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INSTITUTE OF GRADUATE PROGRAMS
FINANCIAL ECONOMICS MASTER'S DEGREE PROGRAM

**A Vector Error Correction Model(VECM) Approach in Explaining the Relationship
Between Interest Rate and Inflation Towards Exchange Rate Volatility in Turkey**

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İSTANBUL

2019

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**Türkiye'de Döviz Kuru Volatilitesi ile Faiz Oranı ve Enflasyon Arasındaki İlişkiyi
Açıklayan Bir Vektör Hata Düzeltme Modeli Yaklaşımı**

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Tezin Onaylandığı Tarih : 13.06.2019

Toplam Sayfa Sayısı:65.....

Anahtar Kelimeler (Türkçe)

- 1) Fed
- 2) Döviz Kuru Volatilitesi
- 3) Enflasyon
- 4) Para Arzı
- 5) Para Talebi

Anahtar Kelimeler (İngilizce)

- 1) Fed
- 2) Exchange Rate Volatility
- 3) Inflation
- 4) Money Supply
- 5) Money Demand

PREFACE

This study is submitted in fulfilment of the requirements of the Master's Degree of Financial Economics program in İstanbul Bilgi University. The exchange rate in Turkey is one of the most important things while taking monetary decisions. It is known that it is highly volatile and effected by the political situations. In order to make a good monetary design, it is crucial to see the role of the exchange rate in Turkish economy. In this regard, in this study the exchange rates are studied.

I would like to express my gratitude and thanks to my adviser Assoc. Prof. Serda Selin ÖZTÜRK for her encouragement and help during my study. I also would like to thank to my colleagues for their supports at every stage of the process.

Serdar Simonyan

Istanbul,2019

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LIST OF ABBREVIATIONS

PPP	Purchasing Power Parity
VECM	Vector Error Correction Model
EXRATE	Exchange Rate(Turkish Lira/U.S. Dollar)
INFRATE	Inflation Rate of Turkey
INTRATE	Interest Rate of Turkey
ADF	Augmented Dickey Fuller
AIC	Akaike Information Criteria
QTM	Quantity Theory of Money

LIST OF SYMBOLS

ε	Error Term
R	Exchange Rate
AHE	Average hourly earnings
CPI	Consumer price index
i	Interest rate
P	Domestic Price
P*	Foreign Price
σ^2	Variance
$\mu, \beta, \omega, \gamma, \Delta, \theta, \alpha$	Parameters

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ABSTRACT

The main drivers of a country's economic health is the real Exchange rate. Exchange rate is a very crucial determinant in a country's trade, which is very important in free markets. On the other hand, the interest rate also plays a vital role in the economy. These two variables together are affected by the variations in the exchange rate. The attempt of this paper is to investigate the relation between inflation rate, interest rate and the Exchange rate volatility in Turkey between the time period 2010-2017. First, the business cycles of the macroeconomic variables of Turkey will be presented and commented. Then the model will be build and the long-run and the short-run relationship between interest rate, exchange rate and inflation rate will be analysed. At the last stage of the paper, it is aimed to search the economic intuitions and possible reasonings of the results found. Through the research, the approaches which are going to be used while analyzing the series is the Vector Error Correction Model(VECM), cointegration test, Granger causality test and stability test. If any shock is founded, then Impulse Response Function(IRF) will be used to understand the response to shock through the model's variables.

ÖZET

Bu çalışma Türkiye’de kurların enflasyon, faizler ve para arzı kullanılarak incelenmesi için bir hata düzeltme modeli kullanmıştır. Çalışmada kullanılan veri seti 2002-2018 arası aylık düzeltilmiş seridir. Bulunan bulgulara göre kurların faizler ile pozitif ilişkide olduğu, enflasyon ile ise negatif ilişkide olduğu saptanmıştır. Bulunan bulgular ekonomik teori ve kurallarla örtüşmektedir. Faizerin yükselmesi hanehalkının daha çok Türk lirası talep etmesine yol açacak, bu da Türk lirasının değer kazanmasına sebep olacaktır. Aynı zamanda, enflasyonun yükselmesi de kur üzerinde baskı yarattığından, o da negatif bir etki yaratacaktır. Bunların yanında modele açıklayıcı veri olarak para arzı da eklenmiştir, ve görülmüştür ki Türkiye’de para arzı kısa vadede kurların üzerinde negatif bir etkiye sahip olmakla beraber, uzun vadede herhangi bir etkisi yoktur. Bu bulgu da ekonomik değerler ile örtüşmektedir. Artan para arzı, Türk lirasını piyasada bollandıracak, bu da parada değer kaybına neden olacaktır.

INTRODUCTION

For decades the Exchange rate played a very crucial role in the discussions of macroeconomic policy in emerging markets and developed countries. A wide amount of studies done about the relationship between the exchange rate and macroeconomic variables. However, the evidence found might differ. After the currency crises in 1990's and 2000's high number of economies changed their direction from rigid Exchange rate to flexible Exchange rate. But however, just by taking this move into consideration, it doesn't mean that the Exchange rate debate had disappeared from policy discussion. The exchange rate in Turkey started to depreciate after the 2008 financial crisis and that is the particular reason why the model that we build will analyse the period after the financial crisis, so that it would be prevented to have misleading results. To be able to understand the effect of inflation rate and interest rate on exchange rate clearly, monthly data will be used instead of yearly data. Economic policy decisions are affected by the volatility of the Exchange rate, for example when a country is adopting the inflation targeting regime, the inflation expectations must be renewed more frequently because of the fluctuations in exchange rate. In this study, we will try to understand how inflation rate and interest rate affects the exchange rate volatility.

CHAPTER 1

LITERATURE REVIEW

After the introduction of the flexible exchange rate system, the exchange rate started to show a significant volatility and uncertainty. This lead researchers to motive their studies in recent years to argue the effects of exchange rate volatility on macroeconomic determinants such as inflation,trade flows and interest rates, which has been fruitful area of research.

When the effect of Exchange rate volatility on international trade is considered, the findings differ with respect to the studied countries development level. For instance, Chit et al. (2008) observe a significant negative impact of the Exchange rate volatility on exports for emerging East Asian countries. Furthermore, eight Latin American countries were studied by Arize et al. (1999) and it is found that there is a significant and negative effect in the long run. On the other hand, when the industrialized countries are studied, the results show an alteration. Gotur (1985) tries to examine the relationship with five industrialized countries and finds out that volatility has no significant effect. In their studies, Hall et al. (2010) use a panel data of emerging and developing countries to see the difference, they report that the volatility effects the exports of developing countries in a negative way, but has no significant effect on developing countries exports.

One of the other important variable which we have to elaborate on is the investment level. In previous studies done, it is clearly seen that the Exchange rate volatility also effects the level of the investment that the country attracts. Dhakal et al.(2010) studied the effect of Exchange rate uncertainty on foreign investment in four East Asian countries and found that the Exchange rate volatility has a significant effect on foreign direct investment. Goldberg and Kolstad(1995) argue in their paper that, if both the Exchange rate shocks and real demand shocks are taken into account, Exchange rate volatility disposed to increase the foreign direct investment. When we consider the case of the private investment, it is fruitful to elaborate on the studies of Serven (2003) which

took the data between 1970-1995 period and studied 61 countries and found a significant negative impact of real Exchange rate on private investment.

When the literature is searched for the relationship between the real exchange rate and output, it is seen that the studies yield mixed results. Kamin and Rogers(1999) studied the case for Mexico for the period between 1981-1995 and observed that depreciation of the currency led to high inflation and economic contraction in Mexico. The study done by Barguelli et al.(2018) take 45 developing and emerging countries through the period 1985-2015 and conclude that exchange rate volatility has a significant negative impact on economic growth. Moreover, they found out that the exchange rate regime and financial openness of a country also effect the exchange rate volatility. When a country adopts flexible exchange rate regime and it is open in terms of finance, this makes volatility more harmful for the economy.

When the effect of country's own real exchange rate on macroeconomic variables are searched, it is seen that there is an important amount of research carried out. Caballero, R. and V. Corbo, (1989) argue in their paper that in most of the developing countries, the larger the real Exchange rate volatility, the larger the damage on exports. The findings of Arize, A., T. Osang and D. Slottje, (2000) are also very remarkable. They took a sample of 13 less developing countries(LCD's) and studied the effect of Exchange rate volatility on export flows. It is suggested that there is a statistically and significant negative relationship between Exchange rate volatility and export. Moreover, they underlined that the Exchange rate volatility must be included in the estimated export demand function for it to provide property of cointegration. Dell'Ariccia, G., (1999) also adresses the same situation in his paper, he argues that the Exchange rate uncertainty has a negative effect on international trade(exports and imports) presenting evidence from 14 European Union countries.

Devereux, M. and P. Lane, (2003) emphasise on the factors which effect the optimal Exchange rate volatility. And the findings suggest that exchange rate volatility is strongly effected by the external debt that the developing countries have. But, for the case of industrialized countries, the result is different and the external debt is not

significant, while optimal standard currency area factors play a vital role there. Another important determinant for the Exchange rate volatility is the size of the official Exchange rate bandwidth. Rose, A., (1996) declares in his paper that, the larger the size of the exchange rate bandwidth is, the larger the degree of the Exchange rate volatility. Rose, A., (1996) says “Words evidently speak as loudly as actions; stated government exchange rate policy affects exchange rate volatility above and beyond the effects of actual macroeconomic policy.”

One of the key drivers in monetary policy design is the exchange rate pass through(ERTP), which can be defined as the sensitivity of import prices for a change in the exchange rate of the importing nation’s currency. In literature it is suggested that the characteristics that the pass-through can be an important aspect while choosing the measure of the inflation target. The monetary authorities have two choice in this case: locally produced goods can be excluded while targeting the inflation rate or by including import prices they focus on total inflation. The exchange rate regime that is chosen for developing countries has an important consequence in the means of pass-through. In fixed exchange rate regimes, the production costs are affected permanently, since the firms believe that the change in the exchange rate is not going to be temporary. Therefore, the prices are adjusted rapidly by the firms. However, the scenario differs in flexible exchange rate regimes. The agents consider the changes in the exchange rate relatively temporary. Consequently, the prices are not adjusted immediately. It is beneficial to distinguish between full ERTP and partial ERTP. Full ERTP takes place when the effect of a depreciation is reflected totally in import prices. However, if the import prices react less than proportionally it can be said that the exporters absorb some part of the change in the exchange rate. Asymmetry may occur in the long run relationship, in the short-run dynamics or both. Price rigidities are able to explain this asymmetry. The pass-through is expected to be smaller, when the price rigidity is high. In contrast, pass-through is expected to be complete in the long-run.

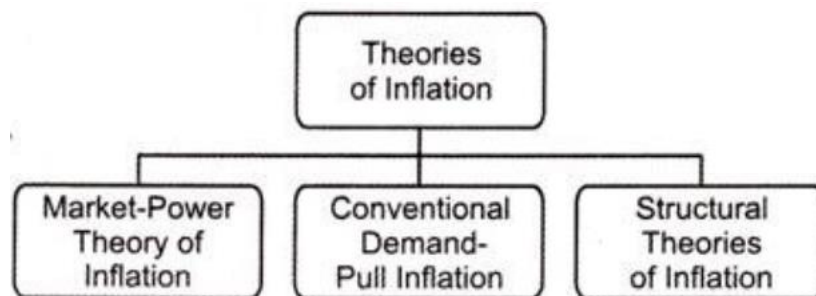
How exchange rate variations effect the prices has been a fruitful area of research over the past years. Several studies indicate that the exchange rate changes impact export and import prices symmetrically. (Froot and Klemperer,1989; Dornbusch,1987; Taylor,2000). The findings imply that the appreciation and the depreciation of the

exchange rate leads to a price change of the same magnitude. However, the reaction of the firms for the exchange rates can be different, depending on the magnitude and the direction of these changes. To be more clear, the exporters in a country may have more interest to appreciations than depreciations since they will be able to increase their prices. The reaction of the exporters to the exchange rate changes can lead to an asymmetric ERPT. Moreover, the magnitude of the exchange rate changes is also very crucial. In the case of a small change, the firms may prefer not to change their prices. But, if the change of the exchange rate is above a given threshold, then the firms may decide to reflect it to their prices. This scenario implies that the exchange rate pass-through can be nonlinear.

There had been a significant amount of research presenting the factors of exchange rate pass-through to prices. The size of the export market, the degree of competition, the duration of the exchange rate variation, the magnitude of the changes in the exchange rate can be counted among those. If there is much competition in the export market and the local demand for the good is very elastic, what the companies do is to absorb the changes in the exchange rate to maintain their position in the market. However, in this case they will have less marginal profits. In contrast, if there is not so much competition for the exporters products, then prices may be considered less responsive to the changes in the exchange rate. The reaction of the exporters to the changes in exchange rate are heavily dependent on the duration of the exchange rate variation. Meurers(2003) found that, if the exchange rate changes are temporary, the exporters may be willing to lower their margins in the case of an appreciation in order to keep their market share. According to Goldberg(1995) and Kadiyali(1997), the response of the exporters to an exchange rate variation can be asymmetric and it is dependent on whether the exchange rate appreciates or depreciates. For instance, exporters can decide to absorb the exchange rate variation in order to keep their prices stable if there is an appreciation. In this scenario, it can be expected that the exchange rate pass-through can be low or incomplete. On the other hand, if there is a depreciation in the currency, then the exported goods will become cheaper, which may encourage exporters to fully adjust the

1.1. A BRIEF HISTORY OF THE INFLATION THEORIES

Inflation is usually defined as the increase of the prices of the goods and services in an economy. The important thing is, this definition does not mean one-time increase of the level of the price. We should refer to the demand-pull inflation in this case, which happens when equilibrium price-level increases for goods and services due to excess demand. Under this circumstances, the demand grows faster than the supply and causes price to be higher. But it is sometimes preferred by some economists to use cost-push inflation, when firms' cost increase due to rising wages, imported input prices or exchange rates. But when we try to describe inflation by the two terms that we mentioned, the process is not that easy. Moreover, the inflation itself can be the reason for the future inflation. In this regard, we need to make a distinction between the short-run and long-run inflation, the concept of the economy being open or closed, or whether we think of a perfect competition or imperfect competition models. In this section of the paper, we are going to elaborate on the causes of the inflation.



