

## **A TEST FOR ASYMMETRIC CENTRAL BANK PREFERENCES IN TURKEY**

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### **Abstract**

The time inconsistency based KPBG models that tried to explain the inflation bias lost their popularity as inconsistent Central Bank behaviors changed in time. However, high inflation for countries like Turkey is still a problem and a new theory to explain this 'time consistent' inflation bias is in need. A theory based on non-linear or asymmetric Central Bank behavior is developed during the last decade to fill this gap. One way to test the empirical validity of the theorem is based on a Taylor Rule variant asymmetric model. This model is tested here for Turkey as it is one of the inflation targeting countries roughly for the last ten years.

**Keywords:** *asymmetric preferences, inflation bias, policy targets, central bank behavior.*

**JEL Classification :** E50, E58, E61.

### **1. INTRODUCTION**

The classical definition of inflation bias lost its ground during the last decade though they have been referenced often during 1980's and 1990's. The loss of popularity of these models have several reasons like increased transparency of Central Banks, inflation target policies and governments that learned from their past mistakes about monetary policies and increased Central Bank independence may be counted for the decrease of inflation. Of course low inflation levels brought critics to the inflation biased Central Bank models of Kydland Prescott-Barro Gordon (KPBG) models with quadratic loss functions that ambitiously target higher output levels.

These critics have theoretical, practical and empirical aspects. Theoretically McCallum (1995, 1997) argues with the idea of persistent inflation biased policies. Even if Central Bank created inflation while trying to increase output, the diverse results of these policies are obvious and it is irrational to model Central Bank as a persistent cheater. Though this critic is meaningful, it does not explain

the inflation differences among different countries and different periods. More than Central Bankers under this structure may be a limited delegation of public without any power or preferences.

Practically the ex-vice chairman of FED Alan Blinder insisted that during his period FED did not apply biased policies that led to time inconsistency. So ambitious Central Banker can not be the main reason of high inflation. However Blinder (1998) also claims that: *“In most situations, the central bank will take far more political heat when it tightens pre-emptively to avoid higher inflation than when it eases pre-emptively to avoid higher unemployment”*. Thus Central Banker still has some headroom to reflect part of their preferences to the policies and these preferences may be asymmetric.

Empirically, Ireland (1999) the seminal empirical paper of inflation bias did not find evidence for the bias for the short term though there are evidences for the long term.

All these changes and critics may be true. However, there is still an inflation phenomenon that has to be explained via Central Bank decisions. Especially after inflation targeting policies became popular among countries, some countries still can not achieve their targets while others even surpass their targets and even undershoot their targets. The ‘new inflation bias’ theory tries to explain these differences and in some cases the persistent inflation even under there are binding contracts for Central Bankers.

The asymmetric Central Banker in Cukierman (2000) tradition does not change output or unemployment directly by active policies, but it gives different responses to actual business cycles or exogenous supply shocks. As the output growth increases above the natural level (say by 1 per cent) Central Banker shows less effort to reduce the gap when compared to the output decrease from the natural level at the same rate. Such an indirect policy may lead to an average growth rate above the natural level or inflation bias, though Central Banker does not directly intend to do it. So Cukierman (2000)’s central banker is asymmetrically biased toward inflation.

Ruge-Murcia (2003) focuses another kind of inflation bias, which points out just the opposite direction. Central Banker weights positive inflation deviations more heavily than negative inflation deviations from the target inflation level, because of the credibility considerations of the Central Banker. This means when inflation level increases one per cent above the targeted inflation level, Central Banker rapidly applies policies to turn it back to low inflation level, but when inflation

level decreases one per cent, the targeted inflation level, Central Banks policies take place more slowly. For economies that target the inflation level, the short term interest rate is used as the major policy tool for the Central Banker. Thus if there is any asymmetric behavior, this could be seen when Central Banker changes the interest rates after supply shocks or unexpected inflation changes. The interest rate changes can also be analyzed as a third kind of asymmetric behavior. Although there are just a few models including such an asymmetry, the thinking is straightforward: Central Banker increases the interest rates more frequently and in smaller portions when output growth is above the natural rate but decreases it less frequently and in larger portions when it is, the natural rate (Florio, 2009).

