MODELING NEW MONETARY POLICY OF THE CENTRAL BANK OF REPUBLIC OF TURKEY

ONUR ÖZVAROL

BOGAZİÇİ UNIVERSITY

2014

MODELING NEW MONETARY POLICY OF THE CENTRAL BANK OF REPUBLIC OF TURKEY

Thesis submitted to the Institute for Graduate Studies in the Social Sciences

in partial fulfillment of the requirements

for the degree of

Master of Arts

in

Economics

by

Onur Özvarol

Boğaziçi University

2014

Onur Özvarol, “Modeling New Monetary Policy of the Central Bank of Republic of Turkey”

Central Bank of Republic of Turkey has started implementing a new monetary policy structure since May 2010. An interest rate corridor has been introduced as the bank's policy instrument. In this study, we evaluate the new policy using several VAR models to test whether Central Bank aims for inflation stabilization. Since interest rate corridor is a unique application firstly implemented by CBRT, no empirical study has been conducted on it yet. Based on Taylor Rule, a variety of reaction functions using policy interest rate, borrowing interest rate (Upper Band) and lending interest rate (Lower Band) are estimated. We also empirically investigate the functionality of gaps between bands and policy rate. Our results imply that Central Bank does not implement inflation targeting regime in the new structure. Instead, the Bank puts financial stability into its target basket and continues to respond developments regarding inflation in selective fashion. We additionally find that upper band responds to internal factors, whereas lower band responds to external factors.

Tez Özeti

Onur Özvarol, “Modeling New Monetary Policy of the Central Bank of Republic of Turkey”

Türkiye Cumhuriyet Merkez Bankası, Mayıs 2010 itibariyle yeni bir para politikası yapısını uygulamaya koydu ve banka tarafından, faiz koridoru, yeni para politikası aracı olarak tanıtıldı. Bu çalışmada, yeni dönemde, para politikasında ki değişimler incelenmektedir. Mayıs 2010’dan sonra, Merkez Bankasının enflasyon hedeflemesi politikasına devam edip etmediği, ekonometrik (OLS) modeler yardımıyla test edilmiştir. Yapılan testler sonucunda, Merkez Bankasının yeni dönemde enflasyon hedeflemesi politikasına devam etmediği tespit edilmiştir. Çalışma, faiz koridorunun farklı bileşenlerinin incelenmesiyle derinleştirilmiştir. Koridoru oluşturan faiz oranları ve aralarında ki boşlukların ekonomik uygulamaları ekonometrik (VAR) modeller yardımıyla değerlendirilmiştir.

CONTENTS

CHAPTER 1

INTRODUCTION

Beginning with New Zealand in 1991, in the last two decades, many advanced countries have embraced inflation targeting regime as their monetary policy. In 1993, John B. Taylor presented his very well-known monetary policy rule that provided the best match with inflation targeting regime. The first version of the Taylor Rule modeled as a reaction function of FED aimed for price and output stabilization.

After Central Bank of Republic of Turkey (CBRT) became independent, inflation targeting regime was introduced in Turkey in 2002 for the first time. During years of inflation targeting practice, Taylor's monetary policy rule has been tested and suggested for CBRT in many studies and research.

Until May 2010, CBRT had implemented an interest rate rule that used a single policy rate as a means of fighting inflation. Severe financial crisis of 2008-2009 and Euro Zone Debt Crisis in 2010 leaded CBRT to make modification in its policy structure and take measures against upcoming crisis. In this regard, CBRT presented and implemented ‘’New Monetary Policy Structure’’ in May 2010. Causes and consequences of new policy structure are communicated carefully with economic agents via various speech and reports during the introduction period.

In the new policy, CBRT has begun to implement interest rate corridor composing of ‘’lending interest rate’’, ‘’borrowing interest rate’’, ‘’policy interest rate’’ and gaps between each rate. Consequently, monetary policy switched to a complicated monetary policy tool, interest rate corridor. Meanwhile, properties of era, global financial crisis and its effects on Turkish economy necessitate a modification in CBRT's policies.

New monetary policy tool brought out question marks in the academic world. Whether the interest rate corridor is implemented as a means of inflation targeting regime or CBRT changed its main strategy. Furthermore, instrumental rates in the corridor and gaps between those rates are questioned if each of them has been utilized for new monetary policy aims, which are financial stability. Because CBRT was the only monetary authority applied that new tool, no study has been conducted to model interest rate corridor. In this regard, this study aims to answer remarkable questions about brand new monetary policy tool of CBRT.

This research is going to attempt to answer following questions;

- Whether including financial variables into interest rate reaction functions is sensible or not?
- Whether lower and upper gap or lower and upper band is actually used as instrument and whether they are significant in the reaction function of CBRT or not?
- Whether CBRT has changed the weight of its targets (price stability, growth sustainability, financial stability) or not? (I.e. coefficient of relevant variable changed significantly after May 2010)

In order to answer the questions above, following hypothesis will be evaluated.

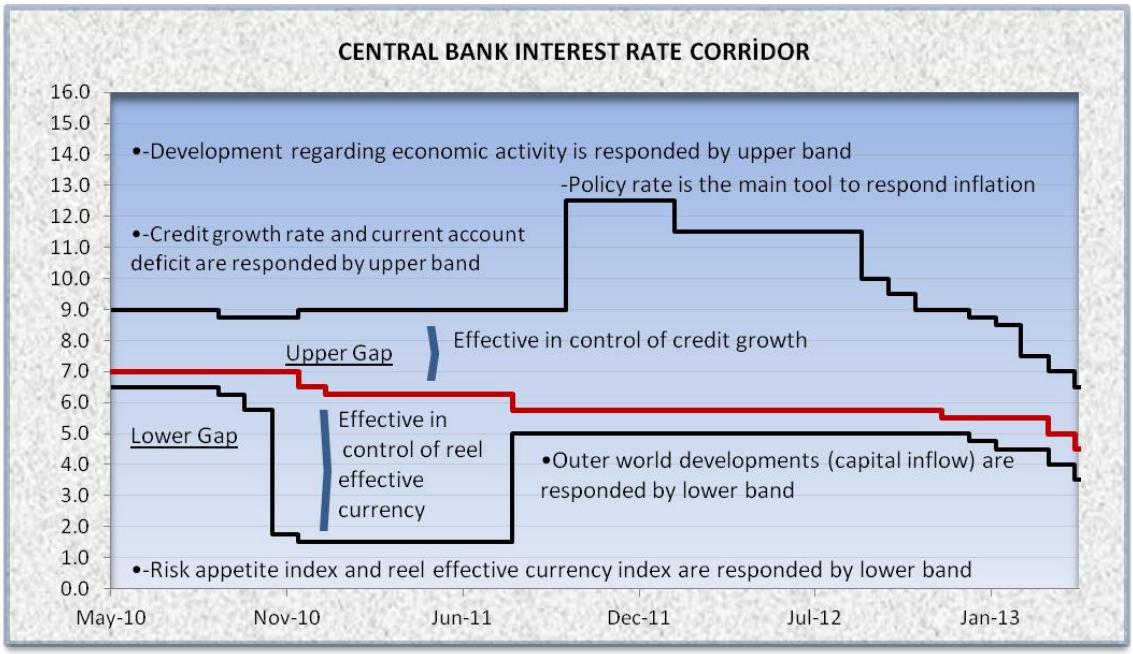


Figure 1: Hypothesis

In this study, our aim is to empirically analyze the modification in monetary policy and the functionality of new instruments. In this regard, first of all, a structural break for reaction function of CBRT is tested via Chow test and the structural break in May 2010 is detected. After that the new monetary policy rule is estimated for CBRT for the period after May 2010. Secondly, other instrumental rates in the corridor, such as lending interest rate and borrowing interest rate are modeled according to claims made regarding their implementations. At last, relationship of financial indicator and gaps between policy interest rates with each band in the corridor are evaluated.

Owing to our analysis in the study, we concluded that CBRT has not implemented inflation targeting regime in new monetary policy structure after May

2010. Instead, the Bank responds to financial variables such as credit extension, current account deficit and reel effective currency. Moreover the bank utilizes upper band and lower band of the interest rate corridor as an effective policy tool to provide financial stability.

Research is constructed as follows. In next chapter, new monetary policy era is summarized. Policies of CBRT, their reasons and consequences are stated in that chapter. In third section, a brief literature review about Taylor Rule is presented. After that, in order to make terms and aims familiar, definitions and hypothesis of the study is introduced. In forth section, models to estimate in the study are accounted. Later, data and methodology section is placed in order to introduce the variables and models implemented in the study. In the sixth section, models for new policy interest rate and borrowing and lending interest rate are estimated by OLS. Besides, Vector Auto Regression models are applied in order to account for the relationship among financial indicators and gaps between policy interest rate and each band rate of corridor. Lastly, concluding remarks are presented in the end of study.

CHAPTER 2

BACKGROUND

2010-2011

Just after a soft recovery in global markets after the severe U.S. finance crisis, a second shock wave hit the advanced economies in Europe because of their debt issues. The impact of transmission of Greek debt crisis to others in Europe and downgrading credit rate of U.S by rating institutions were factors affects economies negatively along the period after 2010.

By the effect of bad news from Euro Zone, sluggishness was dominating global economy in early 2010 and thereafter. Financial institutions in advanced countries were reluctant to take risk and to support real economy. Influence of slow economic activity has embodied in three ways in emerging countries. Distortions have taken place in external demand, financial markets and expectations of agents. For each three channels, policy makers had broad responsibilities in solution process. Steering external demand, monetary authorities regulate the valuation and volatility of their domestic currencies. In addition, private sector also has a role in the story; turning through to different markets which have higher and stable demand or improvement in efficiency could help in challenge under lack of external demand. Second channel financial market is the major concern of recent crisis. Taking lessons from the period of 2006-2009, many governments added financial stability issue on their central banks' responsibility field.

Central Bank of Republic Turkey (CBRT) gained such property in 2001 by structural reforms. Since, in an environment financial markets do not work, real economy is not possible to be efficient, this channel is substantial in exit path from crisis. Last but not least, expectations are quite critique point in economies. It is considered as the main reason underlying many crises in the history including great depression. Pessimistic expectations caused by low global activity can lead the masses to irrational decisions. Whereas the concept of irrational decisions can be discussed, what is meant here is damaging the markets severely. In this regard, authorities should give right signals to markets in order to prevent panic which can bring out unpleasant outcomes. Annual and monthly reports published by central banks, conferences and speech made by officials from governments and money authorities are pretty important in managing expectations. Those expectations are measured by public surveys that are clear indicators of state of the economy. Such surveys are applied by central banks over the world, including CBRT.

Advanced and emerging economies were affected distinctly by the crisis. Whereas, low demand and high public debt stock were the problem for advanced countries, emerging countries were into balancing trade deficit and dismissing unstable capital inflows. General process was as following in the period; after the crisis emerged, because of distortion in financial markets, funding facilities were lowered considerably and a sharp cut in economic activity and demand was observed. In this point, the main problem became lack of liquidity in the market. Then, policy makers came to the stage. By the aim of relaxing financial markets, substantial amount funds was provided to banks and consequently to the markets by FED, ECB and other major central banks.

Owing to high level of liquidity provided, financing by short term funds became less costly for investors. Therefore, unbalanced credit expansion risk emerged. Short term capital inflows from advanced to emerging countries increased considerably, which constitutes a systemic risk for economies.

High level of capital flows affects the economies in various channels. The most obvious and direct one emerges as the risk of sudden stop. Such dramatic events were experienced in many crises around the world, like 1994, 1999 and 2001 economic crises in Turkey. At the blasting point of these crises, huge amount of foreign capital left the economy suddenly. In 1994, it was around 4.2 billion U.S dollar. As a result, interest rates of treasure bonds were above 400%, consumer price index was 121% and half million employees lost their jobs. In 27-28 November 1999, total amount withdrawn from CBRT was 3 billion U.S dollars. Lack of liquidity in the market leaded Repo overnight rates to 200%. In 1 December 1999, rates reached to 1700% for overnight Repo. As for 2001 crisis, 3.5 billion U.S dollar funds flied and interest rates begun to climb again.

Besides, unbalanced soar in foreign funds in the economy cause the domestic currency, become over-valued. Extremely appreciated domestic currency is a serious danger for competitiveness of private sector in export market. In this regard, problem jumps to trade balance, external demand and economic activity, real sector.

In this environment, domestic banks and firms in real sector can find easier and cheaper short term credit facilities owing to excess liquidity in advanced countries provided by their money authorities with support package. Thus, credit expansion might

follow a fluctuating course and a faster path then its natural trend. Such developments are also subject to financial risks. Leverage rate of banks raise to critic point, meaning that they are not safe borrower. A financial institution carries default risk because of high leverage in the market constitutes systemic risk for whole economy depending on its connection with others. In today's global economy, such connections are so deep that each member in the web can be affected by another collapse in the system.

As a result of uncertainty and low economic activity in advanced countries, high level of liquidity had been provided to the markets. After Europe Debt crisis hit big economies of European Union (EU), new aid packages were set for supporting these countries, Greece, Spain, Italy, Portugal, etc. The ECB implemented monetary expansion policies in this environment.

In this environment, the word pronounced by CBRT was cautious. In order to prevent undesirable outcome of global uncertainty, in every channel of monetary policies, cautious policies were implemented in early 2011. The code of the period was low interest rate, wide interest rate corridor and high reserve requirement. In the beginning of the year, vision of relevant policy instruments was as in the table below.

reserve	Turkish Lira										Foreign Exchange				
requirement	dep.	1-m	3-m	6-m	12-m	>12-m	1-y oth	3-y oth	>3-y oth		12-m	>12-m	1-y oth	3-y oth	>3-y oth
17.12.2010	8	8	7	7	6	5	5	5	5		11	11	11	11	11
24.01.2011	12	10	9	7	6	5	9	9	9		11	11	11	11	11
Policy Rates		Decision Date				1 week repo rate				Interest			Borrow	Lend	
		17.12.2010				6.50%				rate			1.50%	9%	
		21.01.2011				6.25%				corridor			1.50%	9%	

Figure 2: Reserve Requirement Table

In the first monetary policy committee (MPC) of the year, reserve requirements, which were differed for different maturities in 17 December 2010 for Turkish requirements, were increased in shorter term maturities. Under intensive short term funds come from advanced markets, preserving or improving the structure of yield curve is crucial for financial markets. Unless having such a yield curve gives higher payoff for longer maturity deposit, transaction mechanism between policy interest rates and market interest rate would be inefficient. In the end, monetary authority loses its ability to steer economy by interest rate instrument. Moreover, average deposit holding rate in Turkey is quite low. As an advantage for financial stabilization, providing longer deposit holding rates was also target in increasing the cost of short term liabilities of banks via increasing reserve requirements for shorter maturities.

