**	**3.0%**	**2.6%**	**3.1%**	**2.4%**

Figure of After Modelling Cases, returns, density and auto corr. for L1F1

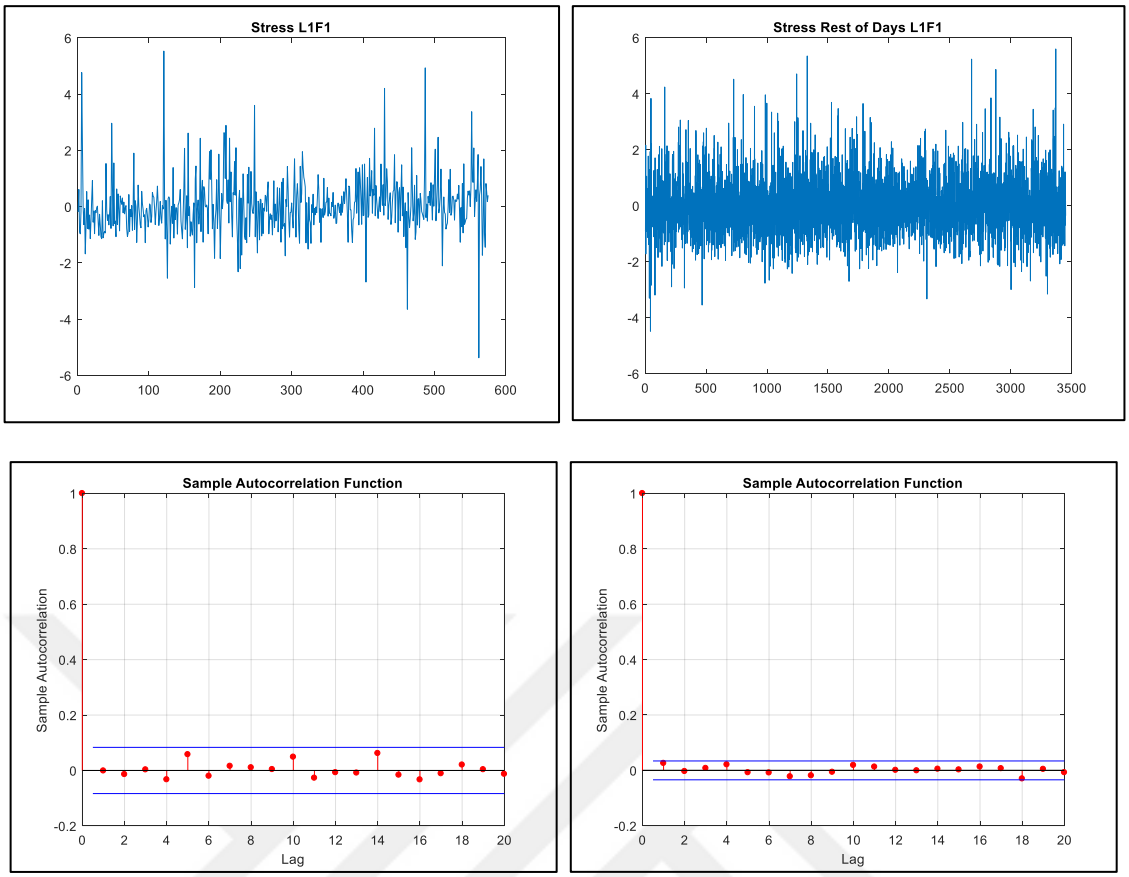
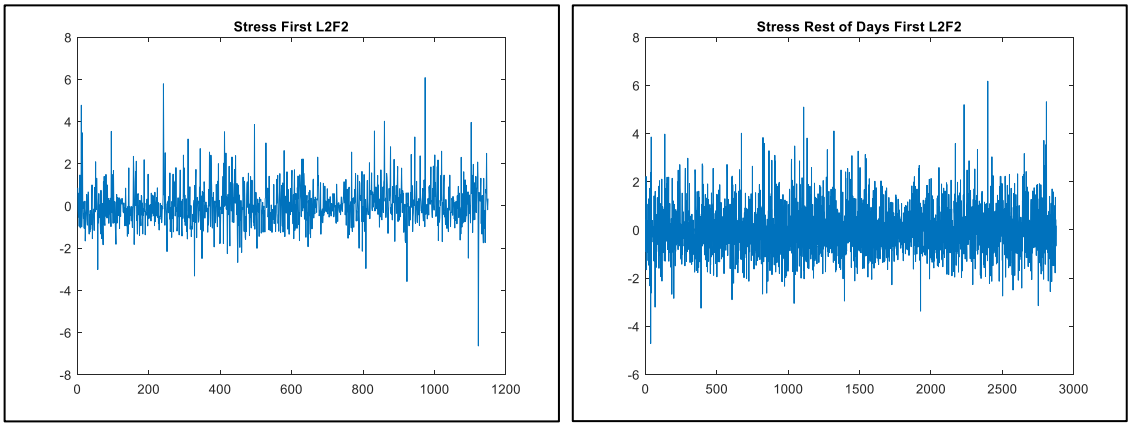