All these possible asymmetric behaviors need empirical evidences. In 2011 more than 20 countries apply open inflation targeting as Central Bank policy\*. To test the asymmetry for any of these countries is straightforward by using a small deviant of the classic Taylor Rule. As the original Taylor Rule is mainly focused on how Central Bank responses to interest rate when inflation deviates from the target level, or when there is a supply shock. The rule tried to create a stereotype Central Bank character there it follows certain rule of thumbs when inflation, output and other macroeconomic variables like exchange rate change.

The Taylor Rule substructure in this literature is used to check the asymmetric behavior when countries apply target rules. Most of the countries (if not all of them) define their policies around inflation targeting symmetrically with respect to deviations from inflation target, any asymmetric behavior thus will lead to inflation (or in some cases deflation) bias. Asymmetric monetary policy under inflation targeting is measured by dividing inflation and output data into sub data and then by applying the Taylor rule separately to this sub data, to check whether the behavior of the Central Banker is in line or not.

Most of the econometric analyses done, divide the data according to the sign of the deviation. The difference between inflation level and the inflation target of the same period, which will be named as inflation deviation from this point on can be positive if actual inflation is above the target level or can be negative if actual inflation is, the target level. If Central Banker gives to both positive and negative inflation deviations the same response in terms of interest rate change than it could be said that Central Bankers behavior was symmetric, if response changes

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\* Hammond (2011) State of the art of inflation targeting CCBS handbook claims that there are 27 full flagged inflation targeting countries in the world in 2011. It also gives detailed classification and description for these countries.

Central Bank policies are asymmetric in terms of inflation deviation. Similarly the sign of the output gap which is the difference between actual and natural output growth rates may affect Central Bank's interest rate policies asymmetrically as mentioned before. While some empirical analyzes rely on just on inflation deviation, others rely on output gap to explain any possible asymmetry. Some other empirical analyses use both of them together, but such an analysis may lead to co integration to some extent.

This paper focuses on the first type of asymmetric behavior, namely asymmetry via inflation deviation, and tries to answer whether positive or negative inflation deviations in Turkey led to different interest rate policies in Turkey. The data used here spans the period between 2003 and 2010. Since Turkey begun inflation targeting just after 2002 the data for periods before 2002 is not available at all and also in 2002 TRLIBOR series begun just after August. Therefore, 2003 was chosen for the beginning of the data set. Asymmetric behavior toward GDP gap has not been analyzed because of the availability of only quarterly data for Turkish GDP and therefore because of the small data set. For such an analysis Suricco (2006) can be a good reference point.

Though the asymmetric monetary policy has limited mentioning under time inconsistency literature, there are still some empirical evidences in the literature. Petersen (2007) showed that Federal Reserve applied asymmetric policies with respect to inflation deviations in US during Greenspan period. Taylor and Davradakis (2006) showed a similar behavior for England during 1990's. Empirical results of developing countries also give positive results. Gredig (2007) for Chili, Horwath (2009) for Czech Republic Bec (2002) for France, Germany and US showed some evidences for asymmetric Central Bank policies. Therefore it is worthwhile to check for any asymmetric behavior of Central Bank of Turkey.

In the paper, a simple model to test the asymmetry of the monetary policy will be set up in the second section. Third section will give a brief description of the data. The forth section will discuss the estimation results and then it would be concluded.

## **2. THE MODEL**

The model presented here is just a Taylor rule and is taken from Horwath (2009) with small changes and his model is taken from Clarida *et all* (1998), which is a Taylor Rule model for symmetric inflation and GDP gap. It is assumed that the Central Banker targets the interest rate with the information available at period  $t$ . The estimated inflation deviation from the target and the estimated output gap are

the two major decision parameters for the Central Banker to decide its target nominal interest rate.

$$i_t^* = i^* + \beta[(\pi_t | \Omega_t) - \pi_t^*] + \gamma E_t(y_t | \Omega_t) \quad (1)$$

