FACTORS AFFECTING PERFORMANCE CRITERIONS OF CENTRAL BANK OF THE REPUBLIC OF TURKEY: A PROBIT APPROACH

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Abstract

This study investigates the determinants of performance criterion of Turkish central bank (CBRT) due to the bank's deviations from its inflation and monetary goals during 1990-2011. For this purpose we establish a probit model to figure out macroeconomic determinants having effects on performance of the central bank. Empirical findings indicate that the factors having impact on performance of the central bank are real growth rate, budget deficit, broader money supply, inflation, nominal exchange rate and output gap. Econometric results of our study also suggest that CBRT has implemented a rule-like monetary policy, instead rule, during the period we investigated
Key Words: *Intermediate targets, Central Bank of Republic of Turkey, probit model*
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1. INTRODUCTION

Aafter the oil crises and collapse of Bretton Woods system, the inflationary process made price stability the main objective of central banks at 1970s. Central banks have begun to implement monetary policy by rule with the effect of monetarist thought, mainly associated with the works of Milton Friedman. Therefore, in recent years a growing consensus has emerged for price stability as the overriding, long run goal of monetary policy of central banking.

The objective of this paper is to examine the factors affecting the performance criterions of the Central Bank of the Republic of Turkey (CBRT) due to the bank's deviations from its inflation and monetary goals during 1990-2011. We know that CBRT has three different monetary policy intermediate regimes in past 20 years for price stability and financial stability: 1) Monetary targeting, 2) exchange-rate targeting, 4) inflation targeting regime. For this purpose we

establish a probit model to find macroeconomic determinants of performance of the Central Bank. Established model is at the same time a proposal of success function (sf) for central banks.

According to our model estimation results, the main performance determinants the central bank in Turkey are real growth rate, budget deficit, broader money supply, inflation, nominal exchange rate and output gap. Our economic result also suggests that CBRT has implemented a rule-like monetary policy, instead rule, during the period we investigated.

2. NOMINAL ANCHORS AND TURKEY EXPERIENCE

The role of a nominal anchor or why a nominal anchor is needed has several explanations. Firstly central banks use these anchors to achieve their goal. For this purpose, most widely, central banks announce an intermediate target (nominal anchor) and use short term interest rate policy or other monetary policy instruments to achieve that goal. Secondly, a nominal anchor can help promote price stability because it helps tie down inflation expectations directly through its constraint on the value of domestic money. Thirdly, a nominal anchor can provide a discipline on policymaking that avoids the so-called time-inconsistency problem described by Kydland and Prescott (1977), Calvo (1978) and Barro and Gordon (1983).

Fourthly, a nominal anchor increases the credibility of the program implemented by the central bank. Preference of the nominal anchor is important. Therefore, it should be

- observable
- controllable
- predictable impact

There are three main nominal anchor used or has been used by central banks. These are exchange rate targeting, monetary targeting and inflation targeting. Exchange Rate-Targeting (ERT) is a monetary policy regime with a very long history. The first application example of ERT is gold standard. It was used in the form of fixing the value of the domestic currency to a commodity such as gold, key feature of the gold standard. But more recently, ERT regime has involved fixing the value of the domestic currency to that of a large, low-inflation country with low levels of inflation. There are some advantages and disadvantages of this targeting. Firstly, ERT fixes the inflation rate to the internationally traded goods, and thus directly contributes to keeping inflation under control. Secondly, in terms

of monitoring and transparency, exchange rate targeting is clear, transparent and easy to follow (Eroglu, 2011). Third, if the ERT regime is credible, it anchors inflation expectations to the inflation rate in the anchor country to whose currency it is pegged. Fourthly, an exchange-rate target provides an automatic rule for the conduct of monetary policy that avoids the time-inconsistency problem. However the biggest disadvantage of this nominal anchor is that an exchange-rate target results in the loss of independent monetary policy (Obstfeld and Rogoff 1995; Frankel, Schmukler, & Serven, 2002). The other disadvantage is ERT leaves countries open to speculative attacks on their currencies.

When we look at the exchange rate targeting experience of Turkey we see that to break the inertia of inflation and to decrease chronic inflation to a low and stable level, with the support of the IMF, a three-year program depending on fixed exchange rate targeting (consisting of a basket of 1 dollar and 0.77 euros) was implemented by the end of 1999. Nominal anchor on which program depends is pre-announced to public. The main objective of the program is to decrease consumer inflation to 25 percent at the end of 2000, 12 percent at the end of 2001 and to 7 percent at the end of 2002. This plan is carried out only 13 months and is ended with an exchange rate crisis.

