The Implicit Reaction Function of the Central Bank of the Republic of Turkey.

Article *in* Applied Economics Letters · July 2000

DOI: 10.1080/135048500351104 · Source: RePEc

2 authors, including:

M. Hakan Berument
Bilkent University
142 PUBLICATIONS **1,645** CITATIONS

SEE PROFILE

Applied Economics Letters, 2000, **7**, 425–430

The implicit reaction function of the Central Bank of the Republic of Turkey

HAKAN BERUMENT* and KAMURAN MALATYALI‡

Department of Economics, Billkent University, Ankara, Turkey and ‡ *State Planning Organization, Necati Bey Cad. No. 108, Yucetepe, Ankara, Turkey*

Reviewing the implicit reaction function estimation under different specifications, it appears that the Central Bank of the Republic of Turkey (CBRT) responds to the lagged inflation rate rather than the forward one, M2Y growth is targeted on an annual basis and a serious output targeting policy was implemented while neither real nor nominal depreciation of the foreign currency basket was taken into consideration during the period 1989:07–1997:03. Also, we conclude that the CBRT does not target currency issued, M2, net domestic assets or net foreign assets nor does it take any of the budget deficit measures into account while determining its monetary policy.

I. INTRODUCTION

For nearly two decades, inflation targeting has been implemented to some degree in the most developed countries such as Germany, Japan and the USA, despite their declarations on monetary targeting (see Leiderman and Svensson, 1995 for review). Clarida *et al.* (1998) estimate the implicit reaction function for the Central Banks of France, Germany, Italy, Japan, the UK and the US. They argue that the central banks of those countries targeted inflation with a forward looking attitude. In addition, it appears that those central banks are inclined to have a watchful eye on the deviations of output from its long run level.

All in all, the central banks of the six developed countries that Clarida, Gali and Gertler considered reflect a similar tendency of forward looking manner on inflation, no matter which incidental variable(s) are introduced to their policy reaction functions. However, this does not imply that they all resort to restrictive monetary policies as some of them have lost domestic monetary control.

As is seen from Clarida *et al.*, the implicit reaction functions of central banks may differ from the declared ones, and it might be interesting to search for the covert objectives of the monetary policy. Such a difference between the declared policy objectives and the implicit ones might be common in the central banks of a developing country, which is likely to assume a range of responsibilities such as preventing a possible currency crisis, supporting the deficit-producing public sector, smoothing of interest rates, guarding the credibility of the financial sector as well as ensuring the stability of the currency.

In this regard, Turkey conveys an interesting case. Beginning at the end of 1980s, by declaring or not declaring targeted items on the balance sheet such as net domestic assets or reserve money and, at the same time, having an eye on international reserves, Turkey considered various intermediate targets in order to decrease its high levels of inflation. Despite recurring disinflationary programmes declared so far it is evident that such programmes do not turn out to be successful. Hence, it would be interesting to watch closely the implicit reaction function of the Central Bank of the Republic of Turkey (CBRT, hereafter) in order to understand the real dynamics underlying the Bank's behaviour and to see if it operates, as the developed country central banks cited above do, in a forward-looking manner, in such a medium.

* Author for correspondence. E-mail: berument@billkent.edu.tr

The method introduced in Clarida *et al.* allowed them to observe the implicit reaction functions of France, Germany, Italy, Japan, the UK and the USA. In this paper, the unspoken reaction function of the CBRT within the period 1989:07–1997:08 is assessed utilizing the work done by Clarida *et al.* (1998), where the sample size is selected by data availability. Whether the CBRT targeted any form of money stock, inflation (forward or backward) budget deficit measures, foreign capital flows or the accounts of the CBRT balance sheet such as net domestic assets and net foreign assets to determine its monetary policy is explicitly considered.

In this study, the overnight interbank interest rate is taken to be the instrument for the CBRT's monetary policy. This line of reasoning is adopted due to the method utilized by Clarida *et al.* who use the same variable as a stance of monetary policy which reflects the findings of Bernanke and Blinder (1992), providing empirical evidence that the federal funds rate might be used to measure the Fed's monetary policy stance. Likewise, Berument and Malatyali (1997) and Kalkan *et al.* (1997) provide empirical evidence that overnight interbank interest rate can be used as a measure of the CBRT's monetary policy stance.

The following section discusses the utilized reaction function while section 3 touches upon the econometrics of the model and presents the results of the econometric analysis and the last section concludes the findings.