$\pi_t$  in the equation is the inflation rate at period  $t$ ,  $\pi_t^*$  is the inflation target of the Central Bank for that period,  $y_t$  is the output gap,  $i^*$  is the desired target interest rate of the Central Banker when output is at its natural rate and inflation is at its target rate,  $\Omega_t$  is the information set available at period  $t$  to make the decision and  $E()$  is the expectation operator. To make the regression easier and straightforward<sup>†</sup> instead of actual inflation data  $\pi_t$  that is unavailable at period  $t$ , inflation forecasts of the public was used in many models including Cukierman and Muscatelli (2008), Horwath (2009) and Taylor and Davradakis (2006). Econometrically, if the explanatory variables are endogenous OLS estimation would lead to inconsistency. In similar models where actual inflation data was used for simultaneous regression GMM models are preferred to overcome the inconsistency problem. Also some other models add a squared variable set to the model to explain asymmetry (Dolado, 2004).

In this paper the first solution was preferred to set up the econometric model and the actual inflation data  $\pi_t$  was replaced with  $E_t(\pi_{t+i} | \Omega_t)$  which is the forecast of inflation  $i$  periods before. Similarly since government announce the inflation target at least before a year. The inflation target notation may include the  $t+i$  periods. Then the equation (1) turns to

$$i_t^* = i^* + \beta[E_t(\pi_{t+i} | \Omega_t) - \pi_{t+i}^*] + \gamma E_t(y_t | \Omega_t) \quad (1)'$$

Thus the model assumes that Central Banker closely follows the public expectations and knowing his own target and public forecast decides the interest rate for the period.

Even when output level or inflation changes sudden the Central Bank can react only with some lag, due to the possible financial instability or uncertainty of effects of the interest rate changes. Therefore, Clarida *et al.* (1998) proposes a gradually adjusting interest rate mechanism which is known as “interest rate smoothing”. The actually applied interest rate by the Central Bank is a combination of the target interest rate  $i_t^*$  and the lagged interest rate  $i_{t-1}$ .

$$i_t = \rho i_{t-1} + (1-\rho)i_t^* + v_t \quad 0 \leq \rho \leq 1 \quad (2)$$

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<sup>†</sup> Inflation forecasts give the expectations of the public and it can be seen as the leading indicator of actual inflation.

In equation 2,  $\rho$  is a parameter for the central banker for how much weight it will give to lagged interest rate  $i_{t-1}$  and  $v_t$  is a forecast error. However, in countries with higher uncertainty like Turkey  $\rho$  is generally higher when compared to developed countries and it can overshadow importance of other variables. Therefore the regression will be done both considering interest smoothing and not.

When equation (1)' and (2) put together, the standard monetary policy turns into;

$$i_t = \rho i_{t-1} + (1-\rho) [i^* + \beta E_t(\pi_{t+i}^f - \pi_{t+i}^*) + \gamma E_t(y_t)] + \varepsilon_t \quad (3) \quad \text{where } \varepsilon_t \text{ is the forecast error with } \varepsilon_t \sim N(0, \sigma^2).$$

The model differs from the classic Taylor rule above when positive and negative inflation deviations  $E_t(\pi_{t+i}^f - \pi_{t+i}^*)$  are separated. The model claims Central Bank behavior is different when forecasts are above the target then the forecasts are , the target.

Thus two data sets are created from  $\pi_{t+i}^f - \pi_{t+i}^*$  :

$$\begin{aligned} \pi_{\text{above}} &= \pi_{t/t+i}^f - \pi_{t+i}^* && \text{when } \pi_{t/t+i}^f > \pi_{t+i}^* \\ \pi_{\text{above}} &= 0 && \text{when } \pi_{t/t+i}^f < \pi_{t+i}^* \end{aligned}$$

and

$$\begin{aligned} \pi_{\text{below}} &= \pi_{t+i}^* - \pi_{t/t+i}^f && \text{when } \pi_{t/t+i}^f < \pi_{t+i}^* \\ \pi_{\text{below}} &= 0 && \text{when } \pi_{t/t+i}^f > \pi_{t+i}^* \end{aligned}$$

When the new defined  $\pi_{\text{above}}$  and  $\pi_{\text{below}}$  is placed into the model the equation takes its final form;

$$i_t = (1-\rho) [i^* + \beta_1 \pi_{\text{above}} + \beta_2 \pi_{\text{below}} + \beta_3 y_t + \gamma X_t] + \rho i_{t-1} + \varepsilon_t \quad (4)$$

where  $X_t$  is a vector for all the other explanatory variables in our case the EURIBOR interest rate and the exchange rate. Actually, this explanatory vector  $X_t$  probably will increase the explanatory power of the regression in the econometric analysis but since the focus of the paper is on asymmetry the vector is not demanding in this case.