1.1.1. Monetary vs Keynesian Inflation Theories

The explanation of the inflation is mainly done by the quantity theory of money(QTM) by classical and neoclassical economists. The theory claims that, the value of the purchases must be equal to the value of all sales of goods. O'Brien(1975) states in his paper that, classical and neoclassical versions of the theory differs in transmission mechanisms. In the neoclassical model, the assumption done is that there is full employment, and wages are determined in the real sector, while nominal prices are expressed in terms of money supply. In this regard, the more money supply means the

higher the general price level, but an unchanged output. O'Brien also explains the case by taking into consideration the assumption of David Hume, who assumes that there is not full employment. Hume states that, a different transmission is not used, when an increase in money supply causes the price level to increase. He allows price rigidities while describing the inflation process.

John Maynard Keynes' (1936) book, *The General Theory of Employment, Interest and Money*, assumed that there is an underemployment equilibrium with a fixed price level. Keynes (1940) built a model of inflation with price rigidities. He explains a process which he calls as *redistribution*. In this model he states that "inflation acts like a pump that transfers income from wage earners who have a low propensity to save and a low marginal tax rate to the entrepreneurial sector with a higher propensity to save and a higher marginal tax rate" (Frisch, 1983: 230). When the demand increases unexpectedly, it increases the price when there is full employment, and consequently this brings profits which are unexpected for the firms. At the same time, the wages does not change. The rise in the demand also has effects on the goods market, which causes the demand to increase. But, the firms' attempt to react for the excess demand in the good market, also creates a reaction in the labor market, which increases the demand for labor. Consequently, when the firms demand more labor, that means the nominal wages will be higher until putting the real wages to their initial level. When the real wages increase, meaning the individuals having more income, means that there will be a new demand increase in the goods market, and this will cause to a price increase again. And the spiral will continue like this until the aggregate demand is reduced by tax increases/decrease in government spending.

1.1.2. Neo-Keynesian vs Monetarist Approach to Inflation: The Phillips-Curve Debate

Keynes(1940) built an inflationary gap model which took into account the demand-side with wage rigidities, but he did not specify any point about the money market. The model that he build was furthermore influenced by cost-push arguments. The *Keynesian neoclassical synthesis* is based on:

IS-LM model introduced by John R. Hicks and Franco Modigliani

Phillips curve developed by Alban W. Phillips and Richard Lipsey

Fleming-Mundell model

The mechanism, which redistributes income which led to price increases in Keynes-Smithies model, was not present in IS-LM model. In the IS-LM mechanism, did not allow a continuous price increase. On the other hand, the income determination difference between the Keynesian and classical theories was shaped just with the money demand, Therefore, Keynesian synthesis took into account of the Phillips curve to be able to delete the wage or price block.

1.1.3. Monetarist-Structuralist Debate: Demand-Pull vs Cost-Push Inflation

The debate of inflation being whether a demand-pull or cost-push issue has been one of the most important debates between the monetarists and structuralists. The cost-push theory of inflation states that supply-side effects the unit-cost and profit components of prices. The structuralist approach can be considered as one of the most important version of cost-inflation theories. Streeten (1962) and Baumol(1967) stated that the inflation is also linked with the industrial sector and traditional sector(agricultural). The very first structuralist inflation models explained the cause of the Latin American inflation as the productivity differences of different sectors. Generally, they claimed that the sector which is considered as the traditional one, responds to monetary shocks with a lag. In the model built, supply legs behind demand. This is the reason why, structuralist model is seen as a cost-push theory.

All the versions of the cost-push theories have common mechanisms, which indicate continuous increase in the price level, which we refer as inflationary process. On the other hand, one-time increase of the price level caused by an exogenous shock is tried to be explained by the supply side theories. The shocks which can be considered as the temporary, such as an oil price shock, causes only transitory changes in the macroeconomic variables, while causing just one-time pressure on inflation.

It is also accepted by the modern QTM that, inflation is present when the growth rate of money supply exceeds the growth rate of the output in the economy. Monetarists argue

that, inflation is solely a monetary and a demand-side phenomenon. The way that they look at the inflation shows us that, they are in contrast with the cost-push theories because the theory is mainly based on the observation of the supply-side. They believe that, costs which arise from the firms' inside composition can not be inflationary, because they are not connected to the money supply.

1.1.4. New Keynesian vs. New Classical Economics

Under the assumption of the market-clearing, imperfect information, researchers tried to observe the impacts of supply shocks on the business cycle. These researchers did not attempt directly to see the price level or inflation changes, but they focused on the effects of the supply shocks on output. But, one can clearly argue that, their reasoning for doing this was to draw our attention to the possibility that, the supply shocks can be an explanatory variable while explaining the inflation.

1.2. THE DETERMINANTS OF INTEREST RATES

1.2.1. Liquidity Preference

The theory of liquidity preference refers to the relation between the level of the income, the bond rate of interest and quantity of money. This relation has been studied previously with a demand for money equation. The liquidity preference approach is a better one, which liquidity variable is defined as exogenous high powered money. Feldstein and Eckstein(1970) argue in their paper that, the interest rate responds quickly within one quarter to changes in liquidity. Moreover, they concluded that the short-run effect is greater than long-run effect.

1.2.2. Inflation – Liquidity Preference Model

It is shown by Irving Fisher that, any particular rise in the expected rate of inflation directly leads to an equal rise in the interest rate. The channel of the process is straightforward. The increase in the expected rate of inflation increases the nominal yield on investment first, the investors will demand for debt funds until the nominal interest rates rises as the same amount of the expected rate of inflation. Mundell(1963)

tried to show that, the real balances will effect the degree of the rise in the interest rate. Because Mundell's analysis uses a static model for a dynamic problem, his result was inconsistent.

1.2.3. The Role of Short-Run Expectations

The portfolio balance model is convenient for the real interest rate when it is expected by the investors that the current nominal interest rate shows continuity into the future but ignores the anticipated short-run interest rate changes. If the investors have the incentive that the interest rates are going to rise in the future due to monetary policy or other factors, the short-term assets are going to be their first preference. This will reduce the demand for bonds, which will raise their return. The research done about the expectations of the interest rate has been limited, because the models used until today are based on the past history of the interest rate changes. The reason why it is done this way is that, it is assumed that the way people form their expectations about the future interest rates is done by observing the most recent past interest rates.

1.2.4. Supply and Demand Effects

Theoretically, it has to be possible for someone to build an econometric theory of interest rates by taking into consideration, the saving and borrowing choices of individuals and surpluses and deficits of government budgets. When the model is build by Feldstein and Eckstein(1970) it is seen that a 10 percent increase in the aggregate saving reduces the interest rate by 16 percent. Moreover, they concluded that, \$10 billion government deficit would rise the interest rate by 21 percent in 1970.

1.2.5. The Yield on New Issues

It is better fort he companies to use the newly issued corporate bonds as the measure of the cost of capital rather than the older seasoned yield index. When the capital gains are taxed at a lower rate, this implies that the pre-tax yield is not going to rise as fast as the new issue rate.

1.2.6. Interest Parity Condition

In the economy, it is assumed that there is free capital mobility. So, the gross domestic nominal interest rate must be equal to the gross world nominal interest rate times the expected gross rate of devaluation of the domestic currency. This relationship can be named as the uncovered interest parity condition. Normally, let exchange rate in the upcoming period denote that agents expect at time t to prevail at time $t + 1$, and let it denote the domestic nominal interest rate, that is, the rate of return on an asset denominated in domestic currency and held from period t to period $t + 1$. Then the uncovered interest parity condition is as the normal one as it is always discussed in the literature. When it is not uncertain, the nominal exchange rate at time $t+1$ is known at time t . The interest parity condition which is uncovered becomes:

$$1 + i_t = (1 + r^*) E_{t+1} E_t \quad (13.8)$$

The equation that we just showed has an important interpretation. It can be said that the equation implies an equality. One side of the equation is the gross rate of return of investing 1 unit of domestic currency in a domestic currency denominated bond. Since the free capital mobility condition holds it should be true that, this investment must yield the same return as investing 1 unit of domestic currency in foreign bonds. One unit of domestic currency buys $1/E_t$ units of the foreign bond.

1.3. THE LAW OF ONE PRICE AND PURCHASING POWER PARITY

In order for the Law of One Price (LOOP) to hold, a good should cost the same abroad and at home. Let P denote the domestic-currency price of a good in the domestic country. And P^* the foreign price of the same good in the foreign country, and let's suppose that the nominal exchange rate is denoted by S , which can be interpreted as the domestic currency price of unit of foreign currency. The LOOP holds if,

$$P = SP^*.$$

When $SP^* > P$, it can be said that the good is more expensive in the foreign country, and less expensive when the equation is reversed. Why should the LOOP hold? Let us imagine that a cup of coffee cost 3 dollars in country X and 1 dollar in country Y. It would be possible for someone to be so rich by buying coffee's in country Y and selling it in country X. The arbitrage opportunity that we have in this situation, would cause the price of coffee to fall in country X and rise in country Y. This trend will hold until the price is equal in both countries.

Now let us ask the question whether law of one price holds or not. To be able to answer this question for a good, the price at home and abroad should be collected, those prices should be expressed in the same currency using the exchange rate between the countries and check whether those prices are close to each other or not. In all academic research done, the most argued example about this issue is a price of a hamburger. Since, the price of it is nearly the same across the countries. Moreover, its easy to discuss the issue of hamburger, since it is a good which is consumed by almost everyone on earth. Let P^{US} denote the dollar price of a hamburger in United States and P^{FGN} the foreign-currency price of a hamburger in foreign country. Then it is possible for us to see a measure of how many hamburger one can buy abroad for one hamburger in United States. We can call this measure as the hamburger real exchange rate, and denote it by e^{hmb} . And it is given by,

$$e^{hmb} = \frac{SP^{FGN}}{P^{US}}$$

If the ratio that we mentioned is greater than 1, that is $e^{hmb} > 1$, then the hamburger is more expensive in other countries. This scenario shows us that, if you exchange the dollar value of one hamburger in the United States into foreign currency, it would be impossible for you to buy one hamburger abroad. We can say that the law of one price is satisfied for hamburgers when the hamburgers real exchange rate equals one, that is

$$e^{hmb} = 1$$

Table shows the case for the hamburger exchange rates for measured in 2015. The table which is presented clearly shows that the law of one price does not hold. Switzerland, as

being the most expensive country in the taken sample, a hamburger sells for 5.60\$, when we compare it to the price in the United States which is 3.54\$. By contrast, hamburgers which are sold in Russia are much cheaper than that is in United States, selling for 1.73\$

Chart 1.1. The Big Mac Price Index

The hamburger standard

	Big Mac prices		Implied PPP* of the dollar	Actual exchange rate: Jan 30th	Under (-)/over(+) valuation against the dollar, %
	in local currency	in dollars			
United States†	\$3.54	3.54	-	-	
Argentina	Peso 11.50	3.30	3.25	3.49	-7
Australia	A\$3.45	2.19	0.97	1.57	-38
Brazil	Real 8.02	3.45	2.27	2.32	-2
Britain	£2.29	3.30	1.55‡	1.44‡	-7
Canada	C\$4.16	3.36	1.18	1.24	-5
Chile	Peso 1,550	2.51	438	617	-29
China	Yuan 12.5	1.83	3.53	6.84	-48
Czech Republic	Koruna 65.94	3.02	18.6	21.9	-15
Denmark	DK 29.5	5.07	8.33	5.82	43
Egypt	Pound 13.0	2.34	3.67	5.57	-34
Euro area§	€3.42	4.38	1.04**	1.28**	24
Hong Kong	HK\$13.3	1.72	3.76	7.75	-52
Hungary	Forint 680	2.92	192	233	-18
Indonesia	Rupiah 19,800	1.74	5,593	11,380	-51
Israel	Shekel 15.0	3.69	4.24	4.07	4
Japan	¥290	3.23	81.9	89.8	-9
Malaysia	Ringgit 5.50	1.52	1.55	3.61	-57
Mexico	Peso 33.0	2.30	9.32	14.4	-35
New Zealand	NZ\$4.90	2.48	1.38	1.97	-30
Norway	Kroner 40.0	5.79	11.3	6.91	63
Peru	Sol 8.06	2.54	2.28	3.18	-28
Philippines	Peso 98.0	2.07	27.7	47.4	-42
Poland	Zloty 7.00	2.01	1.98	3.48	-43
Russia	Ruble 62.0	1.73	17.5	35.7	-51
Saudi Arabia	Riyal 10.0	2.66	2.82	3.75	-25
Singapore	S\$3.95	2.61	1.12	1.51	-26
South Africa	Rand 16.95	1.66	4.79	10.2	-53
South Korea	Won 3,300	2.39	932	1,380	-32
Sweden	SKR 38.0	4.58	10.7	8.30	29
Switzerland	CHF 6.50	5.60	1.84	1.16	58
Taiwan	NT\$75.0	2.23	21.2	33.6	-37
Thailand	Baht 62.0	1.77	17.5	35.0	-50
Turkey	Lire 5.15	3.13	1.45	1.64	-12

*Purchasing-power parity; local price divided by price in the United States
†Average of New York, Chicago, Atlanta and San Francisco ‡Dollars per pound
§Weighted average of prices in euro area **Dollars per euro
Sources: McDonald's; *The Economist*

The Purchasing Power Parity(PPP) is the generalization of the idea of the law of one price for broad baskets of goods, as opposed to a single good. Now in this case, let us consider that P denote the domestic currency price for a basket of goods, and P* denote the foreign currency price for a basket of goods and let S denote the domestic currency price of one unit of a foreign currency. Then, it is possible for us to make a definition for the exchange rate as,

$$E = \frac{S P^*}{P}$$

The real exchange rate E indicates the price of a consumption basket in the foreign country in terms of consumption baskets in the home country. In the case of E being more than 1, the foreign country can be seen as more expensive with respect to the domestic country, and when E is less than one, it can be said that the domestic country is more expensive than the foreign country. It is possible for us to say that absolute purchasing power parity holds when the price of the consumption basket expressed in a common currency is the same domestically abroad, $P=SP^*$ or, when the real exchange rate that we have calculated equals 1.

$$E = 1$$

The discussion that we have to argue here is that, how that could be possible for us to test the absolute purchasing power parity condition. It is clear that we need the data on P and P*. At first glance, it might seem as an easy process but actually the reality is different. Nearly most of the countries in the world have systems and agencies that can track the price of large numbers of consumption goods. The data known as the CPI are produced by these agencies, which is known as the consumer price index. One can think that the measure of P would be the consumer price index. However, the problem that is faced is the consumer price index is an index and not the actual level of prices. They show us clearly about how the price of basket of goods change, but not about the level of the price of such a basket. In order to be able to determine the purchasing power of the U.S. Dollar, the information needed is about the actual price level, not information

about the level of price index. But, to be more clear we can say that price indices are used to observe the changes in the real exchange rate.