In pursuing a strategy of monetary targeting, a central bank commits to a policy of, say, a 10% growth rate of M2 or a 5% growth rate of reserve money. The central bank is then accountable for hitting that target. In monetary targeting (MT) regime, money supply is the single predictor in determining the future inflation. Monetary policy (MT) tools can affect the price level after two terms affecting monetization one –period-lagged. In this regime loss function the central bank is as follows:

$$L_t = \frac{1}{2}(m_t - m_{t-1} - \widehat{m}_t + \widehat{m}_{t-1})^2 \tag{1}$$

To minimize this equation the central bank will use all the monetary tools and avaliable informations to closer current money growth. In this regime money supply is directly under control of monetary authority and can be line to desired direction (increase, decrease) with monetary instruments. The first advantage of this regime is that MT enables a central bank to adjust its monetary policy to cope with domestic considerations. Secondly, a target for the growth rate of a monetary aggregate provides a nominal anchor that is fairly easily understood by the public and is easily communicated to the public. (However, the target may not be quite as easily comprehended as an exchange-rate target). Thirdly, monetary targets can

send almost immediate signals to both the public and markets about the stance of monetary policy and the intentions of the policymakers to keep inflation in check. However, there must be a strong and reliable relationship between the goal variable (inflation) and the targeted money supply, and the targeted monetary aggregate must be well controlled by the central bank, if not, the monetary aggregate may not provide as clear signals about the intentions of the policymakers and thereby make it harder to hold them accountable.

Monetary targeting experience of Turkey goes back to 1990s. Between 1986-89 CBRT made first monetary targeting programs but it was not publicly announced. First publicly announced monetary program was implemented on January 16, 1990. The program relied on targets putting the central bank's balance sheet. Between 1990-2005 monetary programs have employed both for price stability and sometimes for financial stability. First year targets were achieved successfully, internal and external factors like Gulf War, early general elections, Crisis of 1994 and Russian Crisis have made monetary programs dysfunctional during the period. Monetary programs of Turkey are presented in table 1.

The last nominal anchor is inflation targeting (IT) regime. In this regime inflation is not anchored to a macroeconomic variable, instead, inflation itself is targeted for price stability. In IT regime, some requirements have to be fulfilled by the central bank. A medium-term inflation target has to be announced. Transparency, public communication and accountability are crucial properties of an IT regime. Relationship between target and goal is linked to each other. This regime is now implemented by many central banks explicitly or implicitly. There are many advantages of IT regime. Firstly IT regime is easily understood by the public, and helps avoid the time-inconsistency problem since public can hold central bank accountable to a clear goal. This regime also forces policymakers to communicate goals and discuss progress regularly. IT allows for better private sector planning, because the central bank must communicate with public about inflation goals, regular measures of inflation and how to achieve the goals deviated from targets under given current condition. The main disadvantages of IT regime are having potential for increasing output fluctuations, and are usually accompanied by low or medium economic growth. Policy tends to promote too much rigidity, if IT is not flexible, and signal of progress is delayed. For these reasons, several quarters policy effects may not be realized.

Table-1: Monetary Targeting experience of Turkey, (1990-1999)