Figure of After Modelling Cases, returns, density and auto corr. For first L2F2



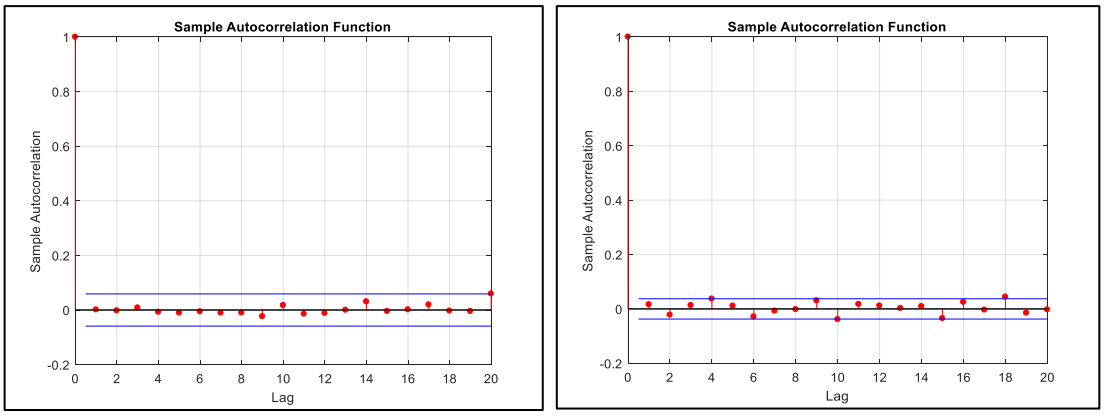


Figure of After Modelling Cases, returns, density and auto corr. for second L2F2