In countries that are depending too much on the exchange rates the equation may also include an exchange rate data or if it is an open economy affected by changes in the world interest rates a variable for euro area interest rates can also be added. However all these variables would have negligible effects as the main comparison here is related with  $\beta_1$  and  $\beta_2$ . If the policies applied are symmetric the hypothesis  $H_0: \beta_1 = -\beta_2$  would easily be accepted or else if policies are asymmetric  $H_0$  will be rejected.

### 3. DATA

The econometric models depending on the Equation 4 demand following variables for the data set: interest rates, inflation target, inflation forecasts and output gap. In case exchange rate or an international interest rate like European Central Bank's interest rate can also be added.

The data used here is monthly data covering the period 2003 to 2010. Instead of quarterly data monthly data is created and used just to obtain statistically significant results. As the number of data are just sufficient with quarterly data (nearly 30 data) to make a regression but not sufficient to check properly the hypothesis given above monthly data is delivered. The TRIBOR of the Banks Association of Turkey which closely follows CBRT borrowing overnight rates but announced daily is used as data for the interest rate. TRIBOR began to be announced from 1 August 2002.

Inflation forecasts are taken directly from the data series that can be found on the Central Bank of the Republic of Turkey official web site, EDDS. Expected CPI over the next 12 month is calculated by the Central Bank indirectly by the survey data with a projection model twice monthly and monthly inflation forecast data is derived from this data set. Inflation forecasts for a far horizon of 12 months may be uncertain and therefore a sensitivity analysis for a shorter period can be used. However since public is aware of the inflation target at the forecast period the forecast is conditional and uncertainty is less compared to an unconditional expectation. Inflation targets are also announced yearly by the CBRT. Again to make this data usable the data is projected linearly to monthly data, assuming Central Banks effort to change the inflation is same for every month.

The GDP growth data is also taken from CBRT. This data set is the most problematic series in the model GDP growth is made monthly with a similar approximation to IMACEC of Chili. However to obtain the GDP gap also natural rate of GDP growth is needed. This data is created directly from GDP series by the Hodrick-Prescott Filter which is the most widely filter used by the economists and the most suitable single variant one for econometric purposes (Sarıkaya, Ögünç, Ece *at all*, 2005). GDP gap is the difference between actual GDP growth and natural rate of GDP growth calculated with Hodrick-Prescott Filter.

Finally the exchange rate data is obtained from CBRT a 50 per cent basket of euro and dollar, and the European interest rates are obtained from the internet site <http://www.euribor-rates.eu/euribor-2010.asp>.

The created series are checked for stationary and it is found that except Exchange Rate and Euribor all series are I(0) stationary. Since these two variables are I(1) their difference series are put into the model.

#### 4. RESULTS

The simple econometric equation is derived from the Equation (4).

$$i_t = i^* + \beta_1 \pi^{\text{above}}_t + \beta_2 \pi^{\text{below}}_t + \beta_3 y_{t-1} + \beta_4 i_{t-1} + \beta_5 x_{t-1} + \beta_6 i(\text{euro})_{t-1} + \varepsilon_t \quad (5)$$

To make the exchange rate and European interest rate exogenous the variables are used with one period lag. The regression is also done for a Central Banker with GDP gap and inflationary considerations only

$$i_t = i^* + \beta_1 \pi^{\text{above}}_t + \beta_2 \pi^{\text{below}}_t + \beta_3 y_t + \varepsilon_t \quad (6)$$

and a single minded Central Banker who only considers inflation important.

$$i_t = i^* + \beta_1 \pi^{\text{above}}_t + \beta_2 \pi^{\text{below}}_t + \varepsilon_t \quad (7)$$

This second and third equations do not just omit parameters but also the interest rate smoothing mechanism.