1.4. TURKISH ECONOMY AND ITS MACROECONOMIC VARIABLES

1.4.1. Inflation Side

High and continuous inflation has always been the speciality of the economy of Turkey since 1965's. When the main determinants of the inflation is searched by Lim C.,G., Papi L.(1997) by using data from 1970-1975, which Turkey had structural changes, it has been found that the exchange rate plays a central role in inflationary process. The conclusion which had been done are the same with the results of other emerging countries, too.

Turkey is a country which often experienced financial crises in its history. When we take a look at the historical data, we can clearly see that, the main reasons behind the crises are the inflation and the Exchange rate. To be more precise, in the crises of 1994 and 2001, the domestic currency of Turkey depreciated 62% and 53%, respectively. On the other hand, when we consider the performance of the output side, Turkish economy performed well between these two crises. The output growth between 1995 and 1999 was %4.2, despite the Russian crisis, two big earthquakes, political tensions and the recession in 1999. When we think of 1994 and 2001 crises, the main drivers behind the crises was totally different, but the crises had a common element, which was the depreciation of the domestic currency, and high interest rates. In these conditions, it is an interesting event to study the effect of the exchange rate volatility on some macroeconomic variables which are inflation rate and interest rate.

The inflation rate in Turkey has always been high and permanent since the 1970s. Various strategies implemented over the years just brought only temporary solutions, and the permanent inflation still remains a major problem for the country. Studies about the inflation level in Turkey can be categorised into three groups: The first group consists of the papers which focus on monetary approach and elaborate on the interaction between prices and money. The second group is made up of the papers which study the public finance approach and point out that monetary expansion occurs as a

consequence of the fiscal imbalances. Lastly, the third group highlight the importance of the structural and cost-push factors.

The main assumption for the monetary approach is that, the demand for real money balances are stable. Which are effected by the returns of the assets and real income. Through this model, an expansionary monetary policy will higher the prices. The public finance approach underlines that, monetization is the residual form of deficit financing. Rodrik(1991) finds a significant relationship between inflation and public sector deficits. He also states that, the results of a deficit on inflation were sharper during the 1980's, because of the decrease in the demand for base money due to the release of foreign exchange regulations. The inflationary role of the structural and cost-push factors are discussed also in some studies. These factors are: (a) the relationship between the prices and the exchange rate; (b) the effect of oligopolistic industrial structure; (c) wage pressures. The permanent and raising inflation and at the same time the continued depreciation of Turkish lira showed a clear pattern of the devaluation-inflation spiral hypothesis. Which states that inflation and devaluation always increases by effecting each other within a cycle. In Turkish economy, we can clearly see that the economy is dependent on imports of capital and intermediate goods. In this regard, depreciation of the domestic currency, or the dollar price of the imported goods cause the inflation to go up, or by other means, increase the price of the domestic products.

In their paper, Lim and Papi(1997) argue the determinants of inflation in Turkey by analyzing price determination with a multi-sector macroeconomic model within the period 1970 to 1995. They conclude that exchange rate and money play a very crucial role in the inflationary process in Turkey.

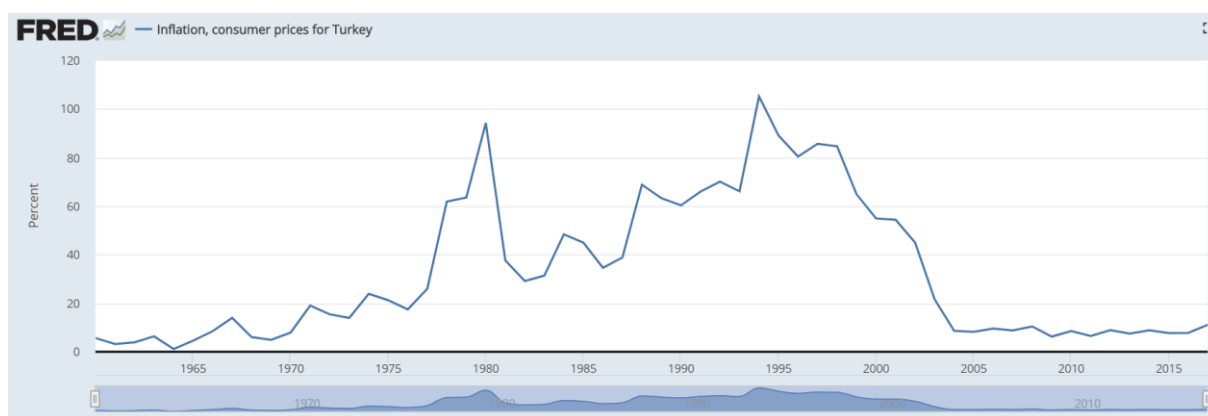
The researchers have reached a consensus about drivers of the permanent and high inflation in Turkey which are:

- (1) The public sector having enormous amount of budget deficit
- (2) Governments investing huge amount of money to infrastructure.
- (3) Having huge military spending due to regional risks
- (4) Applied populist policies which cause political instability
- (5) The inflationary expectations

- (6) The increases of the foreign imported goods (mainly oil and energy)
- (7) Rising interest rates

It is also fruitful to see how the inflation rate evolves yearly in Turkey.

Chart 1.2. Consumer Price Index for Turkey



Source: FRED

1.4.2. Interest Rate Side

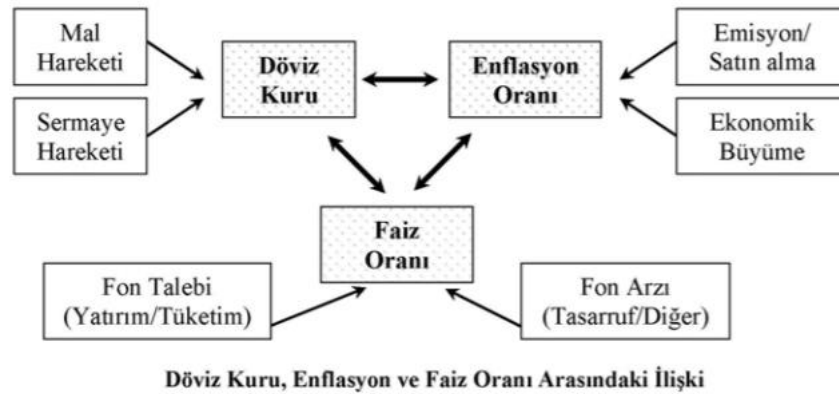
The interest rate discussion has been the main driver for Turkish politics in the near years. Some of the economists argue that the Central Bank should not decrease the interest rates due to the shock that exchange rate is going to experience. On the other hand, the Central Bank reports declare that, the relationship between the exchange rate and the interest rate is very complex and it can be the case that, the reduction of the interest rate may cause exchange rate to appreciate. Karaca(2005) studied the relationship between the exchange rate and the interest rate through the period 1990-2005. His findings suggest that, there is no significant relationship between the interest rate and exchange rate, so it is possible for the Central Bank to decrease them both.

The study done by Kadilar and Simsek(2006) argues that, the long term relationship between the inflation rate and the interest rate in Turkey, clearly supports the Fisher effect which states that there is a positive and significant relationship between the

interest rate and the inflation rate. Mızrak and Sever(2006) studied the relationship between the exchange rate, interest rate and the inflation rate through the period 1987-2006. In the model that they build, they concluded that the variables are effected from both their lagged values and from the shocks of the other variables.

Özel(2000) argues in his paper that, it is possible to have a sustainable growth in an economy if the goods market, money market and financial markets are coherent. In this circumstances, the money that had been generated from the production process, is directly consumed or moved to the goods market as savings in an indirect way. The economic growth is possible if and only if the changes of the values of the variables in economy such as; the prices for the goods and services, exchange rate, interest rate are close to each other. Any unfavorable changes in these variables may harm the economy through the way of effecting the domestic and foreign markets and disturbing the equilibrium.

Chart 1.3 The Relationship Between Exchange Rate, Inflation and Interest



Source: Ekren(2000)

The formation of the inflation rate, exchange rate and the interest rate can be seen from the graph also. The three variables that we discuss are affected by different variables that are present in different markets. Moreover, the three variables are affected from each other also. To be more clear, the internal balance of the economy is related to the external economy. If the equilibrium is harmed in any manner, the cost side will be affected and lead the economy in a negative way. In most of the cases, the changes in

the exchange rate is the starting point, but on the other hand there are also some cases which the change in the inflation rate is the starting point. The inflation rate is the starting point due to the public debt. In a society, when government increases the taxes, the individuals react this in a negative manner, but when the government increases the spendings, the people do not react. In this regard, the policymakers choose to issue debt in order to finance their spendings through two ways. First, the domestic resources are used. Second, the foreign debt. There is actually another way to finance spendings, which is printing money but it harms the economy by increasing the inflation.

The effect of the public debt on interest rate is seen more significant when the debt is internal. To be more specific, in the developing countries, which the savings rate of the individuals are not at a sufficient level, the internal debt pressures the interest rates (Sonat, 1996). There had been plenty of research done about the effect of the public debt on interest rates, and it is seen that the results are related to the countries' level of development and the period that had been studied. Mascaro and Meltzer (1983) found out that the public debt does not have any significant effect on interest rate when they studied the period 1969-1981. Kalulumia (2002) studied the topic with some other methods and developed countries and tried to observe that the public debt effected interest rate through two channels which are the direct effect, and the effect through exchange rate or money demand. But his results were insignificant also. On the other hand, there were significant results obtained in the recent research done.

Laubach (2003) observed in his studies that there was a significant relationship between the public debt and interest rates. According to his paper, one percent increase in public debt/GDP ratio caused the long-run interest rate to raise 2.5 percent. The findings of Engen and Hubbard (2004) supports Laubach.

The increase of the interest rate will cause private sector to borrow external debt at a higher cost. This will decrease the demand of the private sector (also taking the interest rate elasticity of the demand). Consequently, this will increase the interest rates and the private sector will be excluded from the market. On the other hand, the domestic resources available also will be used heavily by public sector, meaning the investments

by the private sector will diminish and subsequently the production will decrease also. The growth rate of a developing country is one of the most important topics that has to be considered. Taking this into account, it can be said that, the developing countries should invest some of their national income to grow faster. The most important driver of this investment is the savings rate in the country. However, the savings rate in developing countries are not at a sufficient level. In order to prevent this problem, the developing countries need external financing. If the debt borrowed by a developing country is not used in an efficient way, the country will need an external financing again. But, every additional debt that is taken by the country will cause interest rate to raise and the country will be in need of foreign currency. In this regard, this causes a well-known definition in economics which is Twin Deficit. These kind of countries are both have public debt and external debt.

The effect of the public debt on inflation depends on the way how the public debt is borrowed. The debt which is borrowed, should be used efficiently. More importantly, the interest rate which is going to be paid has to be less than the growth rate of the economy. Seyidoglu(1996) argues that in some of the countries the central bank prevents the exchange rate to appreciate, even though the inflation rate is high. In this situation, the national currency has a high value, which will increase the hot money flow into the country. This will help the country in the short-run, but on the other hand it will also deteriorate the balances in the country in the long-run which can cause to an economic crisis.

1.4.3. Money Supply Side

In the literature, there had been a lot of debate about the nature of the money supply for various countries, data and time periods. These studies tried to show the endogeneity of the money supply. One of the most important studies that tried to show the endogeneity of the money supply is Kaldor(1982). He studied the endogeneity of the money supply for United Kingdom 20ort hi period 1966 to 1979 by using Ordinary Least Squares(OLS) method. And he found evidence 20ort hi endogeneity of the money supply for UK. He concluded that, the most important determinant of the money supply

is the bank lending. Some other researchers, also found endogeneity of the money supply significant for other countries, while studying different periods.

The U.S. money supply is measured by a couple of ways. M1 can be considered as the most liquid form of money. It consists of currency in circulation, even though not currency held in the banks. It is made up of all domestic account deposits and traveler's checks, also including the ones which pay interest. On the other hand, it is said that it does not count the deposits which are held in U.S. government accounts and in foreign banks.

It can be argued that M2 is a component of M1, because whatever that is inside of M2 is also in M1. It adds savings accounts, money market accounts, and money market mutual funds, along with time deposits under \$100,000. It does not include any of these accounts held in IRA or Keogh retirement accounts. Consequently, it can be argued that M3 is a component of M2, since it includes everything inside it, such as some longer-term time deposits and money market funds. M4 includes M3 plus other deposits.

First, we need to present an important fact, which is a central bank can either control the money supply or interest rate, but not both. If the central bank of any country chooses to decrease the money supply, the interest rates would tend to go up by definition, because of the less supply of money relative to an unchanged demand. Now, we are going to have a higher interest rate. The effect of this is that, if the interest rates are high given from the country, the investment will be high in that country just because the opportunity cost of investing in that country becomes high. This indicates that the demand for currency increases in that country. If there is more demand for something, that means that the price of it rises. Since, the exchange rate can be considered as the price of the currency, this means that that country's currency should go up, meaning that there will be an appreciation of the currency. The other way around happens when the central bank chooses to increase the money supply. The interest rates tend to go down because of more of the supply of money. Now the country has a lower interest rate. Since the interest rate is low, the international investment level in that country will be low also, since the opportunity cost of investment falls. Consequently, the demand in that

hi country's currency will go down. Due to the same reasoning above, the currency of that country will lose value, which actually means a depreciation. As a summary it can be said that,

- Lower interest rates tend to decrease investment levels
- Lower investment levels causes the demand 22ort hi currency to go down
- Lower demand 22ort hi currency causes a depreciation
- Meaning a higher exchange rate 22ort hi country

1.4.4. Business Cycles

In order to develop better models and applying necessary implementations, it is important to understand the sources and properties of the business cycles. To be able to construct appropriate theoretical models, the business cycle tools are used widely. On the other hand, the assessment of different models can also be done by looking at the business cycles.

The year 2001 is a very important year in Turkish economy. By looking at the Macroeconomy, it can be stated that Turkey experienced high volatility in financial sector and in the real side of the economy between 1987 and 2001. High volatility and inflation was the main problem of the Turkish economy in 1990s, and also government deficits and exchange rate jumps. In 2000, Turkey launched a comprehensive stabilization program, and decreased the inflation to 20 percent also by the help of the currency appreciation. However, the program that Turkey launched collapsed in early 2001 mostly because of the weak structure of the financial sector in the country, as well as insufficient inflation and fiscal performance. The real output fell down by a huge amount and there was a currency and financial crisis. The first thing done after the crisis was the reforms aiming to solve the problems in the banking sector. Consequently trying to fix the government deficit and decreasing inflation rate.