After implementation of higher reserve requirement (RR) for shorter maturity, average maturity gained an increasing trend and rose to 62.5 days from 47.5 days in 7 months.

Another decision taken in that MPC was a little drop in policy interest rate. Whereas, policy interest rate regulation normally is made for supporting or limiting economic activity, in some situation, in order to relieve appreciation pressure on Turkish Lira, lower one week repo rate can be implemented. As the ECB applies monetary expansion policy, as a measure to prevent pressure on domestic currency was quite sensible in this point.

Richer policy instruments have enabled CBRT to control different channels at the same time in order to steer economy. That is to say, a lower policy interest rate normally

influences economy as a stimulus factor. Then, increase in credit volume is expected under higher economic activity. In order to prevent such risky credit extension financial stabilization, central bank uses other instrument, reserve requirement. It increased the cost of such transactions for the banking market by higher reserve requirement in order to offset the influence of lower interest rate.

As for liquidity policy, CBRT implemented tightening implementation. Interest rate corridor became liquidity control mechanism of CBRT. Borrowing rate of this band was decreased gradually until November 2010 from 16.75% to 1.75%. After this sharp decrease in the rate in November, CBRT tuned the rate up one more time in December 2010 and set it as 1.5%. Holding upper band (lending rate) almost stable, Central Bank extended the corridor and preserved it so until the August of 2011. Such wide interest rate corridor and very low borrowing rate was the one strong weapon of CBRT against capital short term inflows. Owing to that atmosphere provided by low borrowing rate, investments of short term funds into the market was discouraged.

Deepen debt crisis in Europe in first half of 2011, Euro Zone leaders gathered for additional measures for financial stabilization in July 2011. The path goes to financial stabilization necessitates to save Greece, Portugal, Spain, namely countries in debt crisis. Decisions taken in the meeting had substantial importance for not only Euro Zone Economies but also their peers, including Turkey.

In the meeting, measures of debt crisis and its spreading to other countries, then treating Euro were considered. Alternatives produced in the discussions, a new fund package to Greece, a new tax regulation to burden the part of cost occurred on banking

system and a reconstructing of debt stock proposals were made. General consensus around the world was lack of solution for the crisis in Europe would lead the problem turn into a global problem.

Responding the decisions taken by ECB and their influences on the markets, CBRT moved according to two possible scenarios in this period. First scenario was that solution might be found early owing to new measures applied by EU zone authorities. Second option was the reverse, if solution does not work, economic activity would slow down more.

In consideration of first scenario, anticipated outcome was appreciation in domestic currency owing to liquidity support by the ECB. As for second scenario, lack of solution would lead global economy to a recession. Under both conditions, interest rate corridor tool would be implemented in the same way. CBRT lowered policy rate by 50 basis points in this regard. Such policy would influence Turkish Lira and balance appreciating effect of global conditions under the first scenario. Lower policy rate also support economic activity in the shadow of a recession occurred in second scenario. Therefore, policy rate reduction could be implemented without waiting for one of these scenarios take place.

However, the similar logic was not valid in the implementation of reserve requirement tool. Since, cautious policy should be applied if economic activity rally and capital inflows increase again. In the recession scenario, low economic activity will bring about the need for cheaper credit facilities. Thus, CBRT watched over the markets to decide for higher or lower reserve requirement rates implementation.

In case of reduction in risk appetite, agents would prefer to buy more options to guarantee themselves against unanticipated shocks. In this regard, prices of options will increase owing to higher demand. Thus, VIX index is going to climb up in this environment. Therefore, higher VIX index means lower risk appetite mean.

Depending on increasing concerns regarding global economy and EU countries debt, risk-aversion tendency dominated markets in the middle of 2011. Volatility of risk appetite reached to dangerous levels for financial stabilization. This time, CBRT implemented the reverse of the policy implemented to discourage capital inflows in rising risk appetite period. In August 2011, lower band of interest rate corridor was lifted from 1.5% to 5%. Hereby, foreign investors which might prefer to leave Turkish market could be motivated by higher return to their funds. Since struggling with volatility concerning capital inflows is directly related with volatility of domestic currency, this policy was intended to regulate over-appreciated Turkish Lira volatility in 2011.

This policy also allowed central bank to provide high amount of liquidity by weekly repo auctions. Before, when policy interest rate (weekly repo rate) was 5.75% and lower band was 1.50%, overnight rates in second market would decline through 1.5%, if CBRT provided excess amount of liquidity by weekly repo auctions. Such overnight rate would be risky for currency volatility. Increasing lower band to 5%, CBRT left only 75 basis points between borrowing rate and policy rate. In such

atmosphere, overnight rates could decline until 5% which would not be as risky as the former condition. Therefore, implication of this policy could facilitate monetary authority fund the market in case of an emergency liquidity need.

As for the foreign exchange (FX) liquidity side, reserve requirement for foreign currency liabilities was decreased gradually in July and August of 2011. According to the estimation of CBRT, around 1.5 billion U.S dollar was provided to the market as liquidity by two requirement decline policy decisions. At the same time, CBRT have regulated FX in the market by open market operations, as FX purchase and selling auctions. Owing to debt crisis and its possible influences on Turkey, CBRT paused FX purchase auctions in 25 July 2011. Just after few days, in 4 August 2011, the Bank announced that FX selling auctions would be implemented in case of needed. Lastly, FX weekly repo auctions facility was also available for banks need FX liquidity at that moment, different than just after Lehman Brothers crisis. The strategy was preventing banks to incline higher amount of FX credit in international markets by thought of that they can lean on CBRT to roll over their debts later.

Coming to the second half of 2011, credit expansion growth started to slow down from extremely high levels to relatively more safe rates. In addition, high and increasing internal demand begun to cruise in a stable path, whereas, external demand earned a little steam along the year. Under those developments, Central Bank decided to support economic activity via lower policy interest rate. In August 2011, it set weekly repo rate as 5.75% (which was 6.25% since January 2011).

After implementing precautionary and supportive measures, CBRT could comfortably claim that the Bank was ready for upcoming market news. Whereas, in the first quarter of the year, uncertainty did not allow to guarantee for safety of markets by monetary authority, in August 2011, the Bank was able to say 'I am here'. In this regard, policy stance of CBRT was updated as below.

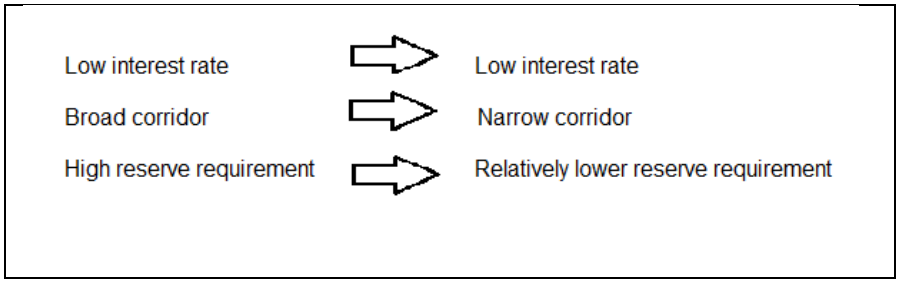


Figure 3: Monetary Policy Structure of CBRT in 2010-2011

Underlying target of CBRT's policies until October 2011 was a soft landing. Looking at history of Turkish Economy, it is obvious that one or two period boom is followed by a huge drop in output. In this regard, after a very high growth rate in 2010, providing sustainability of this development was very critique. As famous phrase of that time, soft landing was pronounced quite often by authorities. In the end of September, Governor of CBRT announced that soft landing actualized. Then, he also stated that 'seat belt warning lights are not turned off, the plane is landed and it is driving on the ground. Storm is coming behind the plane'. That is to say, precautionary framework should not be abandoned, even though the critical part had been passed so far.

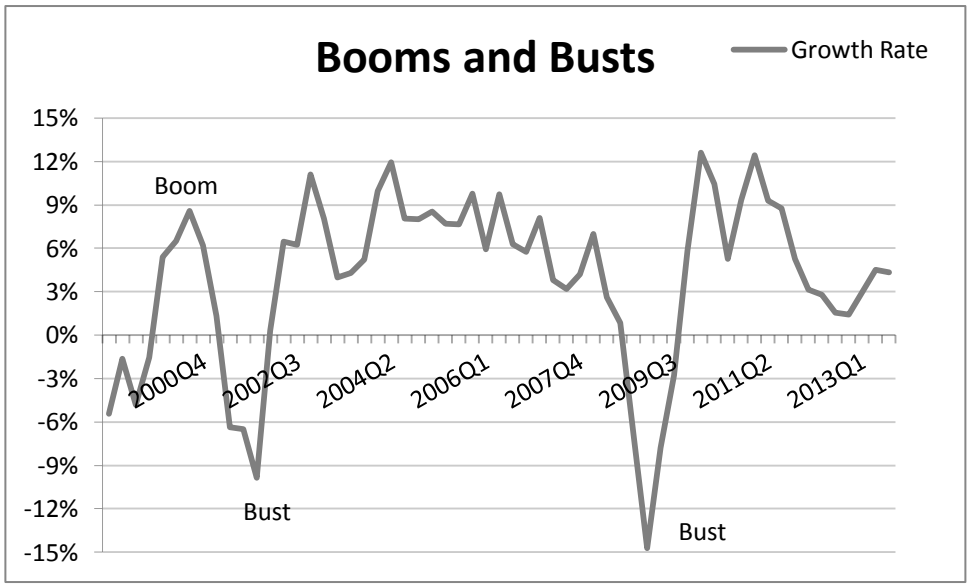


Figure 4: Annual GDP Growth of Turkish Economy

Measures taken by CBRT against uncertainty in Europe in August decreased the effect of global financial problems for Turkish Economy. Under quickly changing atmosphere, in the second half of 2011, because of lower risk appetite and depreciation in Turkish Lira, CBRT turned its general stance from macro prudential policy framework to monetary tightening strategy in October.

Development mention above and modification in price guider asset's value leaded inflation occur higher than anticipated.

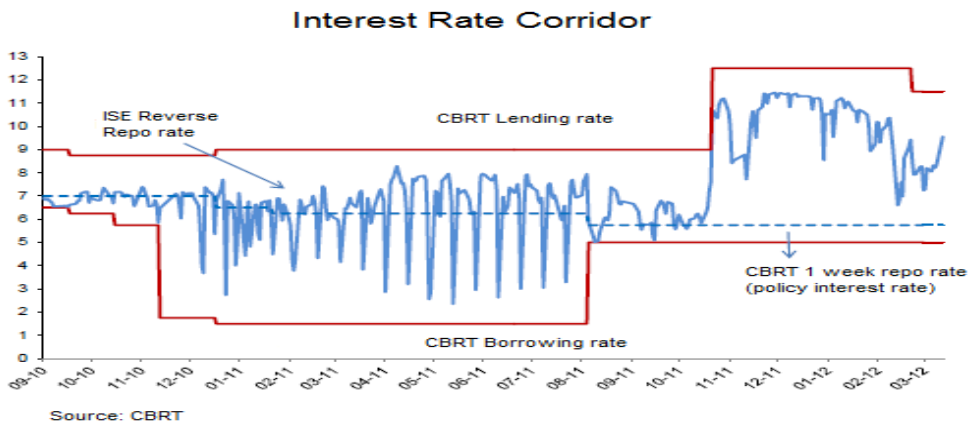


Figure 5: Interest Rate Corridor Implementation

350 basis points increase in lending rate was implemented in October 2011. That was a precautionary decision against potential inflation boost. Thereby, CBRT allowed overnight interest rate in the second market actualized over the policy rate. However, in this way, liquidity facilities might be affected negatively. Thanks to richer policy instrument basket, reserve requirement was applied by CBRT. Relaxing conditions were provided by reserve option mechanism, which will save the effectiveness of credit channels.

Decisions taken in August and October produced desirable outcomes in responding uncertainty in European Markets. Improvements in yield curve and relatively less risky credit extension growth rate were obtained. Internal demand was smoothed, thus trade deficit gave positive signals for recovery. Financing quality was increased considerably, which is a very crucial issue for financial stabilization. Ratio of short-term funds declined significantly, whereas long term funds were surged.

2012 – 2013

In spite of slight recovery in global economy after 2009, unemployment and output deficit remained to comprise in undesirable levels. Analyzing growth expectation for 2012 surveyed in June 2011 and February 2012, we could detect unfavorable atmosphere. Whereas, in June 2011, expectations were 3.6% and 1.7% for U.S and Europe relatively, they declined to 2.6% and -0.3% in February 2012. Thus, estimation for 2012 was not so brilliant especially for Europe affected from the crisis most severely. As for Turkish Economy, similar reduction in growth expectation measured by CBRT was observed. Growth expectations reduced from 4.8% in June 2011, to 3.3% in February 2012.

As their facilities in responding the crisis, advanced and emerging countries differed in terms of interest rate policy applicability. High interest rate level of emerging economies enabled the authorities there to apply this instrument in order to stimulus economic activity and internal demand. However, in advanced economies, policy rates were already close to zero or on that band. Consequently, further decrease in nominal rates was not possible. In this regard, plausible manner implemented was monetary expansion. Advanced economies did that in two distinct ways; asset purchase programs and long term funding. The former one is preferred by U.S, U.K and Japan, whereas ECB provided funding with long term debts to its market. In this period, although it cannot be defined as inflation targeting regime, Japan announced a target inflation rate as 1% for the first time in the history.

Debt crisis problems arose in Italy, Spain, Portugal, Ireland, Greece were mostly relied on financial markets shock. Because of increase in rate of fixed pay-off bonds, risk premiums of these countries were soared considerably. Risk premium measure is estimated by taking difference of relevant country long term bond and Germany's long term bond considered as riskless investment. Whereas, interest rate of German bond was 2%, Portugal bond interest rate reached 14%. It means 12% of risk premium for Portugal. Serious concern was valid for Italy and Spain. In early 2012, reduction in funding cost of these countries relieved financial markets in some extend. However, risk premiums of those countries were still over 3%, which was a risky level for financial stability.