II. MONETARY REACTION FUNCTION

Due to rigidities in wages and prices, central bank reaction function might cause a positive relationship between output and inflation in the short run. The central bank might decrease the inflation and output by increasing the overnight interbank rate. Due to this trade-off between inflation and output in the short run, central banks aiming at reducing inflation rate, cause a decrease in output.

Central banks aiming to reduce inflation in this setting have short run interest rates as the instrument. Hence, central banks with the short run interest rates at their disposal, adjust this instrument by referring to an information set in relation with the expected inflation rate and with the output gap. As a result, central bank reaction function might follow the following rule:[1]

$$r_t^* = r_{\mathrm{LR}} + \beta\left(E\left[\prod_{t+n}|\Omega_t\right] - \prod^*\right) + \gamma(E[y_t|\Omega_t] - y^*) \quad (1)$$

where:

r_t^* = nominal short term interest rate target of the central bank,
r_{LR} = long term interest rate,
E = expectation operator,
$\prod_{t+n}$ = forward inflation rate between time t and n,
$\prod^*$ = targeted inflation rate,
y_t = current output,
y^* = potential output,
Ω_t = information set available to agent at time t.

Here the central bank sets its intended interbank rate by referring to the long run interest rate, deviation of future inflation from the targeted inflation and deviation of the current output from the potential output level. In this setting, central bank increases the interbank rate when the inflation rate and output level deviate from (exceed) their intended levels. We also allow that interbank rates can not adjust to their intended level momentarily since it may take time to adjust. We model the adjustment within two periods:[2]

$$r_t = (1 - \rho_1 - \rho_2)r_t^* + \rho_1 r_{t-1} + \rho_2 r_{t-2} + v_t \quad (2)$$

where $|\rho_1 + \rho_2| < 1$.

Eliminating the unobserved forecast variables and defining them in the error term, we can write the policy rule in terms of realized observations. In this case, the base model might be written as:

$$r_t = (1 - \rho_1 - \rho_2)(\alpha + \beta\prod_{t+n} + \gamma y_t) + \rho_1 r_{t-1} + \rho_2 r_{t-2} + \varepsilon_t \quad (3)$$

where:

$$\alpha = r_{\mathrm{LR}} - \beta\prod^*$$

$$\varepsilon_t = -(1-\rho)\left\{\beta\prod_{t+n} - E\left[\prod_{t+n}|\Omega_t\right] + \gamma(y_t - E[y_t|\Omega_t])\right\} + v_t$$

In this setting, the information set of the central bank includes any lagged or current values of variables which the bank uses to predict inflation and output.

Some central banks might assign importance to variables other than inflation and output. Thus, in order to seek out the existence of such variables, Equation 3 might be redefined as:

$$r_t = (1 - \rho_1 - \rho_2)\left(\alpha + \beta\prod_{t+n} + \gamma y_t + \psi z_t\right) + \rho_1 r_{t-1} + \rho_2 r_{r-2} + \epsilon_t \quad (4)$$

where z_t stands for the vector of variables that the CBRT might consider when setting up its monetary policy.

[1] In Taylor (1993) β and γ are suggested to be 0.5. However, due to differences in the monetary policy objectives among nations, those values may not hold for different countries. So our task in this analysis is to estimate β and γ for the CBRT.
[2] In the estimation process, we consider different lag orders for the interbank rate adjustment period. Lag order 2 works best for our sample.

A point to be noted is that β with a value of less than 1 indicates accommodative monetary policy while a value greater than 1 means a restrictive monetary policy. If β is less than 1, then Equations 3 and 4 suggest that the interbank rate increase is less than inflation. Hence, when the inflation rate increases, then the real interest rate decreases. This suggests an expansionary policy.

After conveying the theoretical framework as above we can focus on the econometric method applied and the results obtained as a result of the analysis of the CBRT's implicit reaction function along the guidelines of the Clarida *et al.* model.

III. EMPIRICAL EVIDENCE

Following Clarida *et al.* this paper uses the Generalized Method of Moments (GMM) in order to estimate the parameters of interest. Since we include the future values of some variables (future values of inflation and output deviation from target) as regressors, the residual terms would no longer be orthogonal to these future values if the OLS method were used to estimate the parameters of interest. To overcome this statistical obstacle, Hansen's (1982) GMM method is utilized. Here, the instruments are the constant term and 12 lagged values of interbank rate, inflation rate and industrial production growth rate. Since the number of instruments exceeds the number of parameters estimated, the model is overidentified. In order to test the overidentifying restrictions, the J-test is used. All the data used in this study is available from *The CBRT Quarterly Bulletins*. Lastly, in order to overcome the effects of the 1994 financial crisis, additive dummies are introduced for each month of the period extending between 1994.4 and 1994.8.