Interest rate smoothing mechanism's coefficient  $\rho$  can be expected to be large in developing countries where uncertainty is more when compared to the developed countries and in Turkey especially during the first half of the decade this variable is the dominant determinant of the interest rates in Turkey. When regressed with interest rate smoothing mechanism;

$$i_t = 0.217 + 0.031 \pi^{\text{above}}_t + 0.117 \pi^{\text{below}}_t + 0.076 y_{t-1} + 0.954 i_{t-1} + 4.423 d(x_t) + 0.253d(i_t^{\text{euro}})$$

Alone the coefficient  $\rho = 0,954$  means that the main determinant of this periods interest rate is last periods interest rate and of course in this regression all of the other variables seem to be negligible. Therefore the regressions below neglect the interest rate smoothing mechanisms to give a proper answer to asymmetric policies. Without the interest rate smoothing mechanism the strength of the regression decreases and also from the correleogram it has been seen that the process has to be an AR(1) process and therefore it has also been added to these regressions. The main focus of this paper is still to check asymmetry and not to forecast the future Central Bank policies, this change can be ignored. The regression results are given below:

**Table 1: Estimations for the Asymmetric Monetary Policy wrt Inflation (2003-2010)**

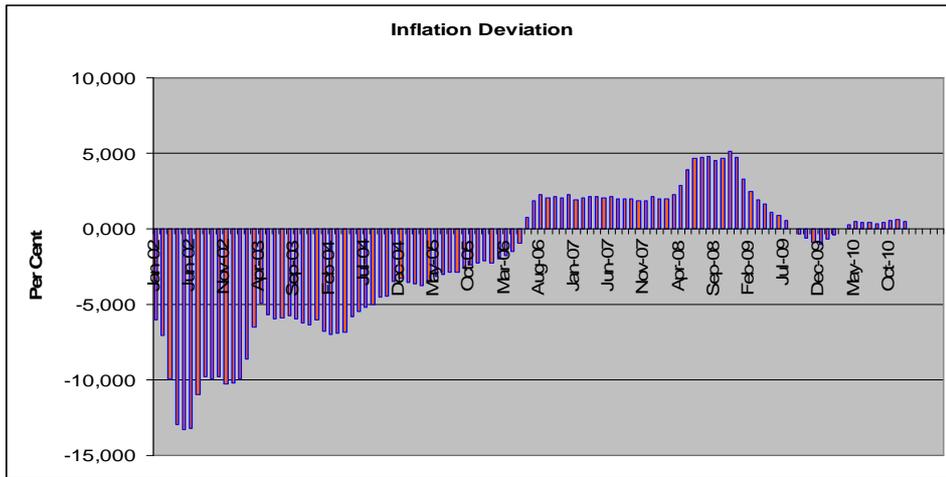
	Model in Eq. (5)		Model in Eq. (6)		Model in Eq. (7)	
<b>C</b>	8,848*	2,238	8,232*	2,630	7,884*	2,783
<b>INFBELow</b>	-0,563	0,346	-0,904*	0,286	-0,975*	0,279
<b>INFABOVE</b>	1,230*	0,332	1,161*	0,329	1,171*	0,326
<b>GDPGAP(-1)</b>	0,039	0,076	0,033	0,077	-	-
<b>D(EXCH(-1))</b>	-0,407	1,622	-	-	-	-
<b>D(EURIBOR(-1))</b>	-0,364	0,411	-	-	-	-
<b>AR(1)</b>	0,941*	0,01	0,949*	0,009	0,951*	0,008
<b>Adj R2</b>	0,985		0,987		0,988	
<b>No. Of Observations</b>	93		95		95	
<b>Coeff. Test (F-test for B1=-B2)</b>	1,804	0,1828	0,324	0,571	0,195	0,660

*Notes: The first column of every Model is the coefficients of the regression and the second column gives the standard deviations. The last row is the Wald-Coefficient Restriction to test for asymmetry. The coefficients with \* are significant at 5% level.*

According to Table 1 CBRT does not lead to asymmetric monetary policies with respect to inflation deviations in any of models as the coefficient tests fail to reject the equity of  $\beta_1 = -\beta_2$ . For the simple models in Equation (6) and (7) the coefficients of  $\pi^{\text{above}}$  and  $\pi^{\text{below}}$  are significant under 10 per cent significance level.