Condition in Turkey was different than Europe. High growth rate and extreme credit extension were developments need to be responded. In this regard, macro prudential framework and monetary tightening policies were implemented in 2011. CBRT modified interest rate corridor in order to take precaution against Europe debt crisis. By lifting lending rate up in the end of 2011, CBRT eliminated the risk of extreme depreciation of Turkish Lira.

In the first half of 2012, public debt stock was still a serious problem for European Markets. Public debt stock was an outcome of high cost funding facilities, which is emerged as spread shocks in markets. These shocks were directly related with unemployment rate in countries also. Countries that are suffered from high debt stock also had higher unemployment rates along shock periods.

In recovering the problems caused by high cost of financing funds, credibility is the key point. Countries need to convince markets that debts would be rolled over

in their maturities. Then, increasing demand to the bonds of relevant countries will cause reduction in interest rates namely cost of funding.

Turkish Economy did not have the same problem during the last financial crisis. Although, public debts have become a hot debate issue for Turkey for years, considerable reduction in that value after structural reforms in 2001 prepared a safe substructure for the economy. In the challenge of providing confidence and credibility among the market, amount of public debt stock and capability to pay them back are quite substantial. In 2002, Turkey made a historical decision under an environment when there was doubt about solvency of its debts. Series of precaution called ‘’retrenchment (kemer sikma)’’ were taken, expenditures were decreased, whereas taxes were increased. After hard times with austerity, in 2012, Turkey could provide a strong reputation regarding its solvency. Germany gained the same trust in recent crisis. After they made balanced budget into a rule, they could become safe port in Europe of today.

While the safe level of public debt to GDP ratio of Maastricht Criteria is %60 to imply strong financial structure, Turkey reached 40% in 2008 and continued around that band along the crisis. In this regard, Turkish economy did not suffer from spread shock.

In the end of 2011, CBRT claimed that depreciation pressure on Turkish Lira was on a risky level. The Bank lifted lending rate in order to lead overnight interest rates to occur over the policy interest rate. After first shock was passed away in Europe, CBRT modified lending rate in February 2012. 100 basis points decline in lending rate was implemented.

Second shock wave visited markets in spring of 2012 owing to elections in France and Greece. Uncertainty in policy preferences of new governments caused ambiguity in markets. In the end of first half of 2012, impacts of uncertainty begun to vanish, the shock was absorbed. In this process, ECB took a strong step and announced unlimited liquidity package to provide in the condition that countries implemented precautionary fiscal policies. In order to stabilize financial markets, CBRT allowed overnight rates to decline gradually via increasing quantity of liquidity provided in weekly auctions. Non-performing debt rate increased in the beginning of second half of 2012. That development was related with financial stability. Then a sharp decrease in market rates was experienced, whereas average funding rate was around %9 in July, coming to the end of the year, it decreased to around 6%. Interest rate corridor provides needed flexibility to the authority under quickly changing global environment. It allows monetary tightening against foreign exchange volatility, in case of a need; otherwise, easing back policy is available at the same time. This is called cautionary stance of CBRT; it is always ready to tightening.

Current account deficit has been another hot debate for Turkish Economy. Some groups criticize CBRT. They claim that current account deficit is not The Bank's business, on the way to price stabilization. However, the importance of financial stabilization is justified in last crisis. Therefore, as a key actor of finance stabilization, current account deficit was of interest for monetary authority. In addition to precautionary measures taken to balance current account deficit, understanding the composition of it and presenting a solution fitting its basis were also quite crucial. Important point about Turkish current account deficit is as follows; it is not caused by public expenditures, namely government is not the main actor.

Real sector and banking sector are leading the case by becoming indebted from abroad. Analyzing its debt/reserve ratio, CBRT stated that net reserves were in a safe level for financial stability. In case of an unanticipated event, CBRT had enough affordable power to pay all its debt one year ahead.

What about real sector and banks? Do they have enough liquidity in response of their indebtedness?

Central Bank invented a fresh new policy instrument. If banks are indebted, they could hold their own liquidity as reserve requirement in CBRT. In this regard, Turkish Lira requirements are allowed to be deposit in foreign exchange currency in a limited portion. In this way, a significant cost cutting facility was provided to banks. Banks shared a part of fund they brought from abroad. Hereby, institutions remained prepared for a potential global fluctuation. In case of intensive fund flow, reserve is increasing and in a liquidity trap, banks can withdraw their holding in central bank to pay back their debts.

One substantial benefit took place in terms of credibility of banks. Because this regulation improved leverage, less costly funding facilities became available for Turkish Banks. That influenced internal market directly by providing the same facilities for agents in the economy. In the end, risk premium of Turkey decreased.

Current deficit was around %10 in 2011, which is an unsustainable level for the economy. All precautions taken by Banking Regulation and Supervision Agency (BRSA), CBRT and finance ministry, and new policy structure brought out promising outcome. By the end of 2012, which is called balancing year by Governor Basci, current deficit decreased to 6%. It was considered that 5% is proper level for sustainability of growth and financial stability. However, as Governor Basci, level of

6% current deficit was also sustainable level under today's easy external financing conditions.

In August 2012, reserve option mechanism entered its second stage by introduction of reserve option coefficient (ROC). By the first decision, for the first 40% of its reserves, banks were allowed to hold foreign exchange deposit valued of 1.1 Turkish Lira for 1 Turkish Lira reserve requirement. Modifications and improvements were introduced gradually.

Looking at announcement of CBRT, we can state usage of this facility is quite high. Banks were being deposited 90.5% of Turkish RR as foreign exchange in November 2012.

This instrument is originally a Turkish invention. It is being implemented for the first time. Besides, as naturally, this tool needs precondition to be successful and effective. First of all, remuneration to reserve requirement should be halted as CBRT did already.

The same facility was provided by gold holding. Banks can deposit 10% of their Turkish Lira requirement as gold. Since high amount of gold is preserved as inactive assets in households, attracting these assets would increase the strength of financial sector. After facility of holding gold as RR implementation, banks inclined to do that and organized various campaigns to call their customers to bring gold assets into the system.

Around July 2012, slowing down impact of Europe Debt crisis brought out in Turkey. Analyzing industrial production indexes and purchase manager indexes (PMI), we can infer that economic activity slowed down.

In this regard, CBRT implemented policies to support economic activity by decreasing lending rate gradually; in September 2012, to 10% by 150 basis points reduction, in October 2012, to 9.50% by 50 basis points reduction, in November 2012, to 9% by 50 basis points.

Before financial crisis, financial system was strongly depending on rating institutions evaluations. Financial stability was pretty sensitive to developments in rating institutions' perspective. A criticize for this regulation was about measurement and evaluation manners. Their models were commonly backward-looking structures. Hereby, they are not able to capture the impact of new policies in short term according to many scholars.

Together with the last crisis, it was justified that relying on such rating notes can bring out unfavorable outcomes. Downgrading of U.S in 2011 was an example. After the announcement, markets were affected severely expectedly. In the meantime, In November 2012, earning the title of investable country, Turkey had ''BBB-'' for its Longer Term Issuer Default Rating by Fitch. Although, a second institution is a must in order to attract many institutions around the world according to their laws, that development influenced markets immediately.

On the other hand, to be prepared for such an upgrading was considerably important. According to the studies, countries which got BBB, experienced higher growth rate, lower interest rate and appreciated domestic currency just after the rating decision. In this regard, CBRT foresaw that upgrading before and took precautionary measures gradually and prudently.

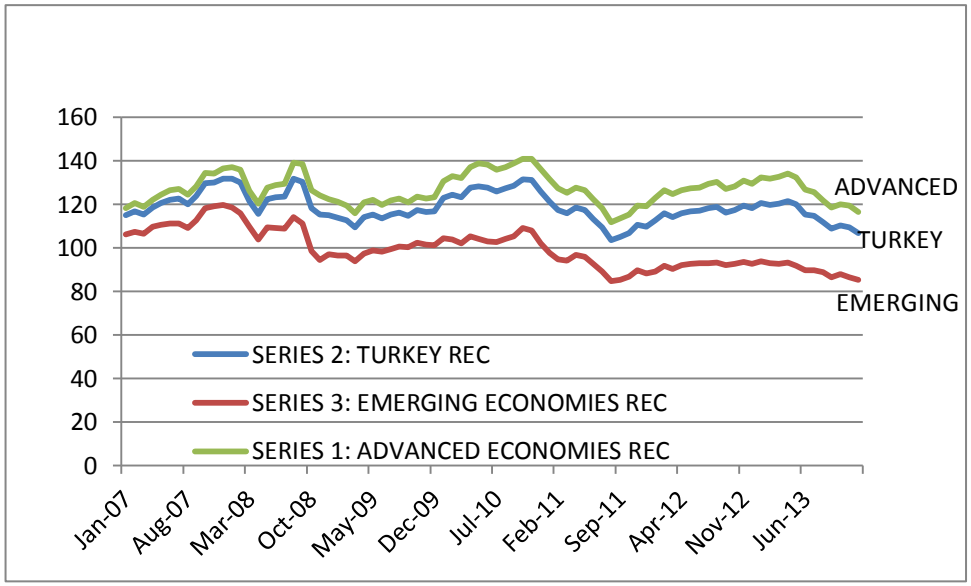


Figure 6: Real Effective Currency of Turkey and Others

Looking at reel effective currency, we can analyze the valuation of domestic currency. In November 2012, the rate reached to 119.21 (100 basis points was set for 2003). Governor Basci stated that annual appreciation over than 2% is considered as over valuation for Turkish Lira. Therefore, REC around level of 120 in 2012 is bringing a competitive and supportive domestic currency rate. However, REC above 120 points would be signal for extreme appreciation and cause CBRT to respond.

One critic point is there is no such a formal limit or target for that variable. Moreover, it is not suitable in floating exchange rate regime that a central bank announces a target real effective currency rate and pursues it. Nevertheless, as an abstract border, level of 120 can be pointed out. In this regard, CBRT may tune its borrowing rate and policy rate up owing to a further increase in real effective currency; not with an aim to stop appreciation, in order to smooth it.

Retarding effect of upper band raise in October 2011 was emerged in the second half of 2012. Credit extension and economic activity were slowed down,

inflation was getting lower. CBRT applied supportive monetary policy and pump liquidity into the market. Together with downwardness in inflation, positive signals from Euro Zone and consistency in currency path allowed central bank to lower the upper band gradually. In the end of 2012, upper band was brought to 9%.

In the end of 2012, global risk aptitude was increased, thus, capital inflow was stronger. While domestic currency is appreciating, CBRT interfered by decreasing policy interest rate by 25 basis point, to 5.50%.

Considering last quarter of 2012, CBRT settled flexible monetary policy stance as the response to global situation. Positive signals from U.S and China and solution attempts in Euro Zone were bringing out high capital inflows. Weak growth rates in advanced country were responded by quantitative easing, then liquidity emerged was ending up as inflows in emerging economies. CBRT, which aimed soft landing in 2011, was into setting 2012 as balancing growth year. Therefore, the Bank remains its macro prudential policy stance.

Quantitative easing and higher risk appetite show their effect in first quarter of 2013 via acceleration in credit extension. In order to offset capital inflow which is increasing credit extension also, CBRT decreased policy in interest rate in March 2013. On the other hand, support of ECB on Euro Zone had a decreasing effect for risks originated in the area. Then, CBRT could allow economic activity to gear up; the Bank decreased upper band gradually to 6.5% in April 2013. However, at the same time, the Bank decreased lower band and kept its flexible stance as a measure against fragile portfolio inflows and risk appetite in early 2013.

CHAPTER 3

LITERATURE REVIEW & DEFINITIONS AND CLAIMS

Literature Review

Well known interest rate rule is invented by the U.S economist John B. Taylor in 1993; the reaction function of nominal term interest rate instrument of the central bank to response to the state of the economy. In his study, he proposed a representative policy rule which implies central bank implement short term interest rate instrument to respond to price level and / or real income. That model has constituted a benchmark for many economic studies. By the time, other scholars evolved the theory by introducing augmented versions including various coefficients.

Whereas Taylor Rule originally assumed that Central Bank use past or current level of variables in its estimations, plenty of alternative models based on forward looking variables as expectations or target values, are also conducted by others.

Clarida et al. (1998, 2000) studied on a forward-looking version of Taylor Rule for U.S, Germany, Japan, UK, France, Italy. In ‘’Monetary Policy Rules in Practice Some International Evidence (1998)’’, they concluded observed countries follow Implicit Inflation targeting since 1979 and allowed for output stabilization. Expected inflation is selected to establish a forward-looking model. In the study, it is pointed that coefficient of inflation variable should be bigger than ‘1’ in case

evaluated country implement inflation targeting regime. Our results are also based on the theory introduced in this study.

Fourçans and Vranceanu (2004) compared model with current inflation and model future inflation deviate from target inflation for ECB in Jan 1999 and Oct 2003. They observed little response to current inflation derives and stronger response to future inflation. Saver and Sturm (2007) studied for different Taylor rules for ECB, which used ex-post data, real time data, forward-looking data in order to answer whether ECB, in its first years of existence under the presidency of Mr. Duisenberg, followed a stabilizing or a destabilizing rule.

In model specification, including or excluding macroeconomic variables is another debate in the literature. Inflation targeting central banks react to changes of some macro variables such as exchange rate, money supply, asset prices, etc. which might have direct or indirect effect on inflation.

Most commonly used variable among all is exchange rate. Taylor (2001) explores for the role of the exchange rate in monetary policy. He stated that monetary policy rules which response to exchange rate, inflation and output at the same time, do not work much better in stabilizing inflation and real output. The result may be even worse than policy rules based on exchange rate. Fourçans and Vranceanu (2004) suggested exchange rate as a factor ECB reacts in its monetary policy. They present evidence that deviation of exchange rate from its average is supposed to be in the reaction function of ECB. Similar results are found for U.S, England and Japan by Chadha et al (2004).