The estimates of the reaction function under different specifications are listed in the Table 1. The first equation

Table 1. *Estimates of reaction function under different specifications*

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
α	39.0	3.06	−28.62	−93.73	56.28	−102.15	−28.51	194.37	41.48	200.21	447.46	−83.65	176.22
	(1.64)	(0.19)	(−1.23)	(−12.36)	(0.63)	(−0.35)	(−1.22)	(1.42)	(0.63)	(0.91)	(0.77)	(−8.56)	(0.56)
β	0.58	−1.19	−0.51	0.20	8.71	−0.54	−0.51	−2.28	−0.42	−3.16	−6.58	0.08	
	(1.95)	(−2.61)	(−1.44)	(1.47)	(−1.70)	(−1.47)	(−1.45)	(−1.40)	(−0.45)	(−1.16)	(−0.75)	(0.32)	
γ	11.28	5.82	7.33	11.10	−0.29	6.93	7.32	9.06	5.33	10.86	14.58	−76.62	35.59
	(3.22)	(3.09)	(3.89)	(0.42)	(−0.24)	(2.98)	(3.87)	(1.57)	(1.70)	(1.17)	(0.74)	(−2.01)	(0.78)
M2Y		3.01	1.57	1.65	0.69	1.66	1.57	3.67	2.13	6.46	11.02	2.13	4.27
		(4.88)	(3.07)	(11.18)	(0.80)	(3.05)	(2.85)	(1.74)	(1.67)	(1.56)	(0.86)	(7.38)	(1.16)
Lagged inflation			1.01	1.02	−0.29	0.80	1.00	−2.50	−0.90	−4.40	−7.97	0.57	−4.58
			(2.31)	(6.96)	(−0.24)	(1.36)	(2.98)	(−1.17)	(−0.86)	(−1.11)	(−0.80)	(10.33)	(−0.66)
Budget deficit growth				1.16									
				(2.27)									
Primary deficit growth					−0.44								
					(−0.83)								
Real exchange rate						33.33							
						(0.27)							
Depreciation of the basket							1.78						
							(1.02)						
Currency issued								−2.81					
								(−1.23)					
Short run capital flow									−0.03				
									(−1.22)				
Cash balance of budget										0.01			
										(0.49)			
M2											−9.33		
											(−0.43)		
Net foreign assets												−0.23	
												(−0.74)	
Net domestic assets													−0.01
													(−0.79)
ρ_1	1.25	1.26	1.27	0.34	1.19	1.27	1.27	1.18	1.18	1.18	1.18	0.19	1.30
	(67.7)	(87.93)	(91.07)	(7.24)	(43.68)	(86.66)	(90.99)	(37.85)	(36.97)	(41.39)	(34.67)	(2.42)	(54.64)
ρ_2	−0.27	−0.28	−0.30	−0.01	−0.22	−0.30	−0.30	−0.21	−0.22	−0.20	−0.20	0.04	−0.32
	(−14.0)	(−19.27)	(−20.32)	(−0.19)	(−8.44)	(−19.61)	(−20.32)	(−7.57)	(−8.32)	(−7.28)	(−7.22)	(0.74)	(14.39)
ρ_3													−1.07
													(−0.77)
DW	1.985	2.020	2.054	0.347	1.721	2.046	2.054	1.672	1.763	1.681	1.667	1.661	1.784
J-Stat	0.183	0.237	0.234	0.149	0.162	0.233	0.234	0.169	0.166	0.171	0.171	0.131	0.172

Notes: *t*-ratios are reported in parentheses.

column (column I) reports the result of the Taylor's specification (Taylor, 1993) which is the base case while column II adds one year forward broad money stock M2Y growth to the base case, where M2Y comprises both the TL denominated and the foreign currency denominated deposits of Turkish residents. Column III adds one period lagged inflation to column II specification, which is our basic specification for the paper. The remaining columns introduce additional variables to the basic specification reported in column III.

The Taylor specification estimate is reported in column I. The results suggest that the CBRT responds to forward inflationary trend but the policy regarding the forward inflation is accommodative since the estimated coefficient for β is less than 1. Moreover, it is evident that as the output gap increases, the CBRT raises the interest rate in order to stabilize the output.