Yıl	Targeted aggregate	target	realization	Deviat.(%)	The ultimate goal
1990	balance sheet	12-22	24,1	-41,76	Control balance sheets and Financial Stability
	Total domestic liabilities	15-25	21,6	-8,00	
	Total domestic assets	6-16	11,9	-8,18	
	central bank money	35-45	26,6	33,50	
1991	balance sheet	n.announced-	58,9		Financial Stability
	Total domestic liabilities		66,6		
	Total domestic assets		64,3		
	central bank money		62,6		
1992	balance sheet	37-47	85	-102,38	Financial Stability
	Total domestic liabilities	38-48	101	-134,88	
	Total domestic assets	27-39	75	-127,27	
	central bank money	40-50	100	-122,22	
1993	balance sheet	n.announced-	60		Financial Stability
	Total domestic liabilities		49		
	Total domestic assets		55		
	central bank money		46		
1994	net international reserves*	n.announced-			Price stability and Financial Stability
	net domes.assets*	306 tril	271		
	net domes.assets	296 tril	260	11,44	
	net domes.assets	293 tril	272	12,16	
		n.announced-		7,17	
1995	net domes.assets	342 tril	260		Financial Stability and price stability
	net domes.assets	367 tril	269		
	net domes.assets	334 tril	217	23,98	
	net domes.assets	366 tril	393	26,70	
	Total Foreign Deposits	n.announced-	102.6	35,03	
	Döviz kuru sepeti			-7,38	
1996	net foreign assets	n.announced-	632.2		Price stability and Financial Stability
	net domes.assets		331.7		
	reserve money*		610.4		
	Total Foreign Deposits		353.4		
1997	net foreign assets	n.announced-	1791.1		Price stability and Financial Stability
	net domes.assets		142		
	reserve money		1129.6		
	Total Foreign Deposits		903.5		
1998	reserve money	18-20	17.3	-9,83	Price stability and Financial Stability
	reserve money	14-16	13.1	-14,50	
	net domes.assets	699 tril	579.4	-20,64	
	reserve money	n.announced-	3333.2		
	net foreign assets		2906.1		
	net domes.assets		427.2		
	Total Foreign Deposits		1380		
1999	net domes.assets	890 tril	369.1	58,53	Price stability and Financial Stability
	net domes.assets	999 tril	899.3	9,98	
	net foreign assets	n.announced	5710.4		

Source: Emir, Y.O., et.al. (2000). Monetary Policy Reaction Function in Turkey. TCMB Tartışma Tebliği,

Inflation targeting experience of Turkey goes back to 2002. In 2002 Turkey has begun to implement IT regime implicitly, because it could not provide all conditions needed for explicit inflation targeting. Between 2002-2005 CBRT has satisfied conditions and decreases the confidence gap (difference between expected inf. and inf. target) to minimum level, and employed IT explicitly after January 2006. IT regime design of CBRT involves three characteristics: 1. Consumer price index CPI is used for inflation targeting, 2. Inflation report is published three times in a year, 3. Inflation target is set by central bank and government, and is set as point target allowing fluctuations in a 2% uncertainty range. Table 2 shows all anchors Turkey experienced in 21 years. As it is seen clearly from table, during this time period CBRT has aimed not only price stability but also financial stability.

Table-2: Nominal Anchors used by Turkish central bank during 1990-2011.

Nomianl Anchors	Time interval	Fundamental goals of CBRT
MT regime	1990-1999	Price stability and financial stability
ERT regime	2000-2001	Price stability
İmplicit IT regime	2002-2005	Price stability
Explicit IT regime	2006--	Price stability and financial stability

Source: Buchanan and Lee: 1984: 284.

3. EMPIRICAL RESULTS

This study uses monthly data from 1990:1 to 2011:4, obtained from electronic data service of the Central Bank of the Republic of Turkey. The World interest rate and the world inflation, for calculating external shocks, are obtained from Federal Reserve Economic Data (FREDII), and the other variables used in the models are calculated by writer. The data we employed in the model is presented in the table 3. The choice of variables used in the model is based on previous studies in the related empirical literature.

We define performance of a central bank on its achievements put on intermediate targets (monetary targeting or inflation targeting) like other similar studies. But, the different part of this study from others is division of these achievements to percentages. A binary logit or probit model needs more data in the sample. Hence, instead of binary probit model, we use a probit model for analyzing determinants of the success of the central bank.

Table-3: Definition and Sources of Variables

Variables	Definition	Source
Real growth (GDP)	logarithm of real GDP measured accordin to Expenditure *Method*	EVDS
Foreign reserves (REZ)	foreign exchange reserves of CBRT. Difference with respect to time of Log(REZ) is calculated: $\log(rez_t)-\log(rez_{t-1})$	EVDS
Domestic inter.rate (INT)	Nominal deposit interest rate. Difference with respect to time of log(faiz) is calculated.	
Budget (BUDG)	the annual percentage change of consolidated budget balance (%)	EVDS
Current acc. balance (CA)	The annual percentage change of current account balance measured in dollar (%)	EVDS
Broad money supply M2Y)	İt shows difference of logarithm of broad money supply with respect to time. When M2Y increases, all PD values are expected to move upwards.	EVDS
Exchange rat(EXC)	Monthly nominal exchange rates.	
Trade opennes(OPEN)	Total international trade (Nominal import and export volume) per current GDP	EVDS
Output gap (GDPGAP)	The percentage of real growth to potential growth rate measured by Hodrick-Prescott Filter (%).	YH.
Inflation (INF)	The annual percentage change of monthly Consumer Price Index (%)	EVDS