Surico (2007) researched first six years of ECB with a general framework. He suggested a model implying distinct levels of reactions of ECB due to whether

contractions or expansions of output or level of the interest rate. In that study, he rejected the hypothesis of M3 growth-rate targeting for ECB monetary policy. The role of asset prices is also evaluated in many articles. No consensus has been reached; Cecchetti et al. (2000), Borio and Lowe (2002), Goodhart and Hofmann (2002), Chadha et al. (2004) and Rotondi and Vaciago (2005) expressed the importance of the target asset prices and presented evidence that central banks react it. However, Bernanke and Gertler (1999, 2001) and Bullard and Schaling (2002) put contrary perspective and reported that monetary authorities should not response to asset prices.

Financial stability and its position in monetary policy have been debated frequently. In classic specification of Taylor rule, financial conditions are not included in the model. Manners to establish a model taking financial stability account is very possible by placing exchange rate or other financial variables. In literature, Driffill et al (2006) and Montagnoli and Napolitano (2005) conducted important studies placing financial stability in monetary policy reaction function. Driffill analyzed the interaction between monetary policy and the futures market and supported futures prices variable. Montagnoli and Napolitano built a financial conditional indicator to present a more accurate model for a monetary policy authority aiming financial stability. They put foreign exchange rate, share prices and house prices to constitute the financial indicator.

Plenty of studies are also conducted for the Central Bank of Republic of Turkey (CBRT). Kesriyeli and Yalcin (1998) is one of them. Applying the model for the period between 1987 and 1998, they implied Taylor rule kind monetary policy is not efficient for Turkish economy because of chronic inflation experienced in those years, in case the goal is to achieve stable and low inflation rates.

Ongan (2004) suggests a Taylor rule model for CBRT for 1998-2003. He set short term nominal interest rate, inflation rate, output gap, nominal foreign exchange rate as independent variables. He concluded a significant relationship between short term interest rate and inflation and nominal exchange rate. Çağlayan (2005) aimed to find out the role of output gap and inflation in CBRT reaction function for 1990-2004. She used a multi nominal logit model and concluded that output gap is responded by CBRT. However, because these two studies are based on periods which have crucial breakdowns (2002; switching to implicit inflation targeting), their results can be questioned.

Considering the period from Jan 1990 to Oct 2000, Berument and Tasci (2004) estimated a forward-looking reaction function for CBRT. Instead of short term interest rate, they set spread between interbank interest rate and depreciation of local currency and included money growth, industrial production, foreign reserves and target inflation as responded variables. Matching with the expectations, they found out CBRT had not targeted the future inflation. Instead, national output, industrial production index was targeted.

Yazgan and Yilmazkuday (2007) presented a forward-looking monetary policy rule for Turkey for the period between August 2001 and April 2004. They found Taylor rule model responding to inflation deviation from target and output gap, is valid for CBRT. Money growth, real exchange rate, and deviation of the real exchange rate from an ‘‘equilibrium’’ level are observed insignificant in the model.

Aklan and Nargelecekenler (2008a) applied Generalized Methods of moments (GMM) to analyze CBRT policies in 2002-2006. They concluded that CBRT has a reaction function with inflation rate, output gap and exchange rate.

Aklan and Nargelecekenler (2008b) also conducted another study for 2001-2006 by the same methodology. They compared coefficients of inflation rate and output gap for before and after 2001 crisis and they found that after the crisis, CBRT react to both inflation and output gap stronger than before.

In order to verify alteration in monetary policy of CBRT in 2002, Onur (2008) examined a long period (1985-2005) by co integration and granger causality analyses. In her study, she supported the achievement of inflation targeting regime between 2002 and 2005. Tales and Zaian (2009) worked on twelve emerging countries. They implemented TAR methodology and implied that Turkey, together with Poland and Brazil, apply Taylor rule type monetary policy.

Civcir and Akcaglayan (2009) investigated the role of exchange rate in monetary policy decision of CBRT. They conducted VAR model over the periods 1987-2001 and 2002-2009. Whereas models shows that strong pass-through during whole period is valid, they stated that CBRT had set exchange rate target and gave huge weigh to catch it in the post-crisis period.

Definitions and Claims

In this section, key terms of the study were defined and how they are implemented was accounted for briefly.

Overnight Lending Rate (Upper Band): Lending rate is the price of money set by CBRT. Economic parties apply to CBRT in order to utilize overnight credit in case they coud not saturate their needs by weekly repo auctions. It is called upper band of interest rate corridor also.

Upper band constitute a ceiling level for possible market interest rate in the economy. Whereas central bank provides liquidity to the market in policy rate, decreasing amount of fund provided in auction, bank may lead market interest rate to approach to upper band. In this regard, economic agents foreseen market rates fluctuate in that range and take their positions to minimize their financial risks. In practice, the study claims that upper band operates parallel to policy interest rate regarding effect on economic activity. Higher upper band means low economic activity and lower internal demand which would decrease credit extension and current account deficit. Therefore, the Bank increases upper band in case of high credit extension and current account deficit. In this regard, it is claimed that after May of 2010 when central bank begun to apply interest rate corridor tool to steer financial stability, relationship between upper gap and mentioned financial stability indicators, credit extension and current account deficit is on positive direction.

Overnight Borrowing Rate (Lower Band): Borrowing rate is deposit interest rate of CBRT. Bank can deposit their asset to central bank to get advantage of that rate. Lower band is the lowest interest rate in the market. Other parties do not offer less than it, because ‘’Lower Band’ is provided by central bank in limitless amount.

Moreover, it is the limit that market interest rate can decrease to. When central bank pumps excess amount of liquidity to the market, market interest rate would approach to the lower band and stop there. In this regard, foreign investors take their position and make the decision to bring their funds to the market or not. Because lower interest rate means lower return, foreign flows will slow down under lower band implemention. Consequently, domestic currency will depreciate. In this regard, Central Bank utilizes this tool by decreasing under over appreciated domestic currency in order to balance financial activities. Therefore, this study claims negative relationship between lower band and reel effective currency.

One Week Repo Rate (Policy Rate): CBRT organizes weekly repo auctions with the fix rate determined in monetary policy committee meeting once in month. CBRT steers the demand to other liquidity resources by changing the fund amount provided by weekly auctions of CBRT. Consequently, market interest rates are leaded. Policy interest rate is the main weapon of the bank to provide price stability. However, the Bank begun to apply this tool also in order to provide financial stability after May of 2010 when central bank begun to applied interest rate corridor tool to steer financial stability. Therefore, this study claims that additional financial indicator variables should be included in central bank response function.

Total Gap (Gap between Lending Rate and Borrowing Rate): Total gap is defined as difference of upper band and lower band of interest rate corridor. That difference is an indicator for central bank monetary policy stance. In case of higher gap (lower gap), monetary stance is considered as tightening policy (easing policy).

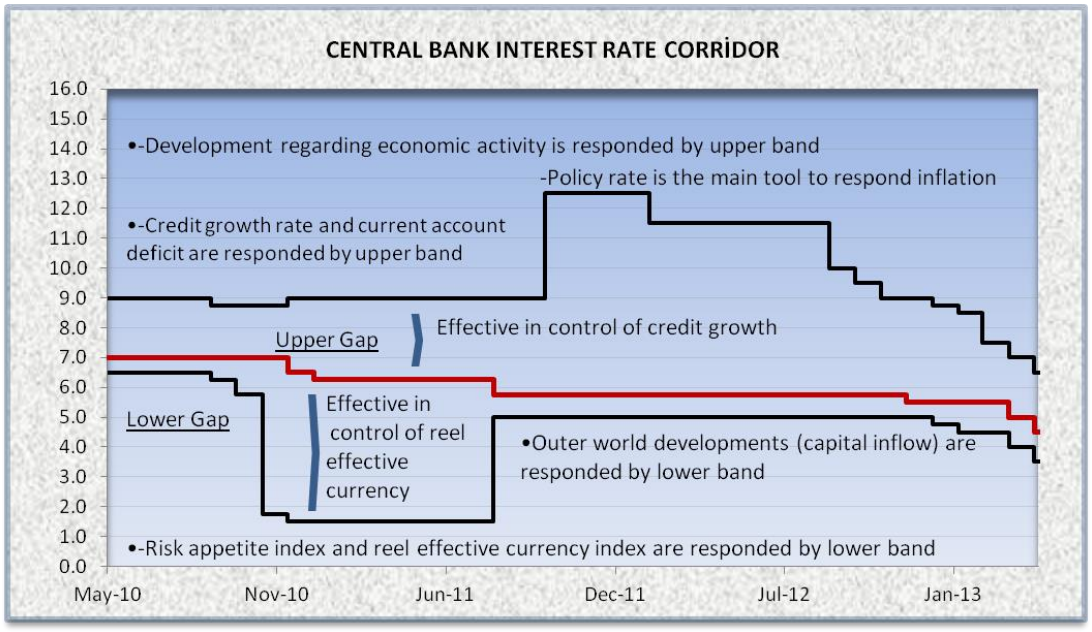


Figure 7: Interest Rate Corridor

Upper Gap (Gap between Lending Rate and One Week Repo Rate): Upper gap is the difference between upper band of corridor and policy rate. This gap is important for parties to determine whether to attend one week repo auction or borrow credit from borrowing rate (upper band). Parties take into account that gap together with potential liquidity need during the day in order to figure out opportunity cost of different funding manner. Higher upper gap means prudent monetary policy and higher possible market interest rate. In this environment, internal demand and naturally economic activity decreases. Consequently, credit extension and current account deficit decelerate owing to lower economic activity. In this regard, this study claims negative relationship between upper gap and financial indicators, credit extension and current account deficit.

Lower Gap (Gap between One Week Repo Rate and Borrowing Rate): It is the difference between policy interest rate and lower band of the corridor. The

variable is an indicator for foreign investors to evaluate the opportunity in the market. Smaller lower gap makes financial market more attractive regarding lower risk and smaller space to volatility in return for funds. In this regard, low lower gap would attract foreign investment and would cause domestic currency to appreciate. Therefore, this study claims negative directed response of reel effective currency against lower band policy implementation.

CHAPTER 4

MODEL

Policy Interest Rate

Well known monetary policy rule; Taylor Rule is implemented to analyze reaction function of CBRT in two periods. Differences of monetary policies in two periods are investigated by the help of OLS estimations results.

Taylor rule is derived from a loss function that central bank targets to minimize by controlling nominal interest rate. Owing to basis of inflation targeting regime, traditional variables put into the model have been deviation of inflation rate from announced inflation target and output gap in literature.

When the rule first introduced by John B. Taylor (1993), he applied the model for FED's monetary policy as below;

Equation 1:

$$i_t = \pi_t + r^* + a_\pi * (\pi_t - \pi_t^*) + a_y * (y_t - y_t^*)$$

It was claimed that central bank increases and decreases nominal interest rate as a response of changes in inflation rate, difference between inflation rate and inflation target and deviation of realized output from natural level of output. In this equation, "i_t" represents for nominal interest rate, which is controlled by central bank and "r^*" is equilibrium interest rate. "π_t" is inflation rate and "π_t^*" is inflation target announced by central bank. "y_t" is realized output produced in the economy and "y_t^*" is natural level of output.

In this equation, both "a_π" and "a_y" were supposed to be positive (as a rough rule of thumb) and Taylor's 1993 paper proposed setting was "$a_y = a_\pi = 0.5$" for the coefficient, which means Central Bank weigh equally to inflation stabilization and economic activity. He also assumed unnounced inflation target of FED was 2%. In the meantime, Clarida et al. (1998, 2000) stated that inflation targeting central bank should provide following condition in its reaction function; "$a_\pi > 1$".

However, along last twenty years, model is improved and adjusted for other central banks in different eras. Basically, factors resonded are differed depending on priority of their monetary policy. In this study, we intended to establish proper version of the model for CBRT under inflation targeting regime and new monetary policy structure. Then we checked whether CBRT implement inflation targeting regime in both periods.

As the law of Bank says; "The primary objective of the Bank shall be to achieve and maintain price stability". Bank supports economic growth in the meantime. In this regard, following equation (equation 2) was estimated.

Equation 2: Reaction function of CBRT

$$pr_t = r\ + \alpha * (\pi_{t-1} - \pi^*_{t-1}) + \beta * (y_{t-1} - y^*_{t-1})$$

Policy interest rate is denominated as "pr_t" in our model. Policy rate of CBRT had been set as borrowing interest rate before 2010 May and it has been set as one-week repo rate after 2010 May by implementation of new policy structure.

"r_t" is the real interest rate and equilibrium interest rate in the model. Equilibrium interest rate is the interest rate which satisfies the market in case of there is no inflation gap and output gap. Another interpretation for equilibrium interest rate

in the Taylor Rule is that it captures other factors that might be crucial for monetary policy. For instance, effect of financial indicators such as credit growth and/or current account deficit or other macro variable can be included in the model.

Inflation targeting regime in monetary policy has been failed around the world by hit of 2008-2009 financial crisis and Euro Zone Crisis. Before, it was believed that central banks can stable economies by targeting price stability. After financial shocks, it became obvious that price stabilization is not enough by itself to provide stabilization in economies. Under those circumstances, financial stability became a debated issue. Would central banks consider financial stability as a goal?

As many other advanced and emerging countries did, Turkey begun to research for new policies to challenge with financial crisis and its upcoming effects. CBRT have stated importance of financial stability and set it as the completing ultimate target together with price stability.

CBRT publishes various reports and summary in order to communicate with market and explain its policies. One of them is Monetary Policy Committee (MPC) meeting reports monthly published. In this report, monthly developments and how central bank responds to them are expressed in briefly. In those reports, it can be seen that CBRT put emphasis on financial stability along the Euro Zone crisis and just after new policy structure implementation.

In the table below, how many times expressions of ‘’financial stability’’ and ‘’price stability’’ are demonstrated between January 2009 and December 2011.