In column II, the forward yearly growth rate of money stock M2Y is added. The rationale of including M2Y is that this money aggregate, since it consists of the utmost monetary liability of the monetary authorities and the banking sector to the private sector, represents the broad liquidity definition. When the money growth rate is included, the evidence suggests that the CBRT targets the M2Y and the output level. In this specification, the estimated coefficient of inflation is statistically significant but negative. This suggests that the CBRT decreases the interest rate with higher forward inflation. This evidence, however, is confusing.

The above evidence on forward inflation rates might be misleading because the CBRT might react to the lagged level of inflation rather than try to adjust its policy to the future inflation rate. Hence, we include annualized and deseasonalized one month-lagged inflation rates in column II and show the results in column III. The estimated coefficient of lagged inflation is statistically significant and slightly greater than one. Moreover, the estimated coefficient of M2Y growth and the deviation of output are both statistically significant and positive. Another point to be noted in this specification is that the estimated coefficient of the future inflation turns out to be negative and statistically insignificant. Hence, this equation suggests that the CBRT reacts to lagged inflation, rather than future inflationary expectations, and targets the output level. Liquidity is also a concern as suggested by the statistically significant coefficient estimate for the M2Y growth. In this case, it seems that the CBRT adopts a tight monetary policy when the forward yearly M2Y growth is expected to increase and the previous month's inflation shows a tendency to rise.

Column IV adds one month forward growth rate of the budget deficit into the reaction function. The estimated coefficient is positive and statistically significant. Even if this seems to suggest that the CBRT adopts a tight monetary policy with the higher deficit, the statistical evidence might represent a reverse causality rather than the behavioural relationship the CBRT adopted. That is, innovations in interest rates might be affecting the deficit growth and not *vice versa*. Since the deficit under consideration includes interest payments made by the general budget, we expect a positive relationship between interbank rates and the deficit, when the term structure of interest rate is stable. Hence, the positive relationship between interbank rates and deficit growth might be due to interest payments rather than the CBRT's reaction toward the growth in the budget deficit.

In order to determine the exact nature of the relationship, we substitute deficit growth with the growth of the primary deficit-surplus where the primary deficit is the consolidated deficit minus the interest payments. In this case, the estimated coefficient of the primary deficit is negative and statistically insignificant, which confirms our argument that the CBRT does not incorporate budget deficit, be it primary or not, into its implicit reaction function. An alternative definition of budget deficit–the operational budget deficit–could be utilized due to the lack of monthly data where the operational deficit might be defined as the primary deficit plus the real interest payments on the government debt.

It is argued by CBRT officials that the CBRT has been targeting real exchange rate. In order to test this argument, we include the real exchange rate of the currency basket of (1 USD + 1.5 DEM) into the regression analysis. In column VI, it is shown that the estimated coefficient of the real exchange rate is not statistically significant either. Hence, empirical evidence on real exchange rate targeting is not well documented for our sample period.

To observe the effects of nominal depreciation rate, after testing for different alternatives such as current, 3 month and 12 month forward values of the currency basket, we added the nominal depreciation rate for the next quarter. The results of this specification are given in column VII. For nominal currency basket targeting, a conclusion similar to real exchange rate targeting can be drawn.

Currency issued might be considered as the immediate liquidity measure of the markets. Therefore, we tested whether the CBRT adopted a systematic targeting on this measure. Column VIII adds one month forward growth rate of currency issued into the analysis. The estimated coefficient of the currency issued is statistically insignificant, leading to conclusion that over the period under consideration, the CBRT's main concern is not the narrowest measure of liquidity.

Since Turkey is a small open economy, her economy is sensitive to capital flows. This might cause the CBRT to determine its monetary policy in response to the anticipated flow of capital. Hence, column IX includes one year forward growth rate of capital flows. As the estimated coefficient of the added variable is insignificant, we con-

clude that expectations on capital inflows do not guide the CBRT monetary policy either.

To test whether the CBRT takes the cash position of the treasury into consideration while determining the monetary policy, the cash balance of the budget was added. In column X, we see that the coefficient of the added variable is statistically insignificant, which suggests that the CBRT does not take the cash balance of the budget into consideration while determining its monetary policy.