In this study, the Hodrick-Prescott filter is used, which is the most common method used in business cycles literature. The steps taken to extract the business cycle is simple as follows;

1. Take logarithms of the series.
2. Decompose the series into trend and a cyclical component.
3. As optimal use lambda as 1600, which is commonly used in economics.

It is also fruitful to discuss how the business cycles behave in Turkey. The high volatility of the real GDP is the main explanation that we have to do about Turkish Economy. It can be noted that the standard deviation of the cyclical component of real GDP in Turkey is roughly around 2 times more than it is in the U.S. But it has to be noted for sure that this is the pre-2001 period. After the crisis that Turkish economy faced in 2001, the scenario changes. The volatility in real GDP starts to drop and starts to react less to the exogenous shocks to the economy, which can be considered as a more stabilized case.

When we analyse the consumption case, it is crucial to see that the volatility of the consumption is even higher than the volatility of the real GDP in all periods. But what is actually important is, that pattern also changes after the implementations in 2001. Even though this comment contradicts with the idea of consumption smoothing, it has to be noted that the excess consumption volatility is also observed in developed countries such as Japan and the Western European ones. The main reason why a result which contradicts with the permanent income hypothesis occurs is because of the concept called durable consumption. The main drivers of high volatility in Turkey can be the underdeveloped financial markets and the possible shocks that are effecting the economy. The cross correlation between consumption and real GDP should also be noted. There a contemporaneous correlation is observed. What we can infer a high correlation between the output and consumption is, the exogenous shocks which effect the economy are considered permanent by the individuals and therefore affect consumption in a significant way. On the other hand, we also have another explanation for this regularity which is the dependence of consumption on the current income due to limited Access to the financial instruments that can led people to do consumption smoothing. However, it should also be noted that the correlation between the output and the consumption is reduced after year 2001 with the effect of the economic regulations taken by the government. Which also implies a significant improvement in the financial markets in Turkish Macroeconomy.

One of the other important variable in analysing the business cycles is the investment. The findings of the business cycle of the investment in theory suggests that for the developed and developing countries, investment is one of the most volatile components of real GDP. When we consider the case for Turkey, we can easily see that the fixed investment amount is around 3 times more volatile than real GDP. And also it should be noted that the correlation between the real GDP and investment is extremely high.

Government consumption is also an important variable which can play a crucial role while taking an action by the policy makers. When we analyse the government consumption, we can easily see that the consumption follows a procyclical pattern in 1987-2009 in Turkey, however after the year 2001 it follows an acyclical pattern which shows us a change after the crisis. What should also be noted is that, the government consumption is much more volatile than the real GDP, in both of the periods after the crisis and before the crisis.

Net exports should also be analysed in order to have consistent comments. It is observed in the Turkish economy that the exports and the imports seem to have positive correlation with real GDP. On the other hand, they are both more volatile than the real GDP. But, the volatility of imports are higher than exports. Moreover, imports are more correlated with the real GDP than exports. What is also important is that, net exports show a countercyclical behavior and the volatility of exports are nearly the same as the volatility of the real GDP. We can also see this effect in other developing countries also.

The pattern of the consumer prices in Turkey is also different before the crisis and after the crisis in Turkey. Consumer prices show countercyclical pattern after the crisis and procyclical before the crisis. When the volatility is the case, it can be said that the volatility of the consumer prices have declined after 2001 crisis, reflecting the monetary policy regime change and the decline of the inflation rate.

What we can see from the overnight interest rates is that, between the period 1987 and 2009, they are countercyclical and a volatility again higher than the real GDP. Another observation that we should definitely mention is that is the behavior of the overnight interest rates after the crisis in 2001. The volatility after the crisis is less than the volatility before the crisis, which is most probably the consequence of the stabilization

of the financial system and the predictability of the Central Bank's actions by targeting the inflation.

Since Turkey is a small open economy, the international variables have a crucial impact on business cycles in Turkey. When the data is checked for Turkey, it is clearly seen that aggregate foreign debt stock is procyclical. When the volatility of it has analysed, it is seen that it is similar to that of output. Also, it would be beneficial to check the volatility of long run and short run. Volatility of short-term debt has a higher value than the volatility of the long-term debt. Since, the current research is done is not sufficient to make clear judgements to understand the difference in cyclical properties, one possible reason can be that hedging purposes are the areas where the long-term debt is used and that is why it behave countercyclical. On the other hand, the short-term debt might be used to finance investments and operations that is why it might be procyclical. It is also beneficial to see all the discussed terms in a table which is published by the Turkish Central Bank.

Chart 1.4. Business Cycle Properties in Turkey

Table 4b: Business Cycle Properties of GDP and Its Components ($\lambda=1600$)

	Old National Accounts 1987:1-2009:4	Old National Accounts 1987:1-2001:4	Old National Accounts 2002:1-2009:4	Old National Accounts 1998:1-2009:4	New National Accounts 1998:1-2009:4
Real GDP					
Volatility	3.737	3.547	3.151	3.894	3.758
Autocorrelation (t, t-1)	0.738	0.664	0.772	0.768	0.788
Consumption					
Relative Volatility	1.083	1.079	0.992	1.046	0.991
Contemporaneous correlation	0.911	0.929	0.871	0.889	0.87
Cyclicity	Procyclical	Procyclical	Procyclical	Procyclical	Procyclical
Phase Shift	Coincidental	Coincidental	Coincidental	Coincidental	Coincidental
Autocorrelation (t, t-1)	0.789	0.747	0.696	0.796	0.787
Gross Fixed Investment					
Relative Volatility	3.165	2.79	3.209	3.543	3.409
Contemporaneous correlation	0.865	0.868	0.882	0.873	0.912
Cyclicity	Procyclical	Procyclical	Procyclical	Procyclical	Procyclical
Phase Shift	Coincidental	Coincidental	Coincidental	Coincidental	Coincidental
Autocorrelation (t, t-1)	0.836	0.721	0.864	0.88	0.831
Government Consumption					
Relative Volatility	1.012	1.091	1.196	1.051	0.748
Contemporaneous correlation	0.374	0.562	0.125	0.224	0.223
Cyclicity	Procyclical	Procyclical	Acyclical	Countercyclical	Procyclical
Phase Shift	Coincidental	Coincidental	Not Clear	Lead (-0.335)	Lead (0.335)
Autocorrelation (t, t-1)	0.48	0.532	0.369	0.463	0.279
Net Exports*					
Relative Volatility	1.264	1.077	1.821	1.208	0.571
Contemporaneous correlation	-0.538	-0.598	-0.369	-0.613	-0.71
Cyclicity	Countercyclical	Countercyclical	Countercyclical	Procyclical	Countercyclical
Phase Shift	Coincidental	Coincidental	Coincidental	Lag (0.823)	Coincidental
Autocorrelation (t, t-1)	0.245	0.493	-0.059	0.601	0.727
Imports					
Relative Volatility	3.094	3.329	2.675	2.846	2.921
Contemporaneous correlation	0.889	0.876	0.862	0.898	0.874
Cyclicity	Procyclical	Procyclical	Procyclical	Procyclical	Procyclical
Phase Shift	Coincidental	Coincidental	Coincidental	Coincidental	Coincidental
Autocorrelation (t, t-1)	0.778	0.729	0.815	0.811	0.767

Source: Turkish Central Bank(2012)

1.4.5. 2001 Crisis and Exchange Rates

It would also be beneficial to argue the effect of the financial crisis to the exchange rate in a manner that it is also a very crucial component that effects the exchange rates in Turkey. In the last decade, Turkish economy faced by two main crises. One of them was the 1994 crisis and the other one was the 2001 financial crisis. At the end of December 2000, the average interest rates, both the overnight rate and secondary market bond rate, was more than tripled with respect to the beginning of the year. Following this news, the exchange rate system also collapsed and the policymakers announced that Turkey is going to implement a floating exchange rate system.

The eye-catching reason that makes the 2001 crisis an interesting scenario is that the public sector borrowings were financed by issuing domestic debt just before the time of the financial crisis. It is well-known that the domestic borrowing hides the foreign exchange losses. The crucial point is that if the real interest rate is positive and there is not an offsetting surplus, it is impossible for the domestic debt financing to be stable. At some time, it is for sure that it will come to an end, but the time when it will happen is dependent on the actions of the actors of debt market and the character of the economy. Suppose that the government tries to implement a stabilization plan, but just because of the upcoming elections, it postpones the plan and continues domestic debt financing. For some reason, let's also suppose that the government should continue debt financing. Based on economic Fundamentals there is no natural collapse and it seems that the economy is not going to face a first-type crisis; of course, in the absence of speculative attacks, if there is speculative attacks present then that means the scenario can totally change and the system would be unable to survive. Despite this fact, the models argue that it is possible for the exchange rate system to collapse if the speculators think that the government of the country will be late or inconsistent while responding to the attacks against the exchange rate. A weak banking sector, or a high public debt could be a probable cause for this scenario.

Based on what we have discussed so far, it is possible for us to conclude that the Turkish financial system which is dominated by banks, is very weak with respect to the effects

of the interest rate and the exchange rate. Moreover, the weakness has increased after the crisis period. The reason why the banking sector was a problem in Turkey is that, the banking sector choose to finance very high public sector borrowing. As the first effect, this caused the government debt to increase. Secondly, the state owned banks were deteriorated because of it. It is beneficial to understand risk accumulation while understanding the crisis dynamics. On the other hand, the rise in interest rates turned the problem that the country faces a debt sustainability. However, the Turkish crisis has some properties that do not fit in the third-generation models. One of the important features is that the high budget deficit, which is mainly financed by the domestic debt.

It can be said that the second crisis that happened in 2001 was more severe than the first one for Turkish economy. As it is stated, the root cause of the crisis was mainly the weak banking sector and some other factors which deepened this weakness. When we analyse the data for Turkish data for the year 2000, we can conclude that there is a poor macroeconomic performance. The ratios that we use in finance such as public debt to GNP ratio, liabilities to reserves ratio were quite bad. On the other hand, the macroeconomic variables such as public sector borrowing, current account deficit were all high. But on the other hand, the Turkish lira was appreciating at that period. However, since the lira is appreciating we can not say that the things are going well in the economy and this can be a misleading conclusion. Turkey started IMF program just in the beginning of 2000. Thanks to the program, it helped Turkish economy to convert some negative trend in a positive trend in some variables. Relative to 1999, the interest rates and the inflation rate had faced a sharp decrease. Consequently, the debt to GNP ratio and public sector borrowing are decreased with the help of the program.

It is totally true that the rise of the current account deficit was a source of increasing concerns about the economy. But it should be stated that, the main source that the current account deficit was due to an external shock like an oil price increase. Since Turkey is a country which is weak in terms of raw material, energy consumption and oil supply, it is totally dependent on the exogenous factors that happens internationally. But on the other hand, it is quite often argued that without fragile banking system and high current deficit, even though the Turkish lira is appreciating, it is impossible to prevent a financial crisis.

1.4.6. Oil Price Shocks and Turkish Economy

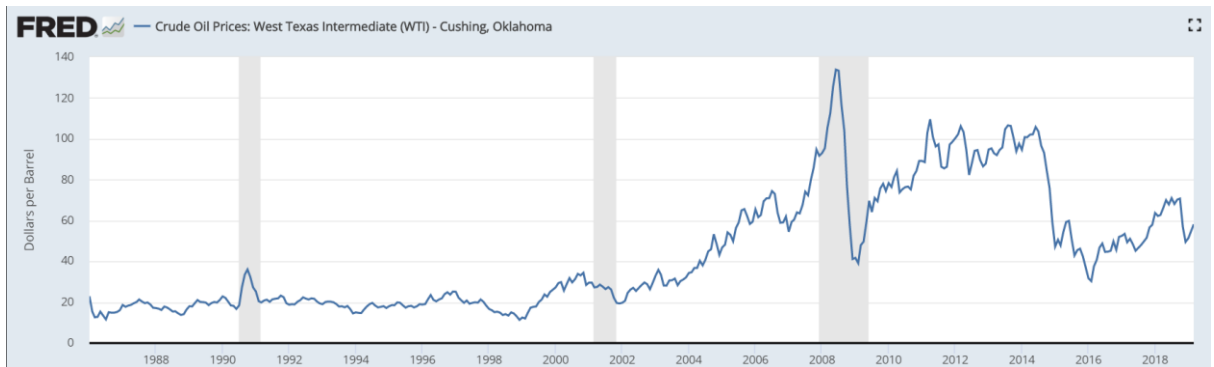
Given the demand and supply side effects, oil prices affect the economy through various transmission channels. One of the possible consequences of an oil price spike, as mentioned previously, is an inflationary shock. This shock causes an increase of the consumer price index (“CPI”), dependent on the relative share of oil in the “basket”: a decrease in purchasing power of households. In turn, they demand higher wages. In the same manner, firms reflect this wage increase in their selling prices, causing a negative spiral and an increasing inflation. In this situation, a central bank tightens its monetary policy in an attempt to keep inflation stable. Bernanke et al. (1997) argue that oil prices are not the cause of macroeconomic fluctuations, but central banks (in their case: Federal Reserve) responding to higher oil prices with increasing domestic interest rates to fight increasing inflation. However, more recent studies (e.g. Hamilton & Herrera, 2004; Kilian, 2008) show that oil price shocks are more important than monetary contraction.

An oil price increase may also affect consumption and employment. For oil importing countries, the idea is that higher oil prices reduce a household’s disposable income through higher domestic fuel prices. The illustrated mechanism works symmetrically for oil exporting countries. This income effect is dependent on the elasticity of energy demand: the less elastic, the higher the effect. However, Edelstein and Kilian (2009) show that the impact of such a reduction is negligent with respect to a country’s GDP. If an oil price increase is persistent, it may lead to a structural change in an oil-dependent sector and cause a relative decline in wages and employment in this one sector compared to the economy (Hamilton, 1988). In other words, a higher oil price instigates labour and capital allocations across sectors. This leads to frictional (short-term) unemployment, if one assumes a delay attached to creating new employment (Loungani, 1986; Segal, 2011).

When we deal with the case of Turkey, we know that nearly all the variables are very dependent to the changes in oil prices. Since Turkey is a country which does not have oil reserves, and the production process is carried out by using oil as an input in nearly all of the industries, the oil price is so crucial while being able to judge the events in

Turkish economy. In this part of the study, it is also important to see the lifespan of the oil price.

Chart 1.5. Crude Oil Prices



Source: FRED

As it can be seen in the graph, the oil prices stay nearly stable until the beginning of the 2000's. One important point we should elaborate on is that, the oil prices are very effected by the politic decisions taken. When OPEC decreases the oil supply, the oil prices tend to increase and when OPEC increases the oil supply then prices tend to decrease. One other important thing which should be noted is that, as it is seen there is a jump in oil price in the year 1990. That is because of the crises that happened between Iran and Iraq. So from this point of view, we can easily see that the oil price is effected from exogenous factors. After year 2000, we can say that the oil price is not stable anymore. The volatility increases and the oil price does not act like as if it is stationary.