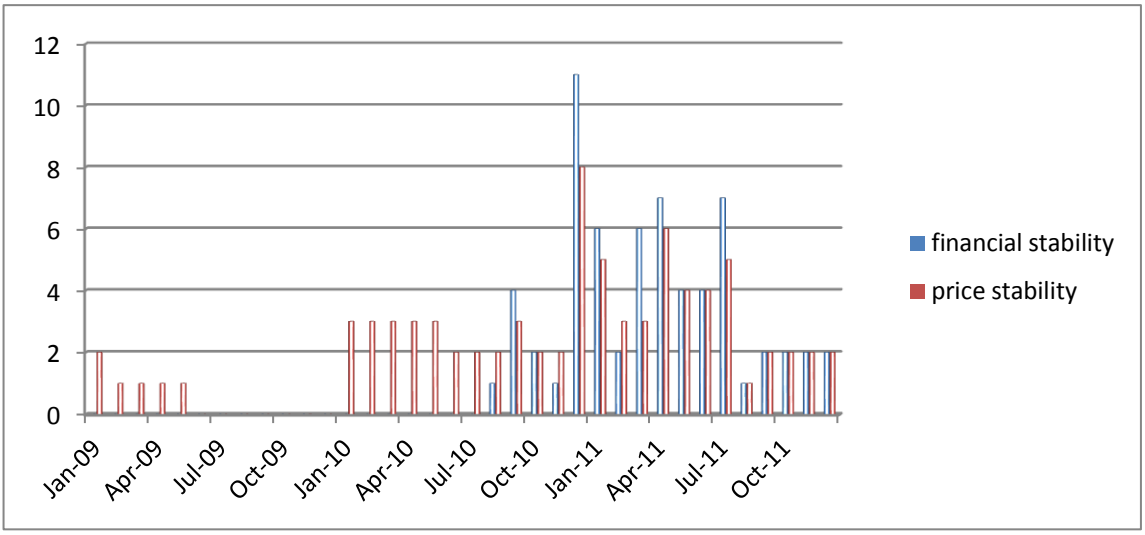


Figure 7: Mention Amount of Key Words in MPC Report Summery

As it is clear in the table, CBRT has begun to mention financial stability (demonstrated with blue), just after implementation of new policy structure in May 2010. Another point here is the Bank has never ignored price stability. Furthermore, in reports, it is carefully stressed that ultimate goal of CBRT is ‘’price stability’’. Numbers of both expressions proceeded parallel to each other. In this regard, CBRT tried to convince economic agents that the Bank kept implementing inflation targeting regime.

As mentioned before, CBRT has implemented a new monetary policy structure since May 2010. Interest rate corridor was deployed and policy interest rate was set as one week repo auction rate. As a liquidity control mechanism, interest rate corridor has changed the concept of monetary policy of CBRT. In this regard, it is claimed that May 2010 constitutes a structural break point in monetary policy of CBRT. In order to test that claim, we practiced Chow structural break test and obtained following results.

Table 1: Chow Breakpoint Test Results

Chow Breakpoint Test			
H_0: *No breaks at specified breakpoints*			
H_1: *There are breaks at specified breakpoints*			
Specified breakpoint: 2010 May			
Equation Sample:	2006 January – 2013 June		
F-statistic: 100,2355	<	Wald Statistic: 400,9418	
H_0 *is rejected*			

According to the results of the test, there is a breakpoint in May 2010. Thus, two periods should be evaluated separately. In this regard, first period was estimated according to ‘’equation 2’’.

Under the new policy structure, financial stability became an important issue. Instead of sole policy interest rate, CBRT possessed also the interest rate corridor and its components. The Bank altered the way to respond to development regarding financial stability and price stability owing to two conceptual reasons. First one is cyclical; the era (May 2010- June 2013) required different strategies comparing to before owing to global crisis. Second one is conceptual; under new policy structure, functions of each interest rate and gap are tuned up.

Analyzing cyclically, we need to consider the conditions caused by global financial crisis and Euro Zone debt crisis shock waves. As mentioned in previous section, CBRT aimed to achieve soft landing in 2011 and balanced growth in 2012.

In this regard, instead of supporting economic activity directly, CBRT preferred to balance internal and external demand, credit extension and volatility of domestic currency in order to provide stability and sustainability of economic growth. Therefore, new monetary policy rule model for policy interest rate was claimed as in equation 3.

Equation 3:

$$pr_t = c + a_1 * \pi_{t-1}^{gap} + a_2 * cre_{t-1}^{gap} + a_3 * rec_t^{gap} + a_4 * cad_{t-1}^{12m}$$

In this analysis, Taylor Rule of CBRT was modified according to the properties of the period. In this regard, financial indicators were added to the model and additional equations are estimated for upper band and lower band of interest rate corridor.

In order to include financial variables into the reaction function of central bank, some reference values were assumed and calculated as target values for financial indicators. Thus, central bank was assumed to be responding deviations from target (reference) value of relevant financial variable. Mentioned reference values were selected according to Governor Basci conferences and speeches.

Credit extension has been a substantial issue for Turkey Economy along the era. As a result of sharp interest rate cut during the first shock of the crisis, economic activity accelerated and effects were reflected on credit growth rate. Central Bank intended to slow down credit extension in order to stabilize economy and prevent a bust after boom. In this regard, 15% annually credit growth rate was stated as a reference value by Governor Basci during his speeches in many meetings (one in Mardin chamber of trade and industry in 03.04.2013). Thus, a target (reference) total

internal credit amount is calculated and its difference with actual internal credit amount was named as credit gap. Credit volume data was obtained from central bank database. Growth rate calculated in the study is annually changing rate and in monthly basis.

Current account deficit has become a chronic problem of Turkish Economy. Unbalanced high internal demand and low external demand in related period escalated financial risk. In order to analyze yearly change and eliminating seasonal effect, current account deficit data is turned into 12 month average. Both for credit extension and current account deficit, data of a specific month are announced to the public in following month. So the bank has not current data during MPC, but one period lagged data is available. Therefore, backward looking variables were used for credit growth and current account deficit.

Taylor rule is modified for various central banks in literature. Most common adjustment is to include foreign exchange rate variable into the model. The importance of currency is undeniable in providing price and financial stability. In this regard, CBRT stated that valuation of domestic currency is monitored carefully and responded in case of over appreciation or depreciation. In this study, reel effective currency was selected as indicator for domestic currency valuation and tha date was taken from central bank database.

Communicating a reference value for reel effective currency is quite sensitive task. Because, there exists a risk to be misunderstood by the market, as Central Bank targets an exchange rate level. If it was so, it would be an exchange rate targeting regime, then it would not be an inflation targeting regime. Therefore, Governor Basci stressed often that CBRT does not target a specific reel effective currency (REC)

level. However, he whispered %2 annually appreciation in domestic currency is a preferable level for Turkish Economy and for the Bank's financial stability target.

In 2003, REC value is set as 100 as base point in our data. In one speech, he stated border of 120 as reference value for the end of 2012. CBRT would respond to REC which is pretty higher or lower than reference level in the end of 2012. In this regard, a reference series is produced according to %2 appreciation rate and its difference from realized REC was defined as REC gap in this study.

The other selected indicator is risk appetite index, VIX. VIX is announced by Chicago Option Market and calculated according to the option prices in this market. It simply measures the fear and risk appetite in the market. In order to include in our models, daily VIX data taken from Bloomberg, was turned in to monthly frame by taking arithmetic average.

Upper Band and Lower Band

In new monetary policy structure, borrowing interest rate and lending interest rate are utilized by the Bank to reach the monetary policy targets. Although these interest rates do not have the same functionality and, in the literature, they were not modeled as policy interest rate, similar regressions can be built in order to explain CBRT strategies regarding implementation of these instruments. Borrowing rate and lending rate are called lower band and upper band in the study.

Owing to functionality of upper and lower band, CBRT uses each rate for distinct targets. As it can be inferred from section 3, upper band of the corridor is altered more likely to respond development in internal market and financial variables related with economic activity. In the meantime, lower band is managed to react against development regarding outer world and financial variable such as reel effective currency. In this regard, alternatives model for two bands were estimated by OLS.

Firstly, upper band is regressed only on credit gap and current account deficit. In this model, it is assumed that the Bank controls the upper band to respond those financial variables related with economical activity and internal economy directly. Constant variable in the regression represents natural value of upper band. It would be the rate that happens in case credit extension is in aimed level and 12 months average of current account deficit is stable.

Equation 4:

$$\dot{ub}_t = c + \alpha_1 * cr_{t-1}^{gap} + \alpha_2 * d(cad_t^{12m})$$

In order to test whether position of policy interest rate matters in determination of upper band of the corridor or not, Model 6 was estimated. Significant coefficient for policy interest rate in this estimation would mean that CBRT choose upper band also according to the position of policy interest rate.

Including traditional Taylor Rule variables and other financial indicators to the model, we tested potential alternative strategies for implementation of upper band in model 7 and model 8.

Lastly, supported policy interest rate reaction function model in this study was regressed also for upper band. Probability of employing two rates in the same way of strategy was tested in this estimation (model 9).

Similar estimations are conducted for lower band. It is claimed that CBRT uses borrowing interest rate to respond to developments in outer world. CBRT takes position by decreasing or increasing lower band in order to decrease financial risks caused by global market condition. For example, in case of high global risk appetite, the Bank prefers to have flexibility to cut interest rate immediately in order to prevent excessive amount of foreign inflow which would appreciate domestic currency and cause financial instability ultimately.

In this regard, REC gap and VIX index were taken as financial indicator in lower band estimations. Model 10 was estimated with reel effective currency gap and VIX.

Equation 5:

$$lb_t = c + \alpha_1 * rec_t^{gap} + \alpha_2 * vix_t$$

After that, in model 11, as it was done for upper band estimation, policy interest rate was included to the regression of lower band reaction function. It was tested if CBRT takes positioning of policy interest rate into account in determination of lower band.

In model 12, classic Taylor Rule model variables; inflation gap and output gap were added into the model. Whether output gap and inflation gap are also responded by the lower band was tested. A broader model was established by adding also variables that are assumed to be related with economical activity in model 13.

In order to slow credit extension down, CBRT would decrease demand on financial markets by implementing higher lending rates. However, credit extension might be caused also by high capital foreign inflow. In this regard, lower band policy implementation can be made to lower capital inflow. In this situation, lower band is implemented to respond to development in credit extension. In model 14, such implementation was tested by including credit extension variable into the regression.

Another strong assumption is that CBRT follows lagged value of reel effective currency gap. The critial point here is when lower band is determined in the middle of the month (in monetary policy committee), reel effective currency data of the month is not yet completed and actualized. Therefore, rest of the data after new lower band rate is affected by new lower band rate selected in the current month. In order to overcome this problem, we established model 15 with both level value and one period lagged value of REC gap.

Lastly, claimed policy interest rate reaction function model was regressed also for lower band. Whether CBRT employs borrowing rate and policy rate in the same way was tested in Model 16.

Upper Gap and Lower Gap

Undiscovered components of the interest rate corridor are gaps between rates. These gaps enable the Bank implement flexible monetary policies and respond to the development in a short time horizon. In monetary policy, wide bands between rates are implemented as prudential policies, whereas narrow bands mean easing policies.

It is claimed that gaps between rates are implemented as instruments after May 2010. However, the analysis of such hypothesis is not easy. In the regression that set a gap as dependent variable, it is not clear if estimator explains changes in one rate of corridor or gap between these rates. For instance, in the model setting upper gap as dependent variable, in case of a change in upper gap, it means change in either upper band or policy rate. CBRT might respond to the development in anyway. Therefore, OLS model estimations are not favorable for this analysis.

In this regard, Vector Auto Regressive Models were conducted in order to detect the relationship between financial variables and gaps in new monetary policy structure. For two periods; before and after May 2010, upper band model was estimated for gap between upper band and policy interest rate by Vector Auto Regressive Model. Later, by the help of impulse response function graphs, influences of gaps on variables are evaluated.

In upper gap analysis, it was suggested that the gap has two sided influence on time series of current account deficit and credit extension which are financial stability variables included in supported upper band reaction function in this study. VAR model 17 was estimated for upper gap.

Equation 6-7-8

$$gapup_t = c + a_1 * gapup_{t-1} + a_2 * gapup_{t-2} + a_3 * d(cad_{t-1}^{12m}) + a_4 * d(cad_{t-2}^{12m}) + a_5 * cr_{t-1}^{gap} + a_6 * cr_{t-2}^{gap}$$

$$d(cad_t^{12m}) = c + b_1 * gapup_{t-1} + b_2 * gapup_{t-2} + b_3 * d(cad_{t-1}^{12m}) + b_4 * d(cad_{t-2}^{12m}) + b_5 * cr_{t-1}^{gap} + b_6 * cr_{t-2}^{gap}$$

$$cr_t^{gap} = c + d_1 * gapup_{t-1} + d_2 * gapup_{t-2} + d_3 * d(cad_{t-1}^{12m}) + d_4 * d(cad_{t-2}^{12m}) + d_5 * cr_{t-1}^{gap} + d_6 * cr_{t-2}^{gap}$$

Before May 2010, policy interest rate was defined as borrowing rate. So, there was no gap between lower band and policy interest rate before May 2010. Consequently, analyze made for upper gap cannot be replicated for lower gap. Two periods cannot be compared. However, in order to test the effect of gap change in financial indicator, VAR model was estimated for lower gap only for second period. In the model, lower gap and REC gap were taken as endogenous variables, whereas VIX was set as exogenous variable.

Equation 9-10:

$$gaplow_t = c + a_1 * gaplow_{t-1} + a_2 * gaplow_{t-2} + a_3 * rec_{t-1}^{gap} + a_4 * rec_{t-2}^{gap} + a_5 * vix_t$$

$$rec_t^{gap} = c + b_1 * gaplow_{t-1} + b_2 * gaplow_{t-2} + b_3 * rec_{t-1}^{gap} + b_4 * rec_{t-2}^{gap} + b_5 * vix_t$$

CHAPTER 6

DATA

In this study, primary target is evaluating alteration in monetary policy of CBRT in new monetary policy structure period. We searched for the differences and main framework of new policy tool, interest rate corridor of CBRT. In this regard, time period between January 2006 and June 2013 is chosen as sample. Then, May 2010, the beginning of new policy structure and interest rate corridor implementation, was tested if constituting a break point to test. Then, we aimed for establishing models for period after May 2010.

Explicitly inflation targeting regime in Turkey has begun in 2006. Therefore, we set the beginning of our sample as January 2006. However, since interest rate corridor is a brand new policy yet, there is not pretty long data to analyze. Thus, lack of data is one weak point of this study.