Although Turkey begun inflation targeting after 2002, a full flagged open inflation targeting just took place after 2005. This changed the inflation expectations of the individuals by conditioning them around the inflation target level. Before 2005 inflation forecasts of public was always below the hidden target, in other words people were overoptimistic that inflation will drop sharply, but after 2005 as people have a standard the expectations became smoother.

**Graph 1: Inflation Expectations Inflation Target Difference**



From Graph 1 this difference can be seen easily, while before 2005 every single inflation deviation data is below null, after 2005 the sign changes. This cycle coincides with economic conditions of Turkey thus it could be expected that the series when used for after 2005 regression will give higher significance for the model and also the  $H_0$  needs to be checked again for this period. Therefore another regression just taking the post 2005 is also given below.

**Table 2: Estimations for the Asymmetric Monetary Policy wrt Inflation (2005-2010)**

	Model in Eq. (5)		Model in Eq. (6)		Model in Eq. (7)	
<b>C</b>	4,852	3,702	4,862	3,699	4,994	3,564
<b>INFBELOW</b>	-2,654*	0,411	-2,615*	0,399	-2,628*	0,397
<b>INFABOVE</b>	1,040*	0,211	1,011*	0,204	1,027*	0,202
<b>GDPGAP(-1)</b>	0,0288	0,050	0,027	0,050	-	-
<b>D(EXCH(-1))</b>	-0,759	1,134	-	-	-	-
<b>D(EURIBOR(-1))</b>	0,007	0,273	-	-	-	-
<b>AR(1)</b>	0,965*	0,011	0,966*	0,012	0,965*	0,011
<b>Adj R2</b>	0,982		0,982		0,982	
<b>No. Of Observations</b>	72		72		72	
<b>Coeff. Test (F-test for B1=-B2)</b>	11,197	0,001	11,522	0,001	11,598	0,001

*Notes: The first column of every Model is the coefficients of the regression and the second column gives the standard deviations. The last row is the Wald-Coefficient Restriction to test for asymmetry. The coefficients with \* are significant at 5% level.*

In this second estimation  $H_0: \beta_1 = -\beta_2$  hypothesis is easily rejected easily in all of three regressions as can be seen from the F-test results. Thus it can be concluded that CBRT policies after open inflation targeting is asymmetrically biased. In all three equations  $|\beta_1| > |\beta_2|$  thus the Central Bank's asymmetric policy can be defined as follows: When inflation forecast is above the target (by one per cent), Central Bank considers that the economy is overheated and increases the interest rates (again nearly by one per cent) to cool it down. When the forecasts are below the target inflation (by one per cent) Central Banker heats the economy by reducing the interest rates but more than one per cent (on the average 2,6 per cent according to our models). Thus CBRT is asymmetrically biased toward higher economic growth according to this model after 2005. Also it has to be noted that the coefficients  $\beta_1$  and  $\beta_2$  are statistically significant in all three models, thus it could be said that CBRT actively rely on inflation deviations to determine the interest rates and the correleogram of residuals should not reveal any serial dependencies

## 5. CONCLUSION

In this paper setting off from a simple Taylor rule a model for the asymmetric behavior of the possible Central Banker is formed. Then this model is applied to the Turkish data and it was questioned whether CBRT has applied any asymmetric policies during the last 8 years where it used Inflation Targeting as the policy rule. Since CBRT at the first three years of Inflation Targeting has used closed targeting, the public had less idea about the target of the Central Banker, but the Central Banker knew it. So when these 3 years is added to the data set no asymmetric policies is obtained. However, when focused just to the open inflation period after 2005, it was shown that Central Bank obviously applied asymmetric monetary policies in favor of economic growth.

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