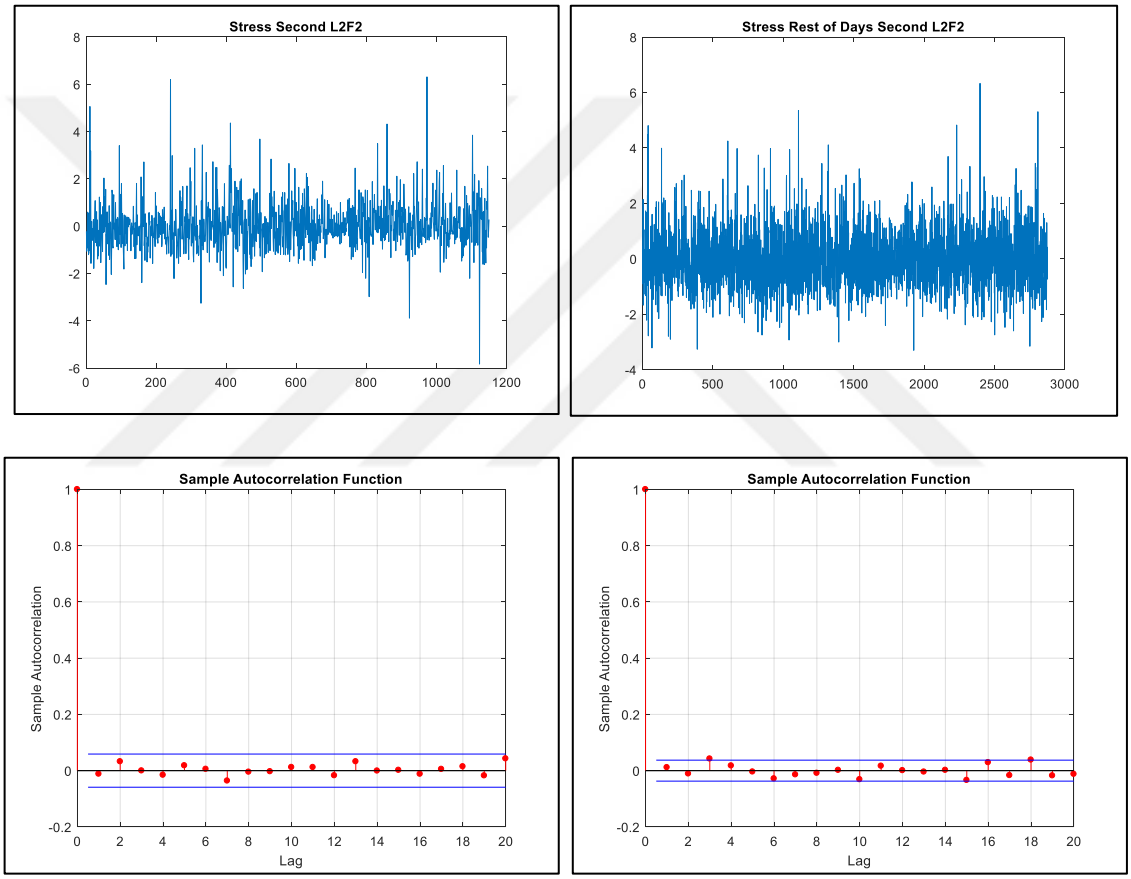


Figure of After Modelling Cases, returns, density and auto corr. for first L1F2

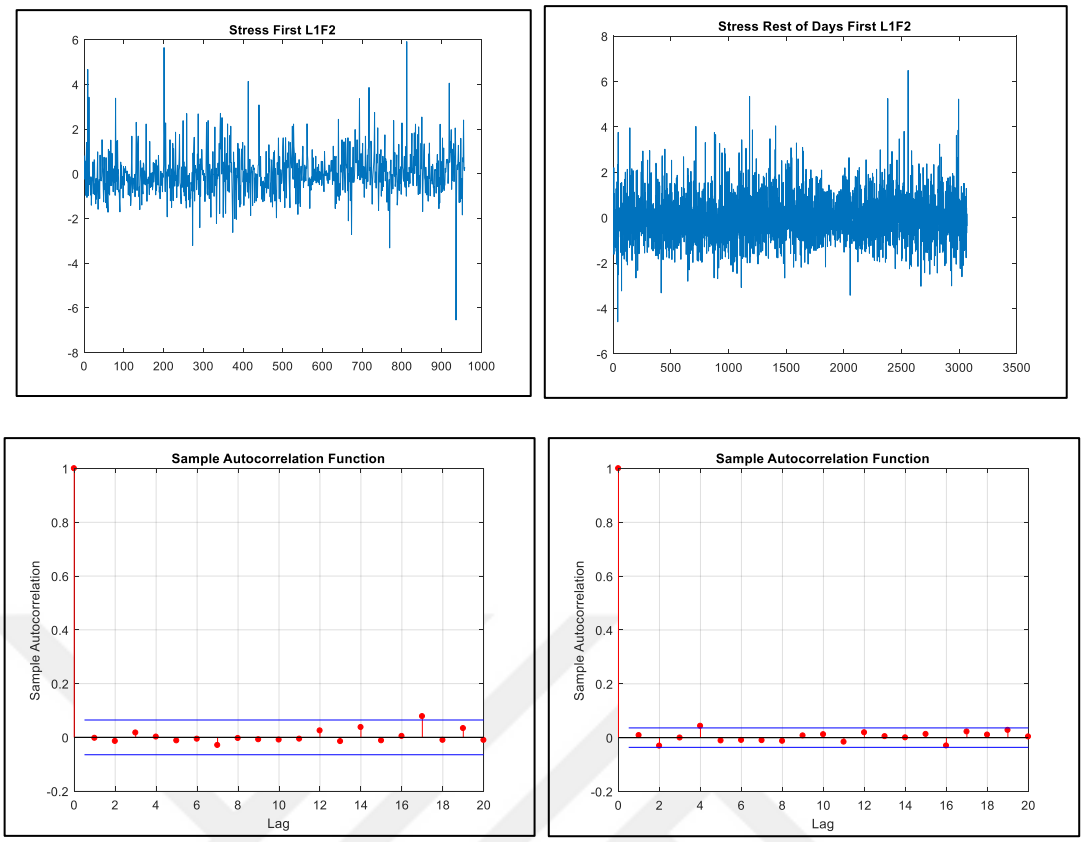
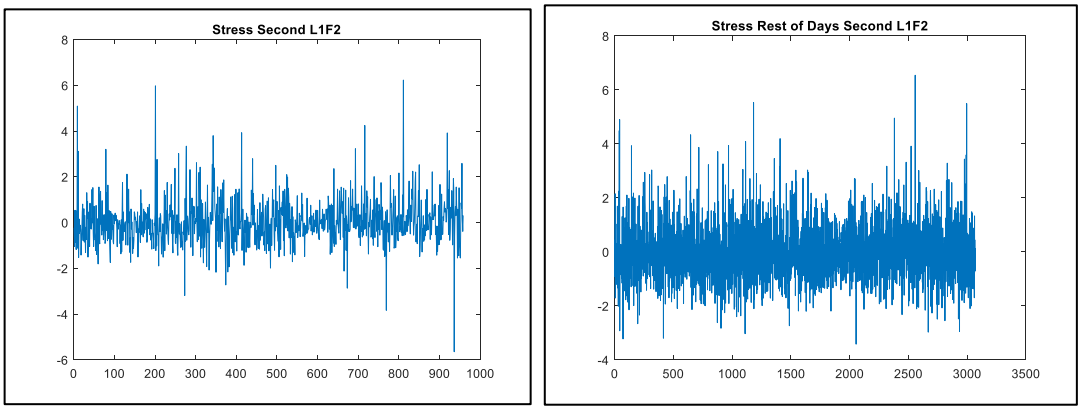