Because dependent variable of the study, nominal interest rate, which is policy interest rate of CBRT, was determined and announced once in a month, monthly basis data was applied in models.

For inflation indicator, consumer price index date was obtained from central bank database and annual changes were calculated in monthly basis. Inflation target is denoted in formulas as "π_{t-1}^{a}", which is announced by CBRT annually as in the table below. Then, interpolation method was applied to turn annual target rates into monthly data.

Table 2: Inflation targets of CBRT for years

Year	2006	2007	2008	2009	2010	2011	2012	2013
Target	%5	%4	%4	%7.5*	%6.5	%5.5	%5	%5

In 3 June 2008, CBRT sent an open letter to government and updated inflation targets for 2009 and 2010. Inflation targets for 2009 and 2010 were %4 before the letter. Then, it was updated as 7.5% for 2009 and 6.5% 2010 and set as 5.5% for 2011 in this letter. That modification was taken into account in the interpolation.

Equation 11:

$$\pi^{a}_{(t)i} = \frac{(12-i)}{12} * \pi^{a}_{(t)} + \frac{(i)}{12} * \pi^{a}_{(t+1)}$$

By this equation, inflation target was calculated as 12 months a head target in the current month. In this formula, (i) stands for the month of the year. If it is June, it means i=6. So inflation target of June composed of %50 of current year target and %50 of next year target.

In order to obtain montly basis output variable, quarterly GDP data was interpolated by the help of industrial production index (ipi). Industrial production index was taken as determiner of GDP shares of months into a quarter.

Equation 12:

$$y_i = \left(\frac{ipi_i}{ipi_Q}\right) * y_Q$$

Whereas (i) stands for a specific month in the quarter, Q defines the quarter, that month in. (ipi) is industrial production index data obtained from central bank database. Natural level of output was calculated by the help of Hodrick- Prescott Filter (1980).

OLS approach was deployed in this study to estimate the Taylor rule of CBRT. In literature, there exist various approaches regarding choice of variable's time. Some prefers forward-looking model with expected variables, some employs backward-looking model as in this study. At the moment, CBRT makes the decision about policy rate, inflation and output variables are not available to put into the model. So, we assume that it is suitable to employ one period lagged variable for output and inflation series.

In the rest of the study, difference between inflation rate and inflation target is defined as inflation gap and difference between actual level of output and natural level of output is defined as output gap.

After modeling Taylor Rule of CBRT for January 2006- June 2013, validity of breaking point May 2010 was tested by Chow Structural Breakpoint Test (1960). In this test, coefficient in the model are evaluated and determined if they are statistically same for periods after and before May 2010.

As a must in a time series analyze, we tested stationary in series in order to elude the risk of obtaining spurious regression. In this regard, Dickey-Fuller (1979) and Phillips Perron (1998) Tests were employed to test unit root in the series. Series in data sample are detected as I(1). Then we tested cointegration. Taking Gujarati's text book; forth edition of Basic Econometrics as a reference, it is considered that the traditional regression methodology (including the t and F tests) is applicable to data involving (nonstationary) time series. In this regard, since cointegration between variables could be detected, OLS models could be applied. Results of tests can be seen in appendix section.

CHAPTER 7

ESTIMATION RESULTS

Policy Interest Rate

Monetary policy rule was estimated for whole period as in model 1. Analyzing the results, we observed that the model has low determination coefficient and coefficient of output gap is not significant according to %5 confidence levels.

Table 3: OLS Results for Policy Interest Rate Estimate

Policy Rate	**Model 1 (2006.01-2013.06)**	**Model 2 (2006.01-2010.04)**	**Model 3 (2010.05-2013.06)**	**Model 4 (2010.05-2013.06)**
C	10.36	9.35	6.35	6.84
	0	*0*	*0*	*0*
RECGAP			0.0249	0.0447
			*1.967***	*2.863****
RECGAP (-1)				-0.0316
				*-2.011***
CREGAP (-1)			0.0147	0.013
			*3.956****	*3.550****
CAD_12m (-1)			0.000272	0.00036
			*3.887****	*3.406****
INFGAP(-1)	0.116	1.1235	0.0128	0.0127
	*3.059****	*10.38****	*4.441****	*4.619****
YGAP(-1)	0.00088	0.0016		
	1.317	*4.711****		
R2	0.12	0.76	0.75	0.78

*Significant in %10 confidence level, ** Significant in %5 confidence level, *** Significant in %1 confidence level.

As for Model 2, when the same specification was applied only for period 1, this time, coefficients in the regression were obtained significant in 1% confidence level. Coefficient of inflation gap variable is bigger than "1" as it should be in an inflation targeting regime (Clarida et al. 1998, 2000). Moreover, signs of inflation

gap and output gap were observed as expected. CBRT increases policy interest rate when inflation is higher than its target and output is higher than natural level. Consequently, we concluded that CBRT implemented inflation targeting regime between 2006 June and 2010 May, as it is claimed by the Bank.

As for new period, modified monetary policy was estimated and following results were obtained in Model 3.

Central Bank has not been responded directly against development in economic activity as it did before May 2010. Instead, the Bank intended to control financial variables closely related to economic growth. Credit gap is very substantial one among them, as a financial stability variable. After the first shock of financial crisis in 2008-2009 and sharp interest rate decline in Turkey, economic activity increased considerably. Consequently, growth rate in 2010 was 8.9%. Credit extension had an undeniable role in this process. In this same period, internal annual credit extension rate reached to 40% in the end of 2010. Such high credit growth constitutes systemic risk for financial market. Therefore, CBRT aimed to balance credit extension. In the ‘’model 3’’, credit gap has a significant and positive coefficient. As it was expected, increase in credit gap is responded by increase in policy rate.

High economic growth and internal demand brought about high current account deficit when it is combined with low external demand caused by Euro Zone Crisis in 2010. As another very important variable for financial stability, current account deficit has been carefully evaluated and intervened by CBRT during the era. In this regard, current account deficit was added into the reaction function of CBRT. The Bank aims to provide balance of internal and external demand. Thus, it is

expected that CBRT would increase policy rate to slow down economic activity in case of high current account deficit. Observed significant and positive coefficient of current account deficit in the model 3 means the Bank responds to this financial variable in second period.

Volatility of domestic currency became another important point mentioned often by CBRT. Among other emerging economy currencies, Turkish Lira was one of the most stable one. Governor Basci stated this achievement many times and claimed that CBRT would respond to extreme appreciation or depreciation of the currency.

Central bank might respond to REC gap variable in different ways according to the situation. High level of foreign inflow may create systemic risk in financial market and cause domestic currency to appreciate. In this case, CBRT decreases the interest rate to discourage foreign inflow. So, the sign of REC gap coefficient is expected to be negative. On the other hand, over appreciated currency causes high consumption and disruption in balance of payment. In this case, CBRT may increase interest rate to courage agents to save instead of consuming. Thus, both signs can be expected for REC gap variable.

Most important outcome of the study was obtained in the results of model 3. CBRT implemented inflation targeting regime before May 2010. Moreover the Bank claims that inflation targeting is still the ultimate target in monetary policy. However, inflation gap coefficient in model 3 implies that CBRT actually changed its main targeting and does not implement inflation targeting regime anymore. Because, in Taylor Rule estimation, inflation gap coefficient should be over than '1' for a central bank aims for inflation targeting (Clarida et al. 1998, 2000). Whereas, reaction

function estimated for before May 2010 obeys this condition, in model 3, inflation gap coefficient was obtained '0.0128'. It means; CBRT continues to respond to inflation development. However, the Bank aims for financial stability and does not implement inflation targeting regime.

In Model 4, lagged value of REC gap was included to the model together with its level value. In the result table, it is seen that lagged value of REC gap has negative sign. It can be interpreted as follows; Central Bank announces monetary policy decision in the middle of the month (usually between 16^{th} and 20^{th} day of the month). So effect of new policy implementation reflects to financial indicator of ongoing month. Owing to fast transmission channel in reel effective currency, it might be the reason to obtain positive relationship between level value of REC and nominal interest rate. Because, when CBRT increases policy interest rate and encourages foreign inflow, then increase in foreign fund in the market causes appreciation in domestic currency. It means REC would increase. However, lagged value of REC gap does not contain that problem. The Bank observes the data and responds to it. In order to balance an appreciation pressure, the Bank decreases nominal rates. So, lagged value of the financial indicator has negative sign.

Upper Band and Lower Band

In Table 4, estimation results of upper band are given. First column is main model. In main model (Model 5), two main financial variables related with economic activity and internal economy, were included together with a constant. According to the model, CBRT increases upper band in case of high credit extension and/or an increase of current account deficit comparing to previous period. In that model, constant represents for a natural level of upper band. It is approximately 7.5% in first regression. All variables in the first model are significant and determination coefficient is 55%, which can be accepted as a good level.

Upper and lower band of the corridor constitute a system that has different meanings according to comparative positions of upper band, policy interest rate and lower band. In this regard, policy interest rate can be claimed as a determiner in upper band reaction function.

In model 6, coefficients are all significant. Pretty high determination ratio is obtained. In this model, it is concluded that comparative position of policy interest rate affects central bank upper band decision, which means upper gap (between upper band and policy rate) is not just a gap. But it is a policy tool, too.

Another claim might be that upper band responds to classic Taylor Rule variables. Inflation gap and output gap were included to the model. In Model 7, these classic monetary policy variables are regressed with related financial variables and, in Model 8, other financial variables were also included to the model. In both regressions, significant estimations cannot be obtained.

Table 4: OLS Results for Upper Band Estimate

Upper Band	**Model 5***	**Model 6**	**Model 7**	**Model 8**	**Model 9**	**(Model 4) PR**
C	7,559		8.03	6,86	4,06	6.35
	15,74		*17,7*	*6,64*	*2,71*	*0*
PR		1,22				
		*17,26****				
RECGAP				0,040	0,085	0.0249
				1,26	*2,11**	*1.967***
VIX				0,010		
				0,313		
CREGAP(-1)	0,038	0,044	0,031	0,048	-0,0144	0.0147
	*5,23****	*6,83****	*4,56****	*3,10****	*-1,22*	*3.956****
D(CAD12m(-1))	0,0066	0,0083	0,0057	0,0066	[-0.0011]	0.000272
	*6,29****	*9,09****	*5,84****	*5,36****	*-4,85****	*3.887****
INFGAP(-1)			0,029	0,025	0.039	0.0128
			*3,21****	*2,44***	*4,24****	*4.441****
YGAP(-1)			0.00003	-0,00004		
			1,122	*-0,163*		
R2	*0,55*	*0,61*	*0,66*	*0,68*	*0,64*	*0,75*

*Significant in %10 confidence level, ** Significant in %5 confidence level, *** Significant in %1 confidence level.

In Model 9, it was tested that whether policy interest rate and upper band can be represented with the same specification. However, test results say that two rates do not have the same reaction function. Insignificant coefficients prove that specification of upper band function should be different. It is the evidence that two interest rates are implemented for different aims.

In the last column, monetary policy rule model conducted in this study is given for comparison. Although functionality of each interest rate is different, they have common variables, such as credit gap and current account deficit. According to one hypothesis of this study, CBRT responds to financial variables more likely with corridor band, instead of policy interest rate. In the meantime, policy interest rate is

also used for financial intervention in case of a need. In this regard, it was expected to obtain higher absolute values for common financial indicator coefficients in upper and lower band regressions. In above table, first and second columns are two significant models to explain upper band. Comparing coefficients of credit gap and current account deficit, we can show that the hypothesis is supported by results. Level to respond to financial development in upper band is higher than the level in policy interest rate.

Analyzes suggest two model for upper band according to two different approaches. First one is Model 5 which is treating upper band as rate determined independent of policy interest rate. Second one is Model 6 which claims CBRT determines upper band also according to the position of policy interest rate. In the second approach, model automatically defends that relative position of upper band and policy interest rate, so upper gap is also a policy instrument. Both models are statistically significant and clarify claims made in the study regarding utilization of upper band of the corridor after May 2010. Briefly, Central Bank alters upper band in order to response deviation in financial stability variables, credit extension and current account deficit.

For lower band, similar procedure was practiced and estimation results are given in Table 7.3. In first column, main model (Model 10) is given. Whereas coefficients are significant, sign of REC gap is contrary to expectations, as it was also obtained in policy interest rate estimation. It is thought that two sided relationship between lower band and reel effective currency causes that situation. That is to say, in a month CBRT decreases lower band, fast transmission channel leads reel effective currency to be affected and decrease also. In this regard, level coefficient for REC gap has positive sign. However, as it is seen in model 15, when

lagged value of REC gap is included, negative sign for the coefficient is obtained as expected. Because, when domestic currency is appreciated, in order to balance the pressure, CBRT decreases lower band and discourages foreign flows.

In the second (Model 11) column, inclusion of policy interest rate was tested in order to evaluate the relationship between lower band and policy interest rate. In this model, it was detected that coefficient of policy interest rate is insignificant. It means that policy interest rate position is not a determiner in lower band instrument implementation. Consequently, lower gap is not utilized as an instrument by CBRT.

In model 12 and model 13, classic monetary policy variables and other financial indicators were included in models. However, in terms of both significance and size of coefficients, models are not practicable. Thus, it was clarified that lower band is not deployed to respond development regarding economic activity and/or inflation.

Table 5: OLS Results for Lower Band Estimate

Lower Band	**model 10***	**Model 11**	**Model 12**	**Model 13**	**Model 14**	**Model 15**	**Model 16**	**(Model 4) PR**
C	0,9549		0,91	1,42	3,344	1,252	8,40	6.35
	1,23		*1,05*	*1,52*	*4,43*	*1,759*	*3,93*	*0*
PR		0.0078						
		0.051						
RECGAP	0,083	0,091	0,083	0,041	-0,016	0,219	-0,07	0.0249
	*4,29****	*4,28****	*4,21****	*1,458*	*-0,664*	*4,39****	*-1,28*	*1.967***
RECGAP (-1)						-0,144		
						*-2,92****		
VIX	0,169	0,212	0,171	0,20	0,201	0,157		
	*4,55****	*4,82****	*4,107****	*7,12****	*6,89****	*4,604****		
CREGAP(-1)				-0,014	-0,049		-0,046	0.0147
				-1,06	*-5,1****		*-2,74****	*3.956****
D(CAD12m(-1))				0,0036			[0,00026]	0.000272
				*3,34****			*0,825*	*3.887****
INFGAP(-1)			-0,0046	-0,0104			0,020	0.0128
			-0,384	*-1,185*			*1,551*	*4.441****
YGAP(-1)			0,00014	0,00003				
			0,388	*0,137*				
R2	0,44	0,41	0,44	0,76	0,68	0,55	0,29	*0,75*

*Significant in %10 confidence level, ** Significant in %5 confidence level, *** Significant in %1 confidence level.