The probit models were firstly introduced in studies of McKelvey and Zavoina (1975). A general statement of a probit model is:

$$y^* = \beta x' + \vartheta \tag{1}$$

Where y^* is unobservable, but a Y_i can be designed as follow:

$$Y_i = \begin{cases} & \text{if } Y_i^* > 0 \\ & \text{, otherwise} \end{cases}$$

Let P_i shows the probability of $Y_i^* > 0$. Then,

$$P_i = Prob(Y_i = 1)$$

$$= Prob(Prob(\beta x' + \vartheta > 0)$$

This last equation means that $P_i=Prob(Y_i=1)$ and $(\mathbf{Prob(\beta x' + \vartheta > 0)}$ are equal.
If distribution of ϑ is random, then a probit model can be established.

In our study we define success of the central bank as $\left| 100 \left(\frac{x - x^*}{x^*} \right) \right|$, Where x is actual and x* is the aimed value of the nominal anchors. According to a given threshold, it is assumed whether the central bank is successful or not. Therefore, similar to Krueger, Osakwe and Page (1998), we define success of the central bank below as adding 1.5 times standard deviation to the expected mean of the deviation from the target value:

$$|succes| \geq \mu + 1.0\sigma \rightarrow \text{central bank is unsuccesful, then } Y_i = 1$$

$$|suces| < \mu + 1.0\sigma \rightarrow \text{central bank is succesful, then } Y_i = 0$$

Table 3 presents estimation result of probit regression. According to results, real growth rate, budget deficit, broader money supply, inflation, nominal exchange rate and output gap are significant in explaining deviations of the central bank from its targets in Turkey. Real growth rate, exchange rate and inflation are highly significant having z-statistics over 3.00. From these results we can observe that the probability of deviation of the central bank from its target increases when the budget balance (%) increases, i.e, budget deficit increases. Increase in broader money supply, in exchange rate is also similar to budget deficit. However, an increase in growth rate, inflation and output gap decreases the deviation of the central bank from its target.

Tablo-3: Estimation result of Probit Model

Number of obs.= 181					Prob > chi^2 = 0.0002	
LR chi^2(10) = 33,40					Log likelihood = -90,92340	
Dependent Var: Success					Pseudo R^2 = 0.245	
Independent variables	Coeff.	Std. Dev.	z	p>|z|	[95% Confidence interval	
GDP	-0,0969*	0,0316	-3,06	0,002	-0,1589	-0,0349
BUDG	0,1285*	0,0478	2,69	0,007	0,0347	0,2222
M2Y	0,0234**	0,0104	2,25	0,025	0,0030	0,0438
INT	-0,0080	0,0061	-1,3	0,194	-0,0200	0,0041
EXC	0.0051*	0,0050	-3,02	0,002	-0,0046	0,0149
REZ	-1,2210	1,5254	-0,8	0,423	-4,2107	1,7688
OPEN	-0,0084	0,0055	-1,52	0,128	-0,0193	0,0024
INF	-0,0853*	0,0280	-3,04	0,002	-0,1403	-0,0304
CA	-0,0002	0,0002	-1,29	0,197	-0,0005	0,0001
GDPGAP	-0,0003**	0,0001	-1,9	0,058	-0,0005	0,0000
CONSTANT	0,6955	0,4180	1,66	0,096	-0,1238	1,5147

Notes: * and ** significant level at 1 % and 5 % respectively.

4. CONCLUSION

In this study we examine the determinants of performance criterion of Turkish central bank (CBRT) depending on bank's deviations from its inflation and monetary goals during 1990-2011. We establish a probit model to find relationship between success of the bank and macroeconomic indicators of the Turkish economy. Empirical findings indicate that the factors effecting the performance of the CBRT are real growth rate, budget deficit, broader money supply, inflation, nominal exchange rate and output gap. Econometric results of our study also suggest that CBRT has implemented a rule-like monetary policy, instead rule, during the period we investigated

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