Figure of After Modelling Cases, returns, density and auto corr. for second L1F2



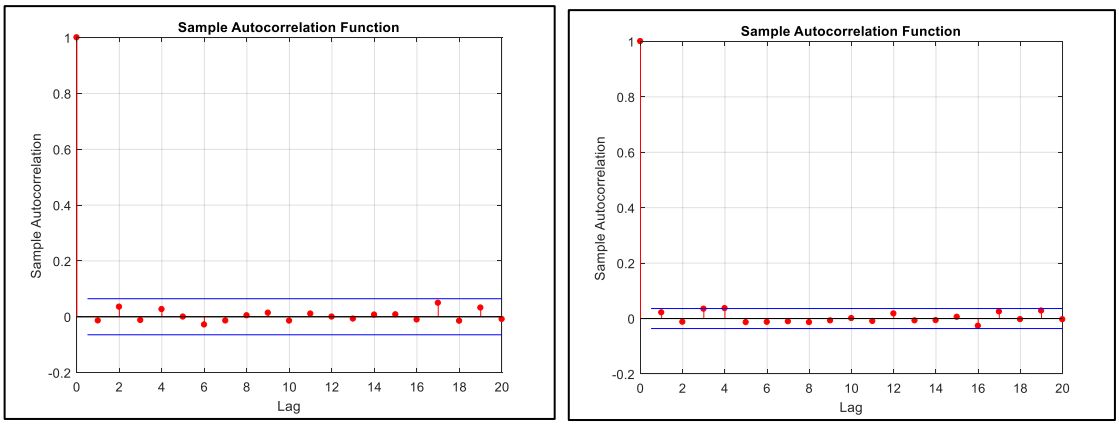


Figure of After Modelling Cases, returns, density and auto corr. for first L2F1

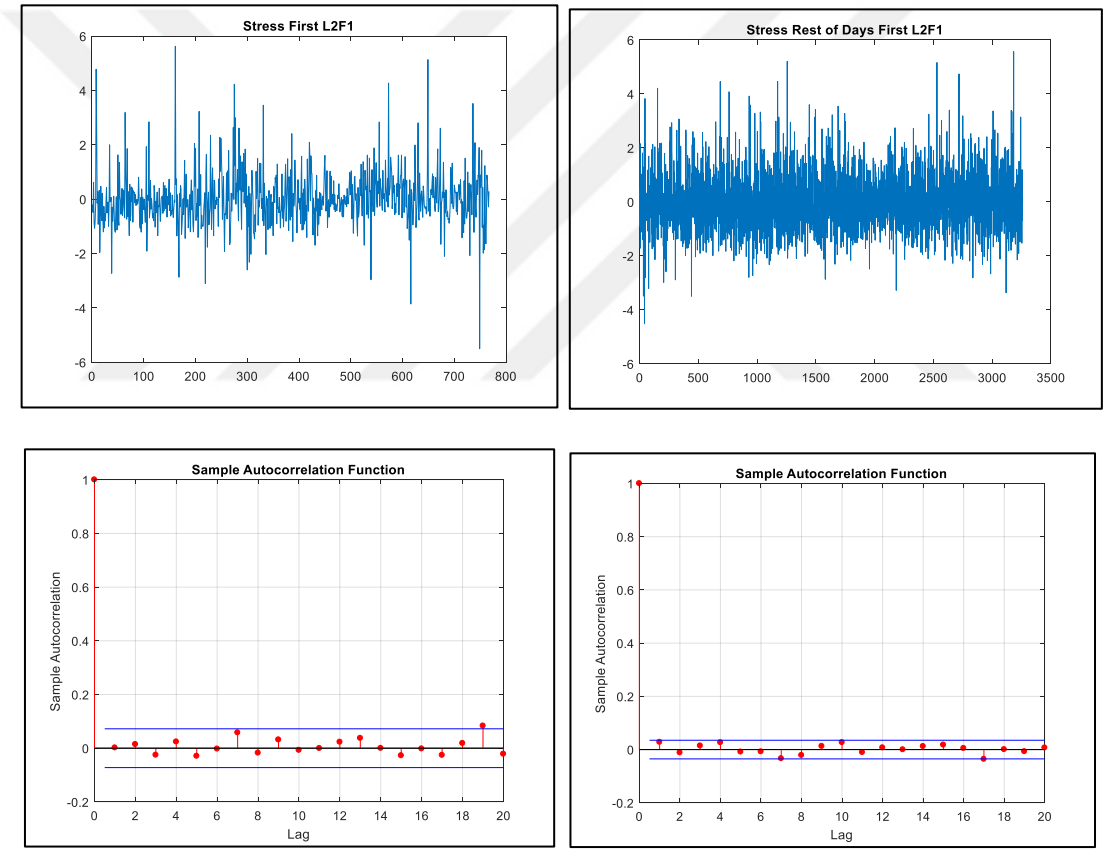
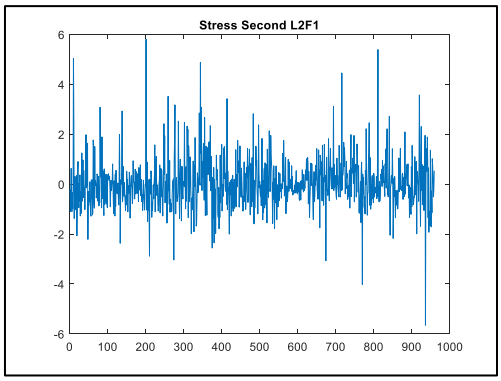
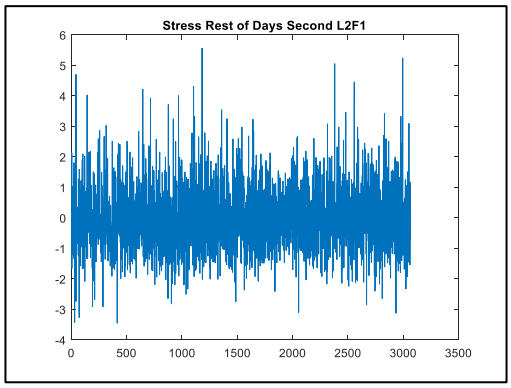
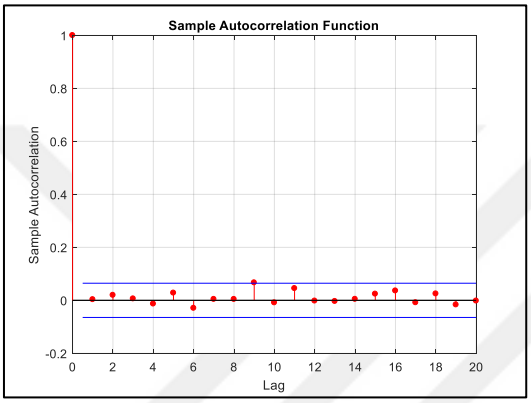
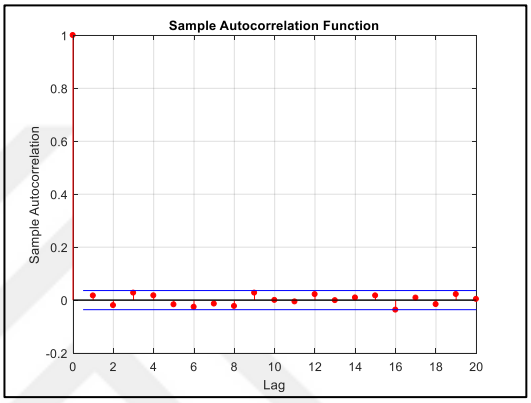


Figure of After Modelling Cases, returns, density and auto corr. for second L2F1


Stress Second L2F1
6
4
2
0
-2
-4
-6
0
100
200
300
400
500
600
700
800
900
1000


Stress Rest of Days Second L2F1
6
5
4
3
2
1
0
-1
-2
-3
-4
0
500
1000
1500
2000
2500
3000
3500


Sample Autocorrelation Function
Sample Autocorrelation
1
0.8
0.6
0.4
0.2
0
-0.2
0
2
4
6
8
10
12
14
16
18
20
Lag


Sample Autocorrelation Function
Sample Autocorrelation
1
0.8
0.6
0.4
0.2
0
-0.2
0
2
4
6
8
10
12
14
16
18
20
Lag

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