In model 14, inclusion of credit gap was estimated for lower band. The logic here is as follows. Credit extension can be ignited by distinct factors like foreign inflow. In case of such situation, CBRT may prefer to slow down foreign inflow by decreasing the lower band. In this regard, it is expected to find a negative coefficient of credit gap as in results of estimation in this study. In the meantime, because it is a rare situation and the main responder of credit gap is upper band, absolute value of credit gap coefficient in lower band model is pretty tiny comparing to the one in upper band model.

In the eighth column (Model 16), lower band was regressed on variables of policy interest rate model in order to clarify distinct functionality of two rates.

Insignificant coefficients obtained in model 16 clarify different functionality for lower band and policy interest rate.

Lastly, coefficients of financial variables in policy interest rate model and lower band model were compared. Last column is given as a reminder. REC gap is the common variable in two models. As it is expected, its coefficient in lower band has a higher absolute value than the one in policy interest rate model. It means lower band is implemented mainly to respond the development regarding domestic currency valuation.

Analyzes suggest model 10 for lower band. Central Bank alters lower band to response deviation in financial stability variables, reel effective currency and global risk appetite.

Upper Gap and Lower Gap

Upper gap was evaluated with the following model. Credit gap and first difference of current account deficit were taken as endogenous variables together with upper gap.

Model 17-18-19:

Sample (adjusted): 2006.01 – 2010.06

$$gapup_t = \underset{(R^2=0.92)}{0.3465} + \underset{(0.1488)}{1.062} * gapup_{t-1} \underset{(0.1498)}{-0.1571} * gapup_{t-2} \underset{(0.000)}{-0.0000573} * d(cad_{t-1}^{12m}) \underset{(0.000)}{-0.000705} * d(cad_{t-2}^{12m}) \underset{(0.012)}{-0.0119} * cr_{t-1}^{gap} \underset{(0.010)}{+0.0117} * cr_{t-2}^{gap}$$

$$d(cad_t^{12m}) = \underset{(R^2=0.92)}{9.9577} \underset{(37.3917)}{-32.8734} * gapup_{t-1} \underset{(37.6452)}{+15.62054} * gapup_{t-2} \underset{(0.1361)}{+0.3134} * d(cad_{t-1}^{12m}) \underset{(0.1411)}{-0.7133} * d(cad_{t-2}^{12m}) \underset{(2.9147)}{-1.335} * cr_{t-1}^{gap} \underset{(2.5963)}{+3.5897} * cr_{t-2}^{gap}$$

$$cr_t^{gap} = \underset{(R^2=0.92)}{8.7781} + \underset{(2.0313)}{0.3981} * gapup_{t-1} \underset{(2.045)}{-1.4814} * gapup_{t-2} \underset{(0.0074)}{-0.024469} * d(cad_{t-1}^{12m}) \underset{(0.00767)}{-0.02748} * d(cad_{t-2}^{12m}) \underset{(0.1583)}{+0.7349} * cr_{t-1}^{gap} \underset{(0.141)}{+0.0452} * cr_{t-2}^{gap}$$

Model 20-21-22:

Sample (adjusted): 2010.05 – 2013.06

$$gapup_t = \underset{(R^2=0.90)}{0.094873} + \underset{(0.1765)}{0.65502} * gapup_{t-1} \underset{(0.20116)}{-0.07235} * gapup_{t-2} \underset{(0.00127)}{+0.000638} * d(cad_{t-1}^{12m}) \underset{(0.00113)}{+0.002932} * d(cad_{t-2}^{12m}) \underset{(0.02124)}{-0.006344} * cr_{t-1}^{gap} \underset{(0.0211)}{+0.01943} * cr_{t-2}^{gap}$$

$$d(cad_t^{12m}) = \underset{(R^2=0.90)}{-207.3426} \underset{(27.8907)}{-57.6167} * gapup_{t-1} \underset{(31.7735)}{+20.1389} * gapup_{t-2} \underset{(0.2000)}{+0.31925} * d(cad_{t-1}^{12m}) \underset{(0.17828)}{+0.01419} * d(cad_{t-2}^{12m}) \underset{(3.35446)}{-0.07616} * cr_{t-1}^{gap} \underset{(3.3319)}{-1.75891} * cr_{t-2}^{gap}$$

$$cr_t^{gap} = \underset{(R^2=0.90)}{24.106} \underset{(1.3734)}{-3.1487} * gapup_{t-1} \underset{(1.5646)}{-1.4519} * gapup_{t-2} \underset{(0.00985)}{+0.02119} * d(cad_{t-1}^{12m}) \underset{(0.00878)}{-0.022746} * d(cad_{t-2}^{12m}) \underset{(0.1651)}{+0.83304} * cr_{t-1}^{gap} \underset{(0.1640)}{+0.06877} * cr_{t-2}^{gap}$$

Impulse response functions were estimated for above models. Results were demonstrated in graphs in figure 7.3.1. In first line, responses of upper gap against the change in current account deficit and credit gap before and after May 2010 can be seen. For the first period, gap does not respond or respond quite little to shocks in current account deficit and credit gap. On the other hand, in second period, as we can see in the first line and second column, after shock in current account deficit, upper gap is increased as a response of central bank. Similarly, in the third column, a shock in credit gap is responded by an increase in upper gap. Those results support

hypothesis regarding the functionality of gap between upper band and policy interest rate.

Figure 8: Upper Gap January 2005- April 2010

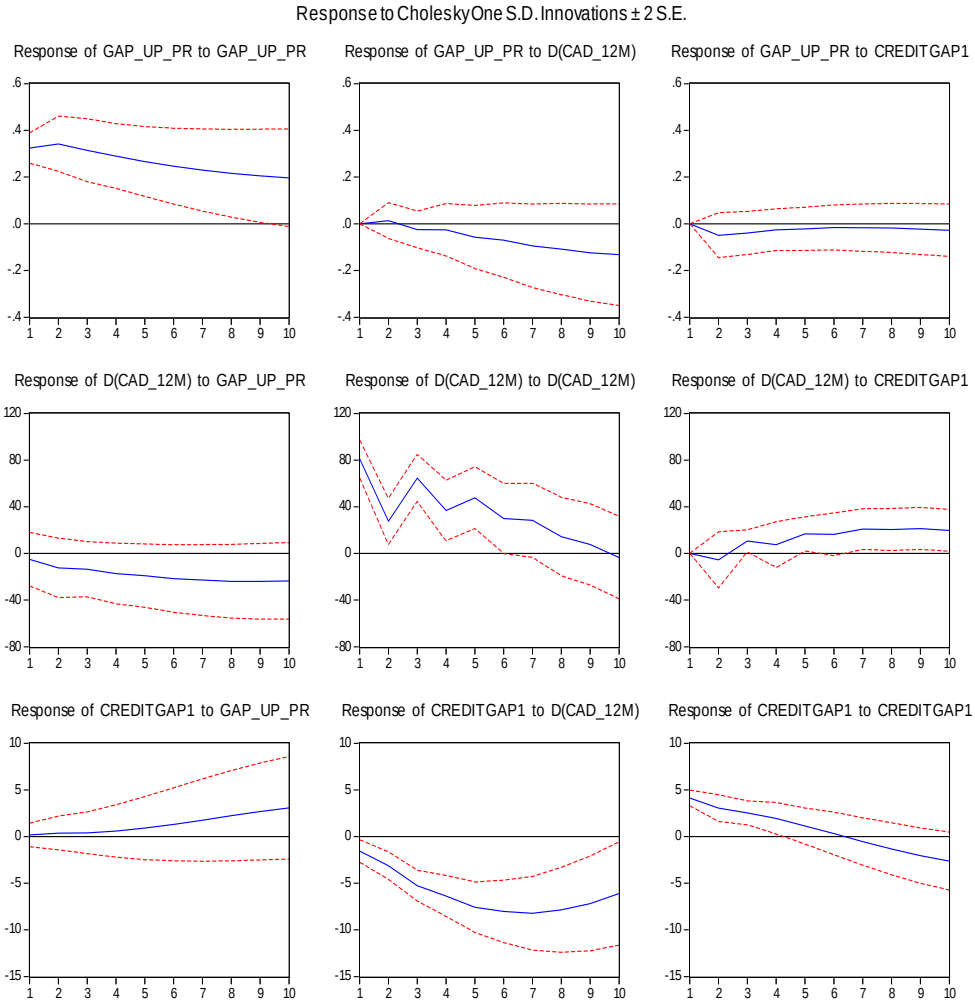
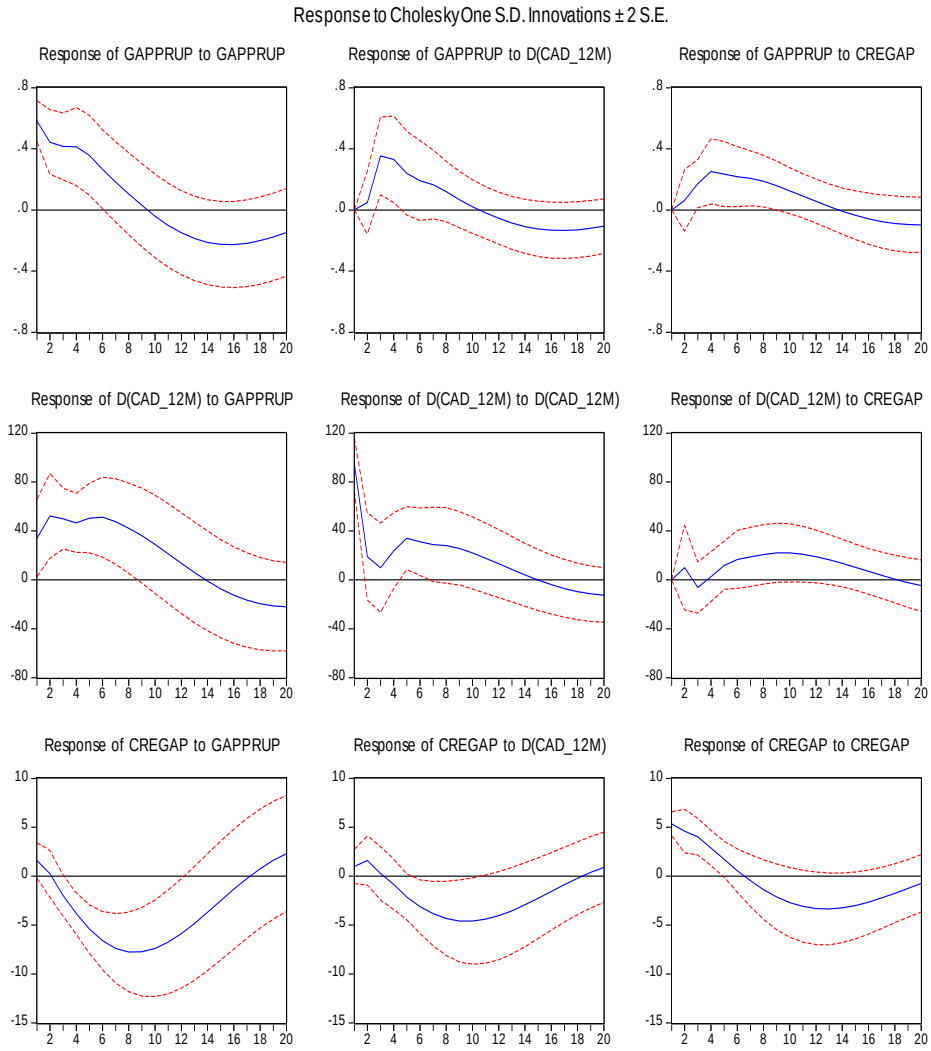


Figure 9: Upper Gap May 2010-June 2013



The other side of analyze is to evaluate the effect of gap alteration on financial variables; current account deficit and credit gap. Looking at the second line, we realize that current account deficit could not be controlled by gap instrument. Response of current account deficit is on positive direction after an increase in upper gap. It means CBRT could not control current account deficit via upper gap in this period.

As for credit gap, CBRT achieved its target to decrease credit gap by decreasing upper gap. In third line, whereas credit gap increases after rise of upper

gap in the first period, after May 2010, credit gap sharply decreases in case of an upper gap widen. Results imply that CBRT could implement upper gap instrument effectively after May 2010.

Besides, wider upper gap also means a lower policy interest rate. Therefore, in models, especially before May 2010 when upper gap was not used as an instrument, increase in upper gap actually means decrease in policy interest rate. In this regard, credit gap increases as a response of wider upper gap (decrease in policy interest rate). One clue supports the idea that underlying effect produced by policy interest rate cut had delayed effect on credit gap. It was demonstrated that increase in upper gap (decrease in policy interest rate) causes a gradually increasing effect in credit gap, owing to relatively slower transmission channel from policy interest rate to economic activity.

For lower gap, VAR models were established with one exogenous and two endogenous variables.