It is widely known in the literature that, if the country is an oil importer, and the production process is heavily dependent on oil, then the decrease in oil prices effects the economy in a positive way. Since the imported oil will be cheaper and it is going to be possible for the companies to have a cost reduction with the help of the oil price decrease. Consequently, since the cost of the produced good is decreased, then it will be possible for the company to have a competitive advantage in the international market with a decreased price and increase its sales. However, the effect of the oil price decrease

should not just be limited with the private sector. The public sector is effected in a good manner as well. Since the imported oil price has decreased now the government will be able to use this less costly oil in its operations and provide the public goods cheaper.

CHAPTER 2

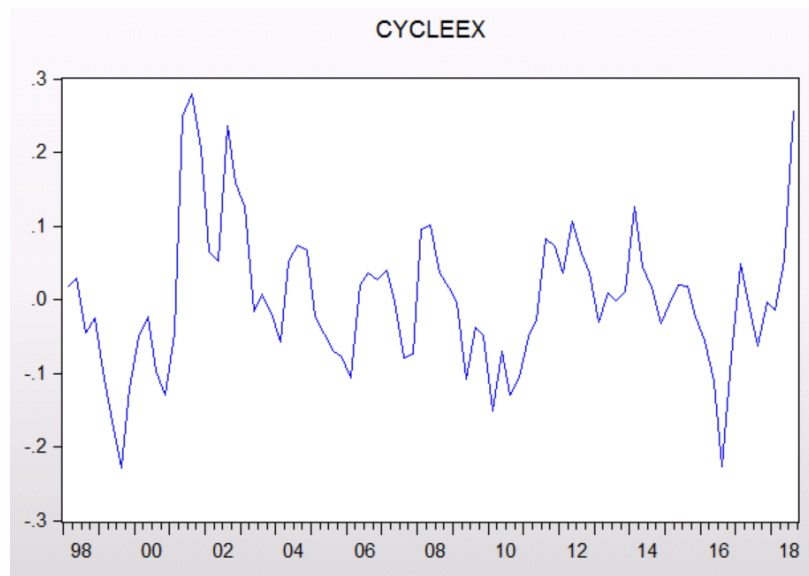
METHODOLOGY AND DATA SET

In the study that it is conducted the data between the periods 2010 and 2018 is used. The data used is monthly data which is taken from the source of FRED. All the variables which are used are seasonally adjusted by the help of the commands in Eviews.

2.1. BUSINESS CYCLES OF VARIABLES IN TURKEY

2.1.1. Exports and Imports

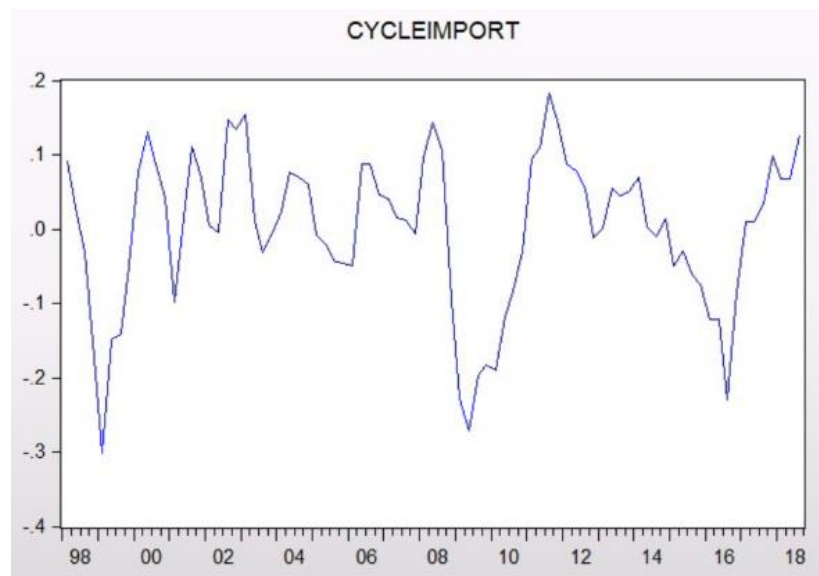
Chart 2.1. Exports Business Cycle For Turkey



Exports and imports are the main drivers of the Turkish economy and it is important to see how they behave through the period that we are going to study. Due to the exchange rate depreciation in 1999, both exports and imports of Turkey are located under the trend by nearly 3 percent. When a country's exchange rate depreciates, we expect imports to go down, but since the price of the goods become cheaper, it is expected for the exports to increase. The reason why the case of Turkey differs is that, most of the inputs that are used in production process are also imports. To be more clear, Turkey is a country which rely heavily on foreign resources in the means of oil,energy,raw material etc. When a

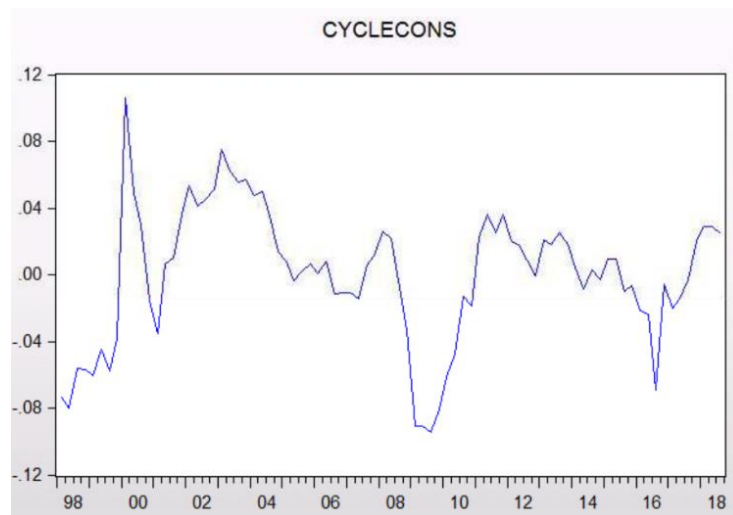
depreciation is experienced in the currency, these prices also go up and the firms need an additional financing. Consequently, this decreases the level of exports also. And the other time period which we have to elaborate on is the 2008 financial crisis. The effect of the financial crisis is clearly seen in both graphs, exports and imports are located roughly 2 percent below their trend.

Chart 2.2. Import Business Cycle For Turkey



2.1.2. Consumption

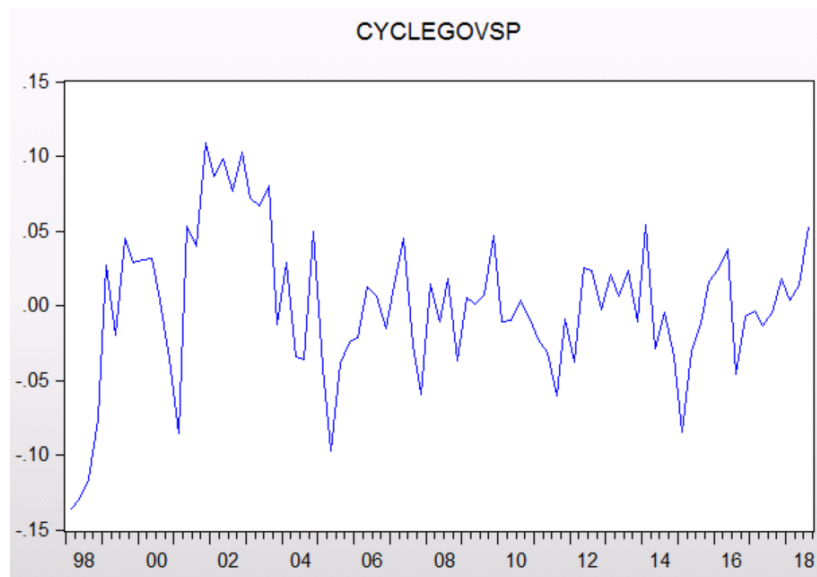
Chart 2.3. Consumption Business Cycle For Turkey



As it is seen from the graph, it can be said that, in 2000 consumption is above of its trend by roughly 12 percent which is the consequence of the interest rate experiencing last 20 years lowest. Then in 2001 the consumption is below its trend by roughly 4 percent which is a clear effect of the crisis in Turkish economy.(Reason for crisis: The public debt was financed by Central Bank’s holdings, and all the bankrupted banks’ financial liabilities were burdened to the state.) And again we see the effect of the financial crisis here, which caused the consumption variable to be under its trend by roughly 8 percent.

2.1.3. Government Spending

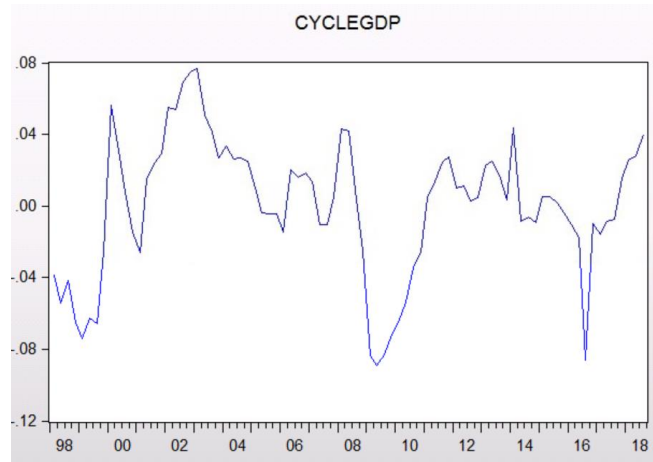
Chart 2.4. Government Spending Business Cycle For Turkey



In 2001, the effect of the crisis in Turkey is clearly seen. The government spending is %8 below its trend. What special for this graph is, in 2008, the government did not cut their spending because of the financial crisis.

2.1.4. GDP

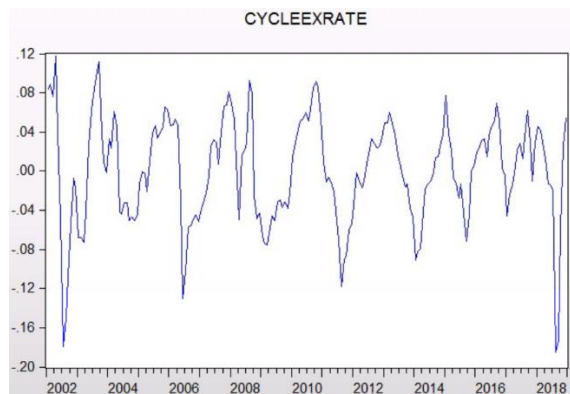
Chart 2.5. GDP Business Cycle For Turkey



Here we can see the effect of the global financial crisis again, the GDP of Turkey lies below its trend by roughly 8.5 percent. Graphing the business cycle of the GDP is important, since we can also see whether the other variables are procyclical, countercyclical or acyclical. Since the correlation coefficient between GDP and consumption for Turkey are positive, we can clearly state that the consumption is procyclical. The coefficient of the correlation between government spending and GDP is also positive, which means government spending is also procyclical.

2.1.5. Exchange Rate

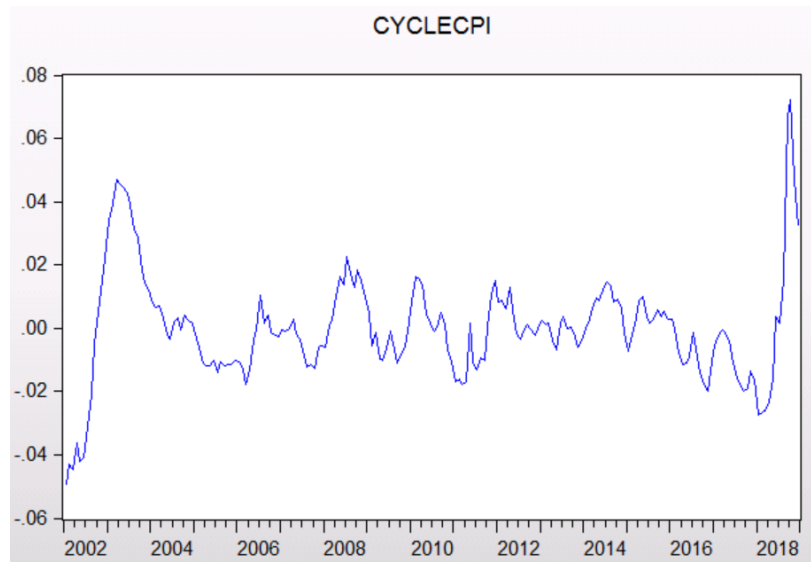
Chart 2.6. Exchange Rate Business Cycle For Turkey



As it is clearly seen from the graph, the exchange rate in Turkey is very volatile. The exchange rate lies below its trend by roughly 18 percent in 2002, because of the crisis in Turkey. And the exchange rate depreciation in 2018 can be observed in graph, also.

2.1.6. Inflation Rate

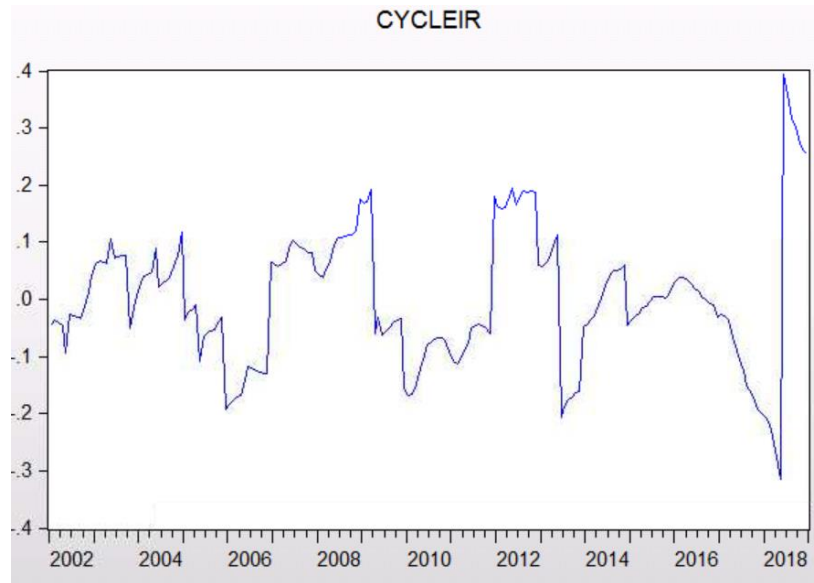
Chart 2.7. Inflation Rate Business Cycle For Turkey



We can observe the reverse effect of the exchange rate depreciation. When the exchange rate depreciates, the inflation rate is placed over its trend as it is seen from the graph in years 2003 and 2018.