In column XI, we incorporated M2, which represents a broad definition of liability in totally TL denomination, into our base specification. In specification III, it was estimated that there is a positive and statistically significant relationship between the interbank rate and M2Y growth. Here, both M2 and M2Y were included into the model to see if two different liquidity measures provide an insight into the guidelines of the monetary policy as well as to test the robustness of our basic findings in column III. In this case, we find that when both money measures are included, they turn out to be statistically individually insignificant. This might be due to a multicollinearity problem between these two money aggregates. However, the test results on M2 when M2 is substituted for M2Y in column III, which are not reported here, suggested that the coefficient of M2 was statistically insignificant. This confirms the argument that the CBRT does not refer only to TL denominated money aggregate but also takes liquidity measure denominated in foreign currency into consideration. Thus, we retain M2Y.

It is often argued that the CBRT targets the net foreign assets in order to overcome a possible payment crisis. Hence, the estimate of the model that incorporates the one month forward net foreign asset growth is provided in column XII. Again the estimated coefficient of net foreign asset growth is statistically insignificant, which implies that over the sample period that we considered such a policy is not detected in the CBRT reaction function.

One of the recurrent declared targets pronounced by CBRT officials has been the net domestic assets growth. Column XIII reports the results after including one month forward net domestic asset growth to the basic specification. Since the AR(2) process – Equation 2 applied in all the specifications above – for interbank interest rate behaviour gave a high autocorrelation for this specification, we tried the AR(3) process for the interbank rate and thus produced the estimates. This specification also turns out to give statistically insignificant coefficients for the net domestic asset growth, which leads us to conclude that there is no statistical evidence that the CBRT targets net domestic assets nor does it employ its policy tools towards this end.

As can be observed through the estimates of different specifications over the period under consideration, the CBRT targets M2Y money stock and reacts to inflation with one month lag. In addition, the Bank seems to have an output targeting policy. Although, real exchange rate targeting or pegging the value of the nominal exchange rate based on the basket of (1 USD + 1.5 DM) is not detected over the sample period considered. This does not mean that such a policy is rejected altogether. Rather, it may mean that, even if the CBRT has incorporated such variables into its reaction function, the duration of the policy not long enough to detect it. One could argue that the analyses are performed with one month forward values of growth in the budget deficit, the primary deficit, the nominal depreciation, the currency issued, the short run capital flows, the cash balance budget, M2, the net foreign assets and the net domestic assets growth rates not the one year forward of those variables. In order to refute such an argument, one year forward values of the above mentioned variables are also used, which confirms the robustness of the reported estimates.

Lastly, in all the different specifications tried above, the J-statistics, which test the overidentification restrictions, appear to be satisfactory. Hence, the overidentifying restrictions cannot be rejected.

IV. CONCLUSION

This paper estimates the reaction function of the Central Bank of the Republic of Turkey (CBRT) for the period 1989:07–1997:03. The empirical evidence indicates that the CBRT responds to the lagged inflation rate rather than the forward one, M2Y growth is targeted on an annual basis, and output targeting policy is implemented. Thus the CBRT has a backward looking attitude for the inflation but forward looking attitude for liquidity and output stabilization. On the other hand, neither real nor nominal depreciation of the foreign currency basket is taken into consideration for the period analysed. Moreover, it can be concluded that the CBRT does not target currency issued, M2, net domestic assets or net foreign assets nor take any of the budget deficit measures into account while determining its monetary policy.

REFERENCES

Berument, H. and Malatyali K. (1997) Parasal ve Reel Büyüklükler Arasinda Nedensellik Illşkisi: Türkiye Üzerine Bir İnceleme, unpublished manuscript.

Bernanke, B. and Blinder, A. (1992) The federal funds rate and the channels of monetary transmission, *American Economic Review*, **82**(4), 901–21.

Clarida, R. Gali, J. and Gertler, M. (1998) Monetary policy rules in practice: some international evidence, *European Economic Review*, **42**(6), 1033–67.

Hansen, L. (1982) Large sample properties of generalized methods of moments estimators, *Econometrica*, **50**, 1029–54.

Kalkan, M., Kipici, A. and Peker, A. (1997) Monetary policy and leading indicators of inflation in Turkey, *Irvin Fisher Committee Bulletin*, **1.**

Leiderman, L. and Svensson, L. E. O. (1995) *Inflation Targets*, Centre for Economic Policy Research, Glasgow, UK.

Taylor, J. (1993) Discretion versus policy rules in practice, *Carnegie Rochester-Conference Series on Public Policy*, **39**, 195–214.