Model 23-24:

Sample (adjusted): 2010.05 – 2013.06

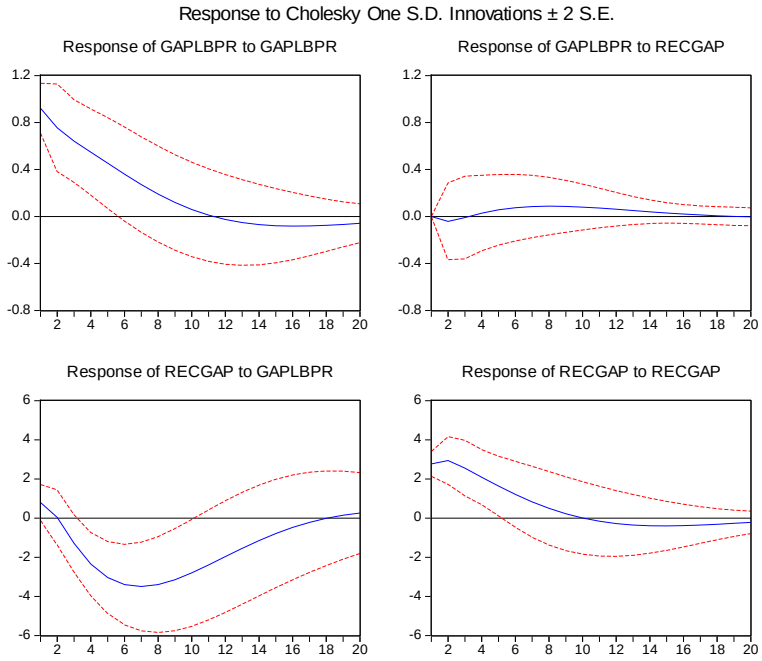
$$gaplow_t = \underset{(R^2=0.77)}{1.2897} + \underset{(0.18512)}{0.8277} * gaplow_{t-1} \underset{(0.219)}{-0.02493} * gaplow_{t-2} \underset{(0.06092)}{-0.02609} * rec_{t-1}^{gap} \underset{(0.05303)}{+0.03457} * rec_{t-2}^{gap} \underset{(0.03010)}{-0.04297} * vix_t$$

$$rec_t^{gap} = \underset{(R^2=0.77)}{4.8363} - \underset{(0.55601)}{0.96585} * gaplow_{t-1} \underset{(0.65778)}{-0.565765} * gaplow_{t-2} \underset{(0.18297)}{+1.000047} * rec_{t-1}^{gap} \underset{(0.15928)}{-0.16568} * rec_{t-2}^{gap} \underset{(0.09040)}{-0.131156} * vix_t$$

In figure 10, relationships among series were presented with impulse response function. In the first line, second column, response of lower gap against a shock in REC gap was given. Nevertheless, the effect proceeds so close to zero that it is not possible to point out a significant effect. On the other hand, effect of lower gap

policy change in REC gap is clearly observable. In case of an increase in lower gap, REC gap responds by moving in negative direction after two periods than policy decision. It is matching with hypothesis in the study. Because lower band is decreased, foreign flows incline to leave the market. Consequently, foreign currency in the market decreases and domestic currency depreciates, which means REC gets low.

Figure 10: Lowe gap May 2010- June 2013



CHAPTER 8

CONCLUSION

In the study, interest rate corridor and alteration of monetary policy rule of CBRT were evaluated. It was assumed that CBRT employs an augmented Taylor Rule. By the help of Chow structural break point test, it was clarified that the Bank implemented different policy rules before and after May 2010. Moreover, estimation results relieved that CBRT stopped implementing inflation targeting regime after May 2010.

Sharp distinction between two periods is also about the way CBRT intervenes developments about economic activity. Whereas the Bank directly had responded to output gap by policy interest rate before May 2010, in new policy implementation, the Bank steered economic activity indirectly, by following other financial variables that are closely relevant to economic activity, such as credit extension, current account deficit. Besides, the Bank included reel effective currency into its reaction function.

Although speeches made by officers of the Bank state that ultimate target of CBRT is to provide price stability, it is concluded that the Bank give higher weigh on financial stability after May 2010. Estimated reaction function of CBRT in the study pointed out that the Bank does not implement inflation targeting regime anymore. Instead, financial stability is aimed and inflation developments are responded by the bank in the meantime.

Moreover, borrowing interest rate and lending interest rate of central bank have been implemented as monetary policy instruments in this new period. Reaction

functions of upper band and lower band of interest rate corridor were estimated due to their functionalities.

It was claimed that upper band is applied against developments in internal economy. That is to say, CBRT responds to credit extension and current account deficit via upper band of the corridor. OLS estimations brought out two alternative models that both include credit extension and current account deficit. Distinction is if including policy interest rate in upper band reaction function or not. In the second model for upper band, policy interest rate was obtained as significant independent variable. It means CBRT takes position of policy interest rate into account in determination of upper band. Moreover, gap between upper band and policy interest rate has functionality in monetary policy implementations.

Similar estimations were made for lower band. The difference between two bands is that lower band is related with external economic variables. In models for borrowing interest rate, reel effective currency and risk appetite index (VIX) were found as significant determiner. However, unlike in upper band reaction function, positioning of policy interest rate was found insignificant in lower band decisions of the Bank.

Very expected results were observed regarding comparison of coefficients of financial variables in reaction functions of policy interest rate and bands of corridor. Whereas policy interest rate is applied to respond to financial variables, upper band and lower band reactions to very same variables are higher.

Observing coefficients of credit extension gap in two models, one can realize that upper band reaction function has higher weigh on it. It means that a development in credit extension is responded in a higher proportion via upper band. The same is

valid also for lower band function. Coefficient of reel effective currency is higher in lower band reaction function. Thus, it is concluded that financial variables are responded more likely by upper and lower band of interest rate corridor.

Lastly, gaps between bands and policy interest rates were investigated by the help of VAR models. In analyzes, it was approved that CBRT change gap between upper band and policy rate in order to respond to changes in current account deficit and credit gap. Moreover, credit extension is affected by gap policy decisions of the Bank in period after May 2010. As for lower gap, it is detected that reel effective currency is affected by changes in lower gap.

Briefly, monetary policy change comes by new monetary policy implementation was studied in this work. It is detected that CBRT changed monetary policy its strategy considerably after May 2010. New policy instrument interest rate corridor was implemented and financial stability target has become priority.

APPENDİX

NOTES

Note 1: Time series of interest rates and gaps in the interest rate corridor

Table 6: Rate Statistics in the Period

	Lower Band	Policy Rate	Upper Band	Lower Gap	Upper Gap	Total Gap
May-10	6.50	7.00	9.00	0.5	2	2.5
Jun-10	6.50	7.00	9.00	0.5	2	2.5
Jul-10	6.50	7.00	9.00	0.5	2	2.5
Aug-10	6.50	7.00	9.00	0.5	2	2.5
Sep-10	6.25	7.00	8.75	0.75	1.75	2.5
Oct-10	5.75	7.00	8.75	1.25	1.75	3
Nov-10	1.75	7.00	8.75	5.25	1.75	7
Dec-10	1.50	6.50	9.00	5	2.5	7.5
Jan-11	1.50	6.25	9.00	4.75	2.75	7.5
Feb-11	1.50	6.25	9.00	4.75	2.75	7.5
Mar-11	1.50	6.25	9.00	4.75	2.75	7.5
Apr-11	1.50	6.25	9.00	4.75	2.75	7.5
May-11	1.50	6.25	9.00	4.75	2.75	7.5
Jun-11	1.50	6.25	9.00	4.75	2.75	7.5
Jul-11	1.50	6.25	9.00	4.75	2.75	7.5
Aug-11	5.00	5.75	9.00	0.75	3.25	4
Sep-11	5.00	5.75	9.00	0.75	3.25	4
Oct-11	5.00	5.75	12.50	0.75	6.75	7.5
Nov-11	5.00	5.75	12.50	0.75	6.75	7.5
Dec-11	5.00	5.75	12.50	0.75	6.75	7.5
Jan-12	5.00	5.75	12.50	0.75	6.75	7.5
Feb-12	5.00	5.75	11.50	0.75	5.75	6.5
Mar-12	5.00	5.75	11.50	0.75	5.75	6.5
Apr-12	5.00	5.75	11.50	0.75	5.75	6.5
May-12	5.00	5.75	11.50	0.75	5.75	6.5
Jun-12	5.00	5.75	11.50	0.75	5.75	6.5
Jul-12	5.00	5.75	11.50	0.75	5.75	6.5
Aug-12	5.00	5.75	11.50	0.75	5.75	6.5
Sep-12	5.00	5.75	10.00	0.75	4.25	5
Oct-12	5.00	5.75	9.50	0.75	3.75	4.5
Nov-12	5.00	5.75	9.00	0.75	3.25	4
Dec-12	5.00	5.50	9.00	0.5	3.5	4
Jan-13	4.75	5.50	8.75	0.75	3.25	4
Feb-13	4.50	5.50	8.50	1	3	4
Mar-13	4.50	5.50	7.50	1	2	3
Apr-13	4.00	5.00	7.00	1	2	3

May-13	3.50	4.50	6.50	1	2	3
Jun-13	3.50	4.50	6.50	1	2	3

Note 2: Test results of Chow Breakpoint Test

Chow Breakpoint Test: 2010M05

Null Hypothesis: No breaks at specified breakpoints

Varying regressors: All equation variables

Equation Sample: 2005M04 2013M06

F-statistic	100.2355	Prob. F(4,90)	0.0000
Log likelihood ratio	166.2586	Prob. Chi-Square(4)	0.0000
Wald Statistic	400.9418	Prob. Chi-Square(4)	0.0000

Note 3: Test results of stationarity test of time series in the study

Table 7: Test Results of Stationarity Test

	ADF		*Phillip Perron*		
	I(0)	I(1)	I(0)	I(1)	**5%**
Pr	0.8308	0.0009	0.8151	0.0012	**I(1)**
1. period	0.7534	0.0192	0.9271	0.0213	**I(1)**
2. period	0.953	0.0152	0.9709	0.066	**I(1)**
Ub	0.8247	0	0.8186	0	**I(1)**
1. period	0.8548	0.0011	0.9203	0.0011	**I(1)**
2. period	0.8586	0.0002	0.7891	0.0002	**I(1)**
Lb	0.8095	0	0.7933	0	**I(1)**
1. period	0.7534	0.0192	0.9271	0.0213	**I(1)**
2. period	0.3396	0.0002	0.2779	0.0002	**I(1)**
infgap	0.037	0	0.1357	0	**I(1)**
1. period	0.0595	0.0202	0.2727	0	**I(1)**
2. period	0.4755	0.0002	0.4205	0.0002	**I(1)**
Outputgap	0.0849	0.0001	0.1146	0.0001	**I(1)**
1. period	0.2326	0	0.2784	0	**I(1)**
2. period	0.2946	0	0.2955	0	**I(1)**

	ADF		*Phillip Perron*		
	I(0)	I(1)	I(0)	I(1)	**5%**
cad_12m	0.019	0.344	0.4515	0.0754	**I(0)**
1. period	0.0015	0.0041	0.4439	0.1599	**I(0)**
2. period	0.0066	0.6186	0.3022	0.6907	**I(0)**
d(cad_12m)	0.344	0.0001	0.0754	0.0001	**I(1)**
1. period	0.0041	0	0.1599	0	**I(1)**
2. period	0.6186	0	0.6907	0	**I(1)**
creditgap1	0.0852	0.0001	0.4017	0.0001	**I(1)**
1. period	0.0339	0.6074	0.4446	0.0041	**I(0)**
2. period	0.6707	0.0259	0.6598	0.0225	**I(1)**
reccap	0	0.0001	0.0974	0	**I(0)**
1. period	0.0917	0.0012	0.2034	0.0001	**I(1)**
2. period	0.3372	0.0235	0.5215	0.0231	**I(1)**
vix	0.0338	0	0.0939	0	**I(1)**
1. period	0.1761	0	0.3342	0	**I(1)**
2. period	0.2685	0.0008	0.1937	0.0008	**I(1)**

Note 4: Co-integration of time series in the study

As a solution for not stationary series, what comes to mind first is taking first difference of series and insert them into the models. When we tested series in first difference, it worked out. The series in first difference were stationary. However, models with such variables were neither constitute a monetary policy in Taylor Rule structure nor empirically significant. Because, a reaction function with differentiated variables would mean that Central Bank respond only difference with previous period. It can't be the fact in real world, so, first difference series were not employed. Instead co-integration tests are conducted in order to get advantage of co-integration and build models with I(1) process.

Table 8: Selected models and integration level of variables in those models

Model/ Period	Dep. var.		Independent Variables				Resid
1/ Whole	Pr*	**I(1)**	Infgap*	Ygap*	R*		Resid model1
2/1	Pr*	**I(1)**	Infgap*	Ygap*	R*		Resid model2
3/2	Pr*	**I(1)**	Infgap*	Cregap*	*Cad12m***	Recgap*	Resid model3
4/2	Ub*	**I(1)**	Cregap*	d(cad12m)*			Resid model4
5/2	Ub*	**I(1)**	Cregap*	d(cad12m)*	*Pr**		Resid model5
6/2	Lb*	**I(1)**	Recgap*	Vix*			Resid model6

*: I(1)
**: I(0)

Selected models are presented in Table with their variables included and their integration level. Integration is tested via unit root test for resides of each model.

Table 9: Dickey- Fuller test results of model resides

	ADF	Critical Values		Probability	
Resid	(-intercept)	5%	10%	(-intercept)	Stationarity
residmodel1	-2.744049	-1.944248	-1.61451	0.0065	**I(0)**
residmodel2	-3.517616	-1.946348	-1.613293	0.0007	**I(0)**
residmodel3	-2.460968	-1.951	-1.610907	0.0154	**I(0)**
residmodel4	-2.630663	-1.951	-1.610907	0.0101	**I(0)**
residmodel5	-4.01052	-1.951	-1.610907	0.0002	**I(0)**
residmodel6	-2.048324	-1.950687	-1.611059	0.0404	**I(0)**

All resides of the models are found stationary according to ADF test. It means each model by itself matches with co-integration theory. Series move together along the period. Therefore, although they include I(1) process variables, series are co integrated and I(0) all together.

According to the theory, variables in the model which will be evaluated as co integrated, need to be all I(1) process. Nevertheless, in model 3, there is current account deficit variable (cad_12m) which is I(0) process. For such cases, in the literature, half integration is presented. In these cases, additional tests are suggested to provide evidence regarding ‘’good model’’ properties. In this regard, for model 3, F test is applied to prove equality of variances of actual and estimated dependent variable.

Table 10: F test to detect equality of variances

F Test	
$H_0: Equal\ Variance\ \ (S^* = S)$	
$H_1: Different\ Variance\ (S^* \neq S)$	
$S^*: Variance\ of\ actual\ data = 0.276$ $S: Variance\ of\ estimated\ data = 0.233$	
F- value:	$\frac{S^*}{S} = \frac{0.276}{0.233} = 1.182$
1.69 < F(37,37) < 1.84	
$H_0\ cannot\ be\ rejected$	

Therefore, co integration in model 3 is claimed as valid.

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