2.1.7. Interest Rate

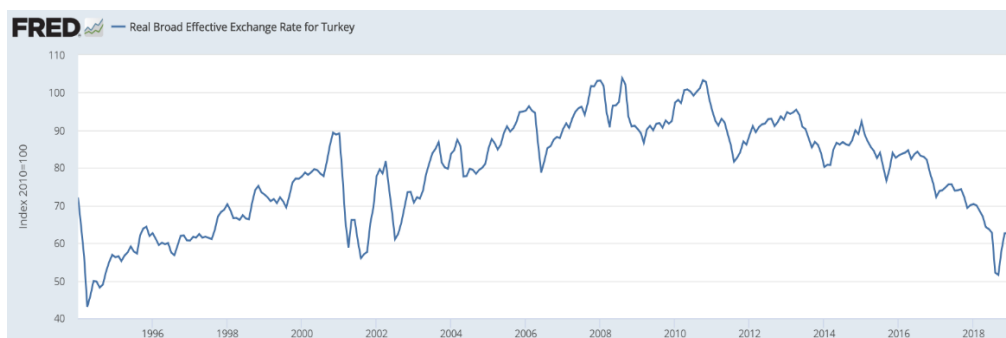
Chart 2.8. Interest Rate Business Cycle For Turkey



The interest rates in Turkey are also very volatile like the exchange rate. As it is seen the level of the interest rate placed roughly 5 percent above its trend in 2018. When the business cycles of the variables that we are going to study on is analysed, it can be seen that there are some similarities through the graphs. This gives us a clue that, there can be a relationship between these variables.

A significant amount of exchange rate literature discussed the effect of exchange rate volatility on productivity growth as insignificant, or quite small. However, Aghion et al.(2009) discuss in their paper that, the real Exchange rate volatility can be an important determinant when we think of the productivity growth. But, the effect of the volatility is dependent to the country's financial development level.

Chart 2.9. Real Effective Exchange Rate For Turkey



Source: FRED

This paper intends to investigate the effects of Exchange rate movements in Turkey. Frenkel, Jacob, A. and H.G. Johnson, (1978) defines the Exchange rate as the relative price of two national money. Being more specific, the definition can be done as the amount of the currency that should be given up to take one unit of the other currency at a specific time. Mundell, R.A., (1961) presents a new hypothesis which is Optimal Currency Area analysis, and he shows that it is possible for the countries to benefit from a common currency when they have a large bilateral trade.

An American economist, Irving Fisher, a relationship between the Exchange rates and the interest rates which is known as the International Fisher Effect(IFE). He claimed that the higher the real interest rate is, the easier to control the Exchange rate volatility.

2.2. MODEL SPECIFICATIONS

In this section of the paper, the methods and the materials and the way how they are going to be the part of the work done is going to be discussed. The model which is going to be used includes three variables, which are Exchange rate, interest rate and inflation rate. The model describes Exchange rate as a function of interest and inflation rate.

$$EXC = F (IR , INF,MS) \quad (1)$$

EXC shows the monthly Exchange rate in Turkey, IR represents the monthly interest rate of Turkey and CPI represents the inflation rate for Turkey. The sign t shows the time trend for the country. The sample includes 204 monthly data from 2001 to 2018 from the Federal Reserve Economic Data (FRED) and Central Bank of Turkey (CBRT). First the data which is taken from those website's made seasonally adjusted, and then all data has been converted into log-log equation for the observations in time-series. And moreover, now it will be possible for us to interpret the coefficient as an elasticity. The model that we are doing could also have other variables such as export and import prices, but since it is thought that the main factors that effect the exchange rate are considered as the interest rate, inflation rate and money supply, these variables are chosen as the main ones for our study.

2.3. STATIONARITY TEST

In order for us to study with the time-series, the first limitation that we have is the stationarity of the process. Meaning the process should have a constant mean, variance and autocorrelation. (It shouldn't have unit root/random walk). They shouldn't change over time. If any of those assumptions fail, it would be impossible for us to make observations with the time-series. If the series that we are going to use while estimating the OLS equation are non-stationary processes, then the modelling at the end will create a spurious regression as it is in Equation 2.

$$Y_t = a + bt + \epsilon_t \quad (2)$$

It is possible for us to eliminate the non-stationarity of a series by differentiating it by producing other set of observations such as the first-differenced or second-differenced value and so on. If we have a stationary series which we don't have to differentiate through, we call it a $I(0)$ series, or integrated of order 0. However, if we have a series which that we have to differentiate it one time is called $I(1)$ or integrated of order 1. In this study, Augmented Dickey-Fuller Test suggested by Dickey, D. and W. Fuller (1979)

and Phillips-Perron test suggested by Phillips, P.C. and P. Perron, (1988) will be used to test the stationarity of the variables in the model.

2.4. JOHANSEN COINTEGRATION TEST

S. and K. Juselius, (1990) argue in their paper to use two tests to detect the number of cointegration vectors. The Maximum Eigenvalue test and the Trace test. The Maximum Eigenvalue test statistic tests r cointegrating relations against $r+1$ cointegrating relations for $r= 0, 1, 2, \dots, n-1$. On the other hand, the Trace test statistic tests the null hypothesis of r cointegrating relations against the alternative of n cointegrating relations, in which n is the number of variables in the system for $r= 0, 1, 2, \dots, n-1$. Alexander, C., (2001) argues that, if the Maximum Eigenvalue test and Trace test present different outcomes, the result of the Trace test is more relevant. Alternatively for the Johansen cointegration test, it can also be used the test called Bounds Cointegration Test. Bounds cointegration test suggests that, if an asymmetric model is being tested, then Johansen Cointegration test will be insatisfactory. When doing a cointegration test by bounds test, the determination of the cointegration is done by checking the critical values of the tests by the Pesaran's paper. If the value for the tests we have is higher than the critical value, we conclude that there is a cointegration. However, if the value that we found is less than the critical value we conclude that there is no cointegration. The interesting point of the cointegration test is, if the value that we have found is between the critical values, the bounds test approach is inconclusive. It is beneficial to use Bounds Test Approach because of three reasons as follows:

1. If we don't know whether the regressors are $I(1)$ or $I(0)$ or mutually cointegrated.
2. When we have a small sample. Since Johansen test is not useful when we have a small sample.
3. If we are testing for asymmetries.

2.5. VECTOR ERROR CORRECTION MODEL

If we have a cointegration between the variables that we have, we can say that there is a long-run equilibrium relationship between our variables. So, we can apply VECM in order to concentrate on equilibrium in short run. If there is no cointegration between our variables, then that means we no longer need VECM, and we can directly pass to Granger Causality test to detect causal links between variables. In VECM the rank of cointegration represent the number of cointegrating vectors. For example a rank of three tells us that three linearly independent combinations of non-stationary variables will be stationary. The equation for VECM is as follows;

$$\Delta Y_t = \alpha_1 + p_1 e_1 + \sum_{i=0}^n \beta_i \Delta Y_{t-i} + \sum_{i=0}^n \delta_i \Delta X_{t-i} + \sum_{i=0}^n \gamma_i Z_{t-i}$$
$$\Delta X_t = \alpha_2 + p_2 e_{i-1} + \sum_{i=0}^n \beta_i Y_{t-i} + \sum_{i=0}^n \delta_i \Delta X_{t-i} + \sum_{i=0}^n \gamma_i Z_{t-i}$$

2.6. GRANGER CAUSALITY

Prediction is the main statistical driver used in Granger Causality. By the means of Granger Causality if a signal A causes another signal B , then that means the previous values of B has to contain some crucial information that helps us for the prediction of A. Linear Regression modeling is used in the mathematical formulation.

2.7. IMPULSE RESPONSE FUNCTION

The impulse response function can be thought as a shock which is given to our modeled system. It helps us to observe the response of the dependent variable in VAR when a shock is introduced into the error term. A unit shock is applied to each variable and it is

intended to see the effect on VAR system. If we had used any asymmetric model in our study, what we would intend to study is the dynamic multiplier of the model that we had.

2.8. VARIANCE DECOMPOSITION

Variance decomposition helps in the interpretation of the VAR model once it has been fitted. It helps to determine the proportion of variation of the dependent variable explained by each of the independent variables. In our case, we are going to observe how the variation in the exchange rate is explained by our explanatory variables which are inflation rate, interest rate and money supply.

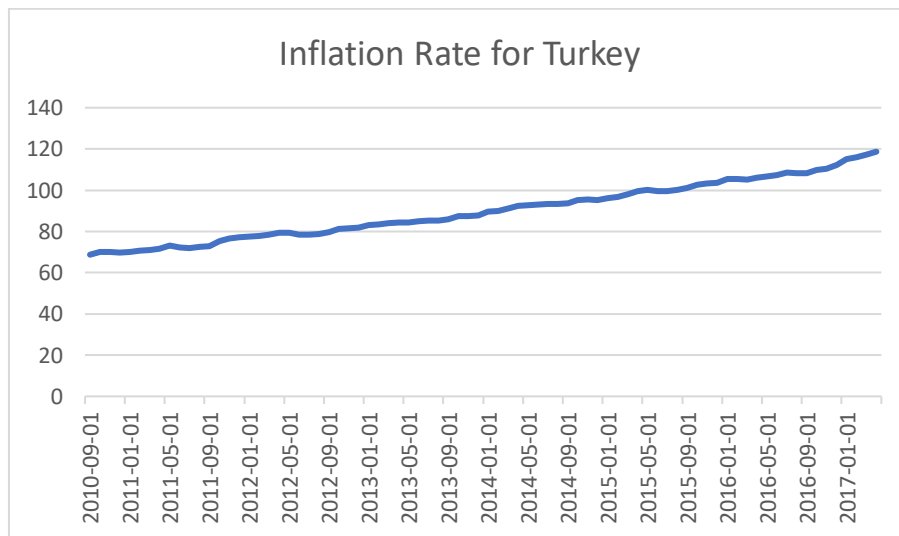
CHAPTER 3

IMPLEMENTATION AND FINDINGS

3.1. RESULTS OF THE STATIONARITY TESTS

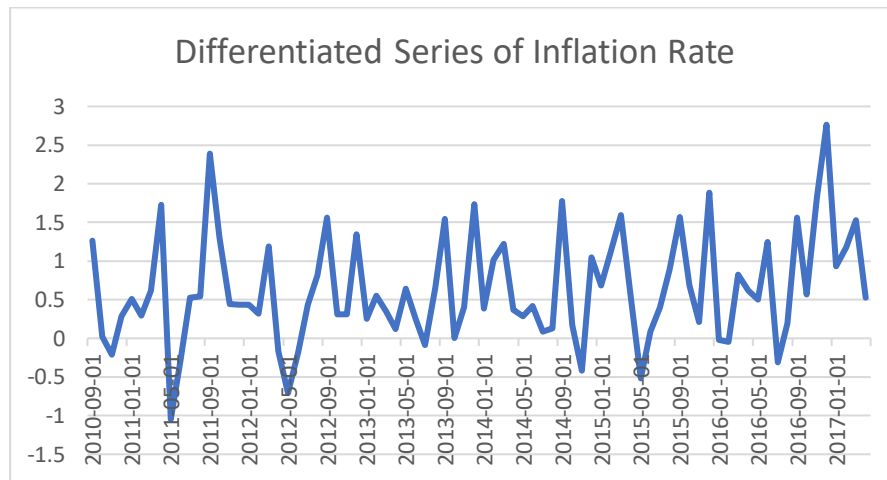
3.1.1. Inflation Rate

Chart 3.1. Inflation Rate For Turkey



The first thing which is done regarding the data is that, the data is adjusted to seasonality. If the data is not seasonally adjusted, it is impossible for us to build up a model. When we look at Figure 1, it can easily be said that the series have a trend, which makes the series non-stationary.

Chart 3.2. Differentiated Series of Inflation For Turkey



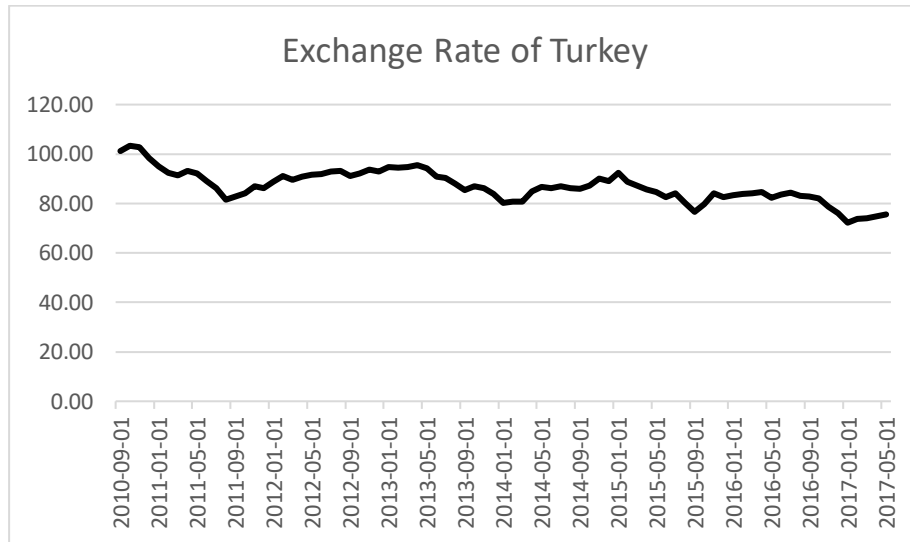
In order to make the series stationary, it is differentiated. It is possible to see from the outcome that now the mean seems like constant. But just by looking at the data, we can not say whether the process is stationary or not. We should apply Phillips-Perron and Augmented Dickey Fuller test to verify that we do not face any non-stationarity problem.

The null hypothesis of the test shows that the series has a unit root, which means we have a non-stationarity problem. When we look at the t-statistic of the test, we see that the statistic is less than all of the critical values, so it is quite possible for us to reject the null hypothesis and conclude that by looking at Augmented Dickey-Fuller test, we can say that we don't have any non-stationarity problem. I also wanted to add Phillips-Perron test to check the robustness of the test. Phillips-Perron test does heteroskedasticity and Autocorrelation consistency correction to Augmented Dickey-Fuller test.

The null hypothesis is no different than the ADF test. Since the outcome of the t-statistic test is smaller than the critical values, by also looking at the Phillips-Perron test it is possible for us to reject the null hypothesis and conclude that we do not have any non-stationarity problem with the inflation rate.

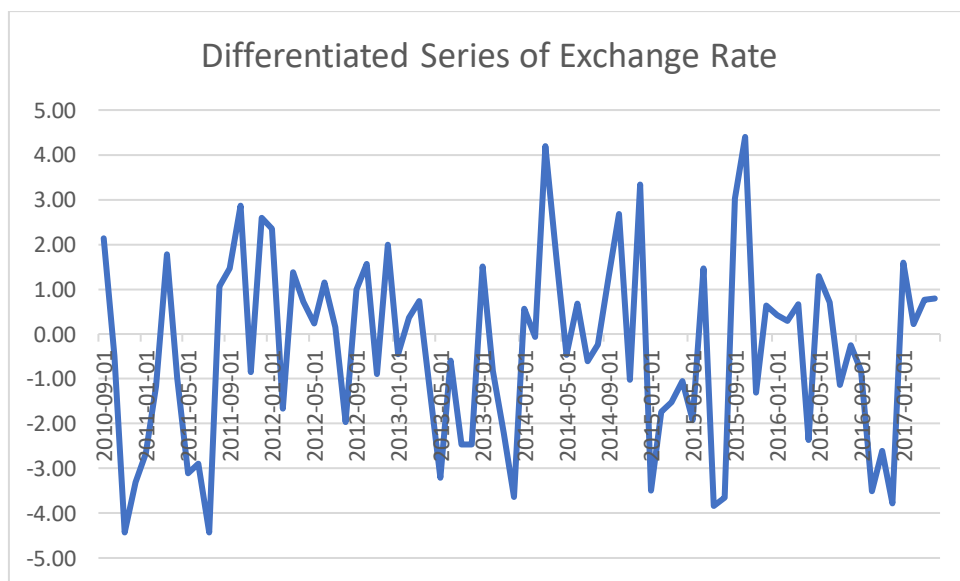
3.1.2 Exchange Rate

Chart 3.3. Exchange Rate For Turkey



The mean of the Exchange Rate in Turkey through 2002-2018 does not seem like a constant one. So I differentiated the series to get a constant mean series.

Chart 3.4. Differentiated Series of Exchange Rate For Turkey



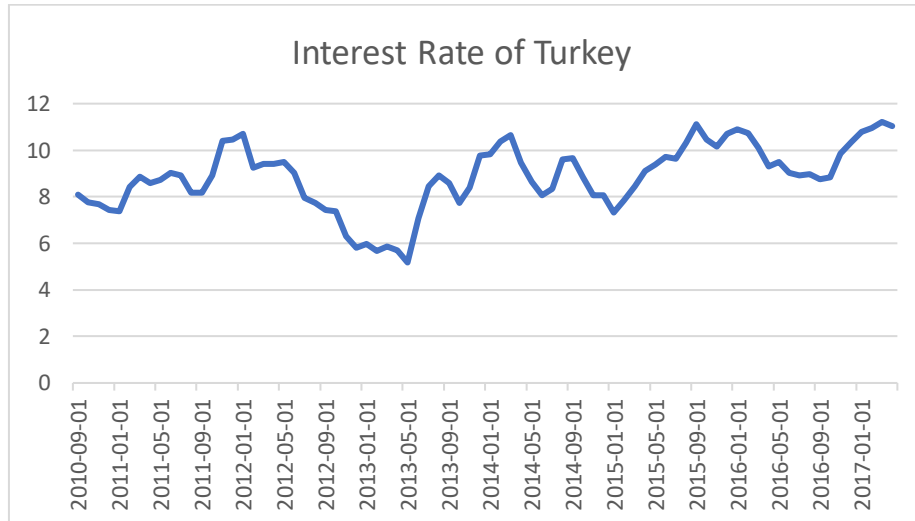
When the series is differentiated we can observe that the mean is now constant. But we should verify the stationary by doing PP and ADF tests again.

When we check the t-statistic of the test we see that the statistic is less than the critical values, so we can reject null hypothesis and conclude that Exchange Rate in Turkey does not have any non-stationarity problem. PP test yields the same result for the differentiated series of Exchange Rate in Turkey. The outcomes of the PP and ADF test both give us the same result. We can conclude that our series does not have any non-stationarity.

3.1.3. Interest Rate

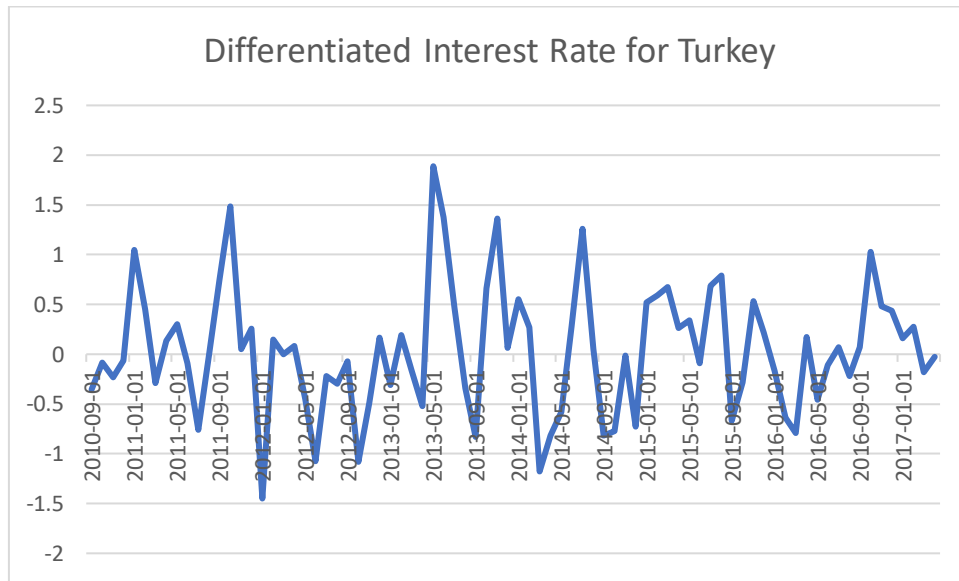
The mean of the Interest Rate in Turkey through 2002-2018 does not seem like a constant one, again the function should be differentiated in order to solve the problem of non-stationarity.

Chart 3.5. Interest Rate of Turkey



When the series is differentiated, it is seen that the mean of the series is now seems like a constant one. The verification will be done by PP and ADF tests.

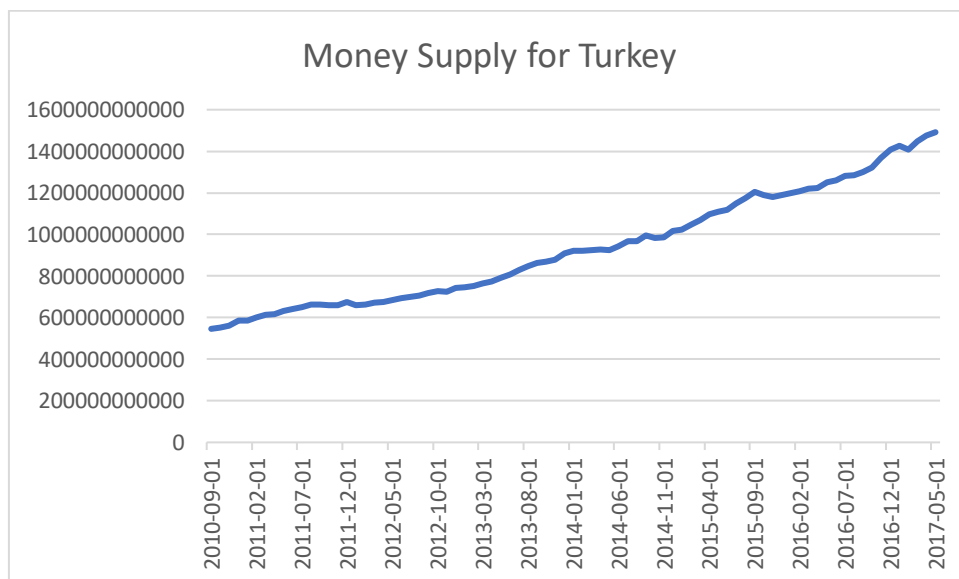
Chart 3.6. Differentiated Interest Rate of Turkey



By looking at the t-statistic of the ADF test, we can reject the null hypothesis and conclude that our series is now stationary. PP test also yields the same result. So in total we do not have any non-stationarity in Interest Rate in Turkey when we differentiate the series.

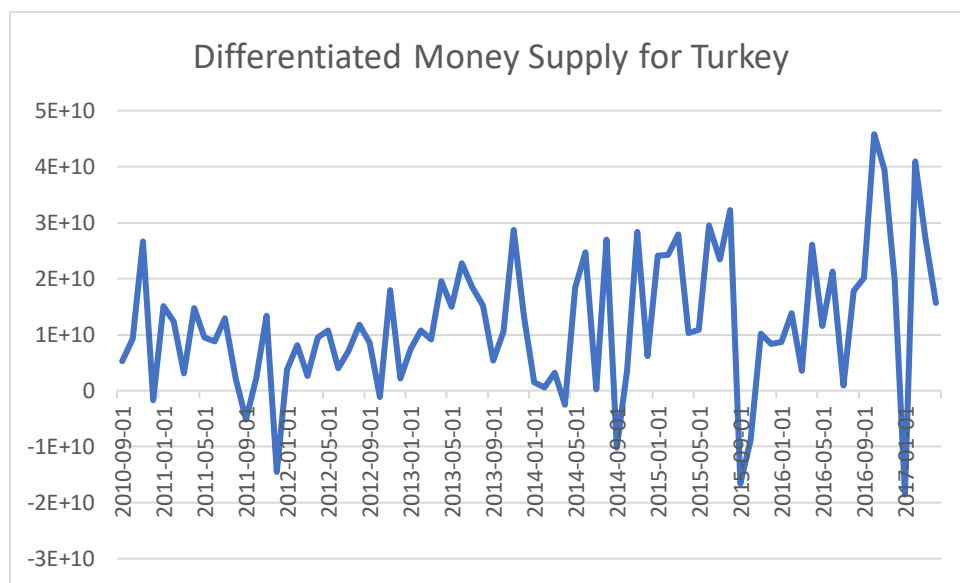
3.1.4. Money Supply

Chart 3.7. Money Supply Graph of Turkey



The mean of the money supply graph for Turkey does not seem like a stationary one. So, in order to make it stationary, we have to differentiate the series first. If we can not obtain a stationary series again, we have to differentiate more than once.

Chart 3.8. Differentiated Money Supply Graph of Turkey



When we differentiated the series for once, we saw that the series now looks like a stationary one. The ADF-Test also supports the claim that the series is non-stationary in levels, but stationary in first difference.

3.2. MODEL SPECIFICATIONS AND FINDINGS

The lag selection criteria also has a vital importance while building our model. The optimum lag number can be chosen by looking at the Akaike Information Criteria, Schwartz Criteria and Hannan Quin Criteria. By looking at the lag selection criteria we can say that the best lag for our model is one. But, since the model that we build presents better results with lag length two, we are going to choose two as the best fit for our model.

By looking at the Johansen cointegration test we can easily observe the cointegration between our variables. In this part of the study, we have two statistics which we can choose the cointegration between the variables, Trace statistic and Maximum Eigenvalue statistic. When we look at the probabilities of the tests, we see that both tests reject the null hypothesis that there is no cointegration. But fail to reject there is one cointegration. As it also states at the bottom side of the figure, both tests indicate one cointegrating equations at the 0.05 level. So, for our model we are going to take Johansen cointegration as one. The test result can be seen in the appendix section at the end.

In order for our model to be consistent, there has to be no serial correlation. For that reason, serial correlation check is done. The Chi-Square probability we can see that we can not reject the null hypothesis, and we conclude that our series have no serial correlation problem. The result can be seen in the appendix.

One of the most important point for our model to function properly is that, the residuals must not be heteroskedastic. Meaning, variances of the residuals should be constant. It should not depend on the dependent variable. By using Breusch-Pagan- Godfrey Heteroskedasticity Test, we check whether our residuals are heteroskedastic. Since, the Chi-Square Probability is bigger than 0.05, we conclude that we don't have a heteroskedasticity problem with our residuals. If we continue building our model with heteroskedastic errors, then the OLS estimators will not be efficient, confidence intervals and hypothesis tests for standard errors will totally be wrong.

Table 1.1. Results of Long-Run Causality

<i>Long Run Causality Results</i>	
EXRATE(-1)	1.000000
INFRATE(-1)	-1.2207 (0.574) [-2.12464]
INTRATE(-1)	1.955 (0.739) [2.6437]

MSDEF(-1)	0.612565 (0.311) [1.96]
C	-51.617

Note: The values presented are the coefficients of the variables.

The values in () show the standard errors, while the terms

in [] shows the corresponding t-statistics.

Table 1.2. Results of Short-Run Causality

<i>Short Run Causality Results</i>	
COINTEQ1	-0.21 (0.043) [-4.9338]
D(EXRATE(-1))	0.0465 (0.111) [0.41745]
D(EXRATE(-2))	0.1040 (0.097) [1.064]
D(INTRATE(-1))	0.3915 (0.3291) [1.189]
D(INTRATE(-2))	0.00621 (0.31413) [0.0197]
D(INFRATE(-1))	-0.3336 (0.2859) [-1.166]
D(INFRATE(-2))	-0.183097 (0.28060) [-0.6525]
D(MSDEF(-1))	-0.9271 (0.1444) [-6.41770]
D(MSDEF(-2))	-0.493060 (0.17871) [-2.759]
C	1.70 (0.419) [4.05]

Note: The values presented are the coefficients of the test.

The terms in () show the corresponding standard error of the test,

while the terms shown with [] show the corresponding t-statistics.

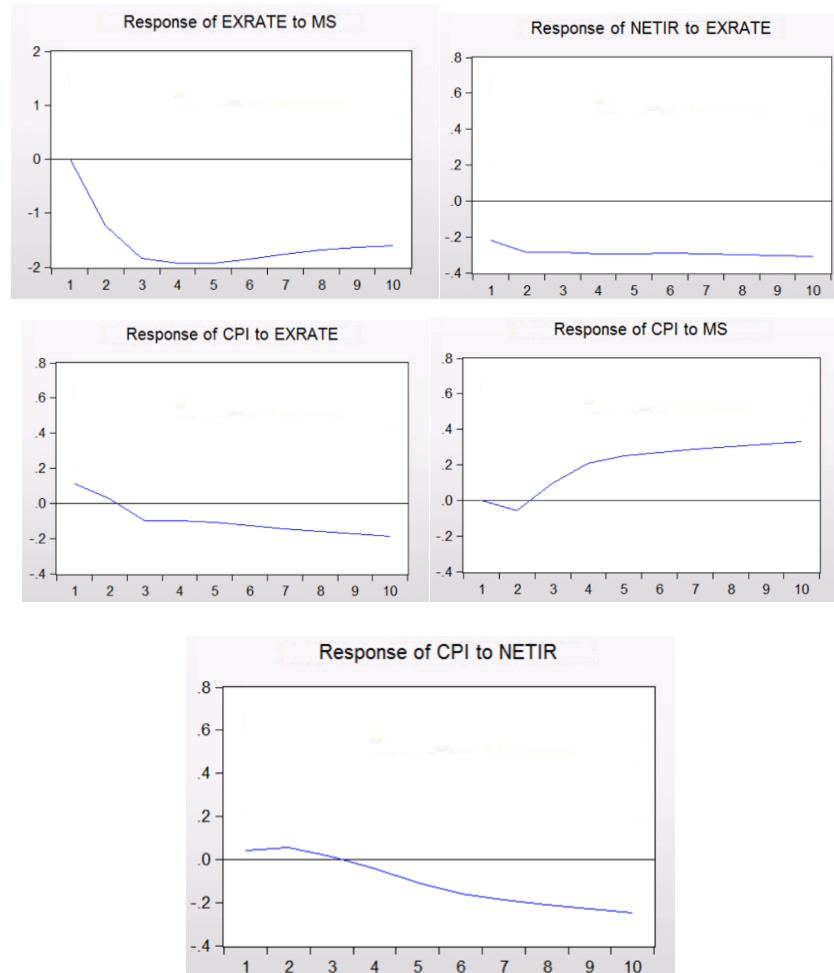
In our Vector Error Correction Model(VECM) we used exchange rate as the dependent variable and the money supply, inflation rate and interest rate as explanatory variables. As it is seen from the model, the coefficient of interest rate is significant and positive, and the coefficient of the inflation is significant and negative. However, the t-statistic of the money supply is at the critical region, so the effect of it to our dependent variable will be neglected.

It is also important to identify the short run causality, in the model that we build. We will use Wald-test to identify whether our variables in our model is significant in short run. First, we started with interest rates, and jointly testing whether the coefficient is zero or not. When we look at the Wald-test result, we can clearly see that we fail to reject the null hypothesis and conclude that there is no short-run causality running from interest rate to exchange rate.

By looking at the Wald-test for interest rate, we can see that we fail to reject the null hypothesis and conclude that we do not have a short-run causality running from interest rate to exchange rate. When we look at the case for the money supply, it is seen that we reject the null hypothesis and conclude that there is a short-run causality running from money supply to the exchange rate. At the same time, the short-run variables are tested whether there is a mutually cointegration or not, in order to see that, a wald-test is applied and it is analysed whether there is a mutually cointegration in our model. But, it is seen that there is also not a mutually cointegration in our model. But since the model to be consistent, we kept the variables in our model. Otherwise, a serial correlation or an heteroskedasticity problem should have been faced.

3.3 IMPULSE RESPONSE FUNCTIONS

Table 1.3. Generated Impulse Response Functions



Impulse response functions can be interpreted as the movements of the variables on y axis when there is a one standard deviation shock to the variable in x axis. The impulse response functions that we have generated for our model represent us consistent results with the theory.

A one standard deviation shock in money supply, causes the exchange rate to depreciate starting from the first period and stays negative in ten periods. The response of the

inflation in our model to a shock in money supply also makes sense. When there is one standard deviation shock to money supply, the inflation increases starting from the second period and stays positive in ten periods.

When we analyse the situation for a shock in exchange rate, we can see that the interest rate decreases when there is one standard deviation shock in exchange rate. The intuition behind this result is that, for recent years the policymakers in Turkey are trying to decrease the interest rates in order to boost economic activity. However, when the exchange rate depreciates, it is hard for them to apply this policy. To be more clear, they choose to decrease the interest rates, when they observe an appreciation in the exchange rate, so they think that the other variables in the economy are not harmed in an intense manner. So the response of interest rate for a shock on exchange rate is also intuitive in Turkish case.

In our case it is seen that the short-run variables are not significant except the money supply rate, but it should be clearly noted that it can be the case that. Inflation rate, interest rate and money supply can mutually be cointegrated. At that scenario, that could be the reason why when we check the variables one by one and check their significance, they could be insignificant and they would be jointly significant. In our model, variance decomposition shows how the variance in the exchange rate changes when the variances in the other variable changes and which impact is higher. The model that is built shows that the variances of the exchange rate is effected highly by itself and the variances of the money supply. But, it is clearly seen that the effect of the money supply tends to be higher in consequent periods and the effect of variance of exchange rate decreases. Even more, the effect of the variance of inflation is more than the effect of the variance of exchange rate.

3.4. ECONOMIC INTUITIONS BEHIND THE FINDINGS

The relationship between the exchange rates and the interest rates has been a crucial point in economic research. Most of the studied models indicate that interest rate can be

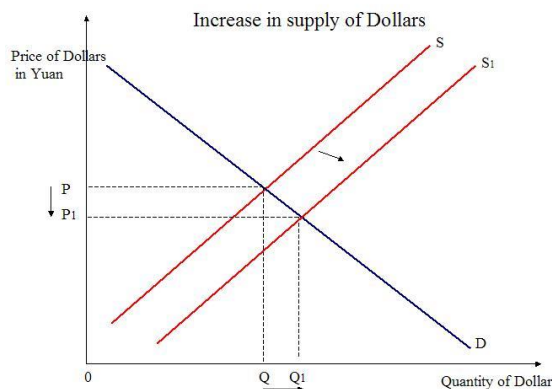
an important variable to predict the movements of the exchange rate. However, the models that study the relationship between the exchange rate and interest rate have found conflicting results. Eichenbaum and Evans (1995) found that interest rate innovations cause a currency appreciation. On the other hand, Calvo and Reinhart(2002) studied the case for developing countries and found that there is no relationship between the two variables. Moreover, the research of Drazen and Hubrich(2006) show that, the long-run and short-run reactions of currency to an interest rate increases differ.

Vegh, A., Hnatkovska, V., Lahiri, A. (2008) studied the relationship between the nominal interest rates and the nominal exchange rate. They formalized a small open economy model for developing economies such as Brazil, Korea and Thailand. They argue that, higher interest rates have three effects. They raise the burden on the government, since the capital costs will increase, it is going to reduce the output, and ,the demand for domestic currency assets will increase. These consequences have different effects on the currency. The first two will depreciate the currency, while the last one will cause it to appreciate. To predict the final effect on the exchange rate, the relative strengths of the opposing forces should be known.

Through the model that they built, they argue that when there is an increase in the policy-controlled interest rate, an inflationary pressure on government is created due to the high interest on the outstanding government debt. Consequently this effect will increase the required seignorage revenues and will cause a depreciation in the currency. Second effect is the output effect, when there is a rise in the interest rate, this will cause to a decrease in employment and output due to the increasing borrowing cost for the firms. In order for the banks to balance their balance sheets, they will increase the holdings of government bonds. This causes government's fiscal burden to increase and pushes the required seignorage revenue up, which will again cause the currency to depreciate. The last effect can be named as the "money demand" effect. When the interest rate goes up, the households are going to demand less cash, since the opportunity cost of holding money rises. At the same time, the interest paid on demand deposits will increase also. Which in turn will higher the demand for deposits. The response of the money demand direction is dependent on the domination of the components. For low steady state values of the policy interest rate, the increase in demand deposits can be seen as sufficient to

dominate the fall in cash demand, which leads to an increase in the value of the currency. (Note that, this effect is also strong enough to counterweight the fiscal and output effects that we previously discussed). The effect that we see in our study is the last money demand effect. When the interest rate goes up, the exchange rate responds with an appreciation. It is also beneficial to see the short-run effect of money supply on exchange rate. As we know from economic theory, when the money supply goes up, the exchange rate goes down. In our model, we observed also the same result in the short run. When there is an increase in the money supply in the short run, it directly decreases the exchange rate. It will also be beneficial to see the relationship in a graph.

Table 1.4. Money Supply Graph



Source: www.wordpress.com

The case is here analysed as the dollar yuan case but we have the same scenario in the model that is built. When the money supply goes up, which is in this case the increase in supply of dollars, then the price of dollars in Yuan decreases which can also be considered as the exchange rate.

The determination of exchange rate can also be explained by one of the oldest theories which is the Purchasing Power Parity (PPP). Grohe, Woodford, Uribe (2016) explain the theory as the change in the exchange rate by the change in the price levels of two countries. The idea comes from the fact that, similar goods must be sold for similar prices, then according to this logic, as prices change internationally, the exchange rates must also adjust to changing price levels in two countries. Kulkarni, G., Ishizaki (2002)

tested the PPP explanation between US Dollar and Japanese Yen data and found out that higher inflation experienced in the home country decreases the competitiveness of the country in the international market. Which lowers the level of country's exports causing a decrease in the demand for the local currency, which in turn depreciates the value of the home currency.

The PPP has been studied between United States and four high inflation Eastern European Countries by Choudhry, T. (1999), and he found out that the relative PPP holds for these countries. Under the assumption of taking the currency of U.S. stable, when any of these countries experience a high inflation, the effect of it to the exchange rate is a depreciation. Bahmani, M., and A. Mirzaie (2000), also studied whether the PPP theorem holds for developing countries. They chose 22 developing countries and the developed countries as their main trade partners between the period 1973-1997. The results show that in some of the developing countries the PPP holds. J. D. Alba and D. H. Papell(2007) studied the PPP with 84 countries and found out that, the countries which are more open to trade, closer to United States, with lower inflation tend to show stronger evidence of PPP. Moreover, they showed that PPP holds for Latin American and European countries but not for African and Asian countries. They claim that, country characteristics has a vital importance while detecting the validity of the PPP.

The effects of the oil price decrease can also be discussed in macroeconomic level. When the oil price decreases, since it will be cheaper for the company to import the good, the budget deficit of the country will go down, as previously stated before which is the biggest problem that Turkey has. The decrease of the budget deficit will cause exchange rate to experience an appreciation, which will also drive the inflation rate down. And one other effect which is also very crucial is the effect on interest rates, as it is also discussed in this paper. Since the exchange rate experiences an appreciation and the inflation rate goes down, the appropriate situation to decrease the interest rates is ready. So just by looking at the analysis done in here, we can say that the decrease in oil prices have crucial effects which can cause the economy to perform much better. All the crucial variables, which are interest rates, inflation rate and exchange rate is effected in a good manner from a decrease in oil price. However, since it is an exogenous variable, it is impossible for the Turkish policymakers to control the price of oil. So what should

be done, is to make good approximations and forecasts about the oil price which reflects the market conditions. If the approximation is done wrong with totally wrong assumptions, then it could have harmful results for the economic indicators as it is clearly seen.

CONCLUSION

The movements of the inflation rate, exchange rate and the interest are the key drivers for a stabilised economy. If the balance between these three variables are harmed, then the economy suffers. The less values that these variables take means a better macroeconomic performance for the country. However, these values being so high may not indicate an economic crisis, but a significant decrease in the utility of the households, the profits of the firms and inequalities between the income distributions. By looking at the results that are observed, it can clearly be stated that the exchange rate is dependent on inflation rate, interest rate in the long run, and the money supply in the short run. It would be fruitful for the policymakers to know that the effect of the inflation rate on exchange rate is negative in the long run, while the effect of interest rate is positive. When the case of short run is considered, it can be said that the only significant variable is money supply, which effects the exchange rate in a negative way. Moreover, it is stated in the Project that the Purchasing Power Parity holds for the case of Turkey in the long-run, while it does not hold in the short run. Since the reaction of inflation does not show any significancy.

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APPENDIX

APPENDIX A

Hypothesized No. of Cointegration	Eigenvalue	Trace Statistic	Critical Value
None*	0.254140	32.46	29.79
At most 1	0.071393	9.589	15.49
At most 2	0.047792	3.819	3.851

Johansen Cointegration Test(1995). * denotes the rejection of the hypothesis at %5 level. Trace test indicates 1 cointegrating equation at the %5 level.

APPENDIX B

Hypothesized No. of Cointegration	Eigenvalue	Max-Eigen Statistic	Critical Value
None*	0.254140	22.87	21.13
At most 1	0.071393	5.768	14.25
At most 2	0.047792	3.819	3.851

Johansen Cointegration Test (1995). * denotes the rejection of the hypothesis at %5 level. Maximum Eigenvalue test indicates 1 cointegrating equation at the %5 level.

APPENDIX C

	ADF	
	<i>Variables in levels</i>	<i>Variables in first differences</i>
EXRATE	-2.42	-7.22*
INTRATE	-3.14	-6.33*
INFRATE	1,81	-6.22*
MSDEF	-0.22	-8.55*

Note: ADF: Augmented Dickey-Fuller test. In all the cases, the unit root test has been performed using the model trend and intercept. The presented values correspond the t-statistic of the tests. * indicates significant at %5.

APPENDIX D

Lags	LM-Stat	Prob
1	14.75	0.542
2	14.90	0.5317
3	9.76	0.8788
4	20.93	0.1810
5	9.88	0.8727
6	24.53	0.0985
7	20.40	0.2031
8	15.07	0.5192

Note: Representation of the Breusch-Godfrey serial correlation LM test.

The null hypothesis states no serial correlation between residuals.

APPENDIX E

Joint Test:

Chi-sq	Prob
178.89	0.509

Heteroskedasticity Test. Null hypothesis states

there is no heteroskedasticity.

APPENDIX F

Interest Rate

Test-Statistic	Value	Probability
F-statistic	0.8844	0.4177
Chi-square	1.7688	0.4130

Note: Wald Test. Null hypothesis: Interest rates are jointly insignificant.

Inflation Rate

Test-Statistic	Value	Probability
F-statistic	0.736	0.482
Chi-square	1.473	0.478

Note: Wald Test. Null hypothesis: Inflation rates are jointly insignificant.

Money Supply

Test-Statistic	Value	Probability
F-statistic	27.49	0.00

Chi-square 54.99 0.00
 Note:Wald Test. Null hypothesis: Money supply are jointly insignificant.

APPENDIX G

Period	S.E	EXRATE	INFRATE	INTRATE	MSDEF
2	2.349	70.39	1.793	0.597	27.21
6	5.115	32.46	7.081	0.429	60.02
12	7.082	25.12	10.585	0.854	63.43
18	8.436	21.88	12.461	2.041	63.60
24	9.543	19.82	13.735	3.299	63.14
30	4.385	7.88	14.652	4.403	62.58

Note: Variance decomposition. S.E. shows the standard error.