OUTPUT-INFLATION VARIABILITY TRADEOFF AND STABILIZATION POLICIES

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ABSTRACT

By assuming that policymakers only intent to construct the price stability conditions, choosing price level target instead inflation rate target in stabilization policies causes a less tradeoff between output and price variability. In this study, when policymakers take care of not only price stability but also output stability, it has been tried to find out an answer for the question of which political variables should be used to construct a less tradeoff. The results show that interest rate policies can not be used for this purpose because of it makes the tradeoff positive and demand shocks also are not appropriate to built a less tradeoff, because it causes a high tradeoff. Using the supply-side political variables clearly makes the tradeoff less between output and inflation variability.

INTRODUCTION

A lot of monetary policy is employed with the intention of to reach price stability conditions. In some cases, however, stabilization policies are charged not only price stability but also output stability. Over the last decade or so, a lot of discussion has been done about the success of these policies [e.g. Lown and Rich (1997), McDonough (1997), Mishkin and Posen (1997), Cecchetti (1998), Dittmar, Gavin and Kydland (1999), Siklos (1999), etc...]. The most of these discussions tried to find out an answer for the question of how should be a policy that intends to reach price stability. By supposing that the proposition of the policymakers aim to reach only at price stability is true, choosing price level target instead inflation rate target in price stability policies causes a less tradeoff between output and inflation variability. Applying Svensson (1997b)'s methodology, a study was prepared by Yamak and Küçükkale (1999) implied that the same result is valid for Turkish case. According to the authors, if *The Central Bank of Turkey* choose a price level target instead inflation rate target, the tradeoff between output and inflation variability would be less than the other situations.

In this study, when policymakers driving a price stabilization policy just beside output stabilization policy, it has been searched out a solution for the problem of which political variables should be used to construct a less tradeoff. The methodology was firstly constructed by Cecchetti (1998) obtained that price stability and output stability preferences could be together in the central bank's loss functions in different weights, thus output stabilization policies had a form appropriate to test addition to price stabilization policies. In the study, the opinion that choosing a price level target instead inflation rate target leads a less tradeoff between output and inflation variability was accepted as true due to Yamak and Küçükkale (1999). Additionally, it has been investigated which policies, that policymakers should follow, should be applied to obtain each of these two stabilizations simultaneously.

METHODOLOGY

It has been assumed that policymakers struggled to minimize the discounted sum of squared deviations of output and prices from their target paths. The general form of such a loss function can be written as follows,

$$L = E_t\left(\sum_{i=0}^{h}\beta^i\left\{\alpha\left[p_{t+i} - p^*_{t+i}\right]^2 + (1-\alpha)\left[y_{t+i} - y^*_{t+i}\right]^2\right\}\right), \quad (1)$$

where; p_t is log of the aggregate price level; y_t is log of the aggregate output; p^* and y^* are the desired levels for p and y; β is the discount factor; h is the horizon; α is the relative weight given to squared price and output deviations from their desired paths, and E_t is the expectations that are available at time t. To complete the formulation of L, the full description of p^* and y^* are required. Cecchetti (1998) has focused on the desired path of the price level, ignoring the desired output path. p^* can be formulate in two different ways. In the case of price level targeting, p^* would be as follows,

$$p^*_t = p^*_{t-1} + \pi^* = \pi^* t, \quad (2)$$

where π^* is the desired steady level of inflation. Equation (2) shows that the optimal price level for this period equals the optimal price level for the last period plus desired inflation rate. Alternatively, in the case of inflation rate targeting, p^* would be as follows,

$$p^*_t = p_{t-1} + \pi^*, \quad (3)$$

In equation (3), the target price level is the sum of the last period's realized price level and desired inflation rate.

If p^* that was captured in equation (2) or (3) substituted in equation (1) then L function would become a function of the parameter vector $\theta = \{\alpha, \beta, h, \pi^*\}$. Revaluing α that means relative weight of price variability to output variability is depend on the fundamental reasons, like in choosing π^*. In the policies aimed pure price stability it would be $\alpha = 1$; and in the policies aimed pure output stability $\alpha = 0$. This coefficient was valued as "1" in Svensson (1997b). Namely, Svensson took only care of price stabilization, ignoring output stabilization.

The question of which path should be choose can not be answered without *a priori* knowledge of the dynamics of output and prices as functions of the policy control variable and the stochastic forcing process driving the economy. These are the structure of the economy and the constraints of the optimization problem at the same time. Proposing that the direct policy variable of the policymakers is interest rate and the indirect variables are the nominal and/or real shocks (aggregate demand and/or aggregate supply shocks), it can be written as follows,

$$\begin{bmatrix} y_t \\ p_t \end{bmatrix} = A(L)\begin{bmatrix} \varepsilon_t \\ r_t \end{bmatrix}, \tag{4}$$

where; $A(L)$, is an $(n+1)\times 2$ matrix of lag polynomials in the lag operator L. The coefficients in $A(L)$ describe a reduced form of the economy. Cecchetti (1998) ignored the fact that $A(L)$ is likely to change when policy rule changes. Additionally, he argued that using interest rate as policy variable is not necessary and the control variable could be any quantity that is directly governed by policymakers. In this case, the variables in ε_t can be used as control variable as much as interest rate.

Now, the policymakers' problem as choosing a path for r_t that minimizes the loss function, with either equation (2) or equation (3) substituted in for p^*, subject to equation (4), can be characterized. It is as follows,

$$r_t = \phi(L)\varepsilon_t, \tag{5}$$

where; $\phi(L)$, is a lag polynomial. $\phi(L)$ is a function of the parameters θ, as well as the coefficients in $A(L)$ and the covariance matrix of ε_t, $\Sigma\varepsilon_t$ can be thought as aggregate and/or supply shocks.

Cecchetti (1998) considered a simple one period case in which the horizon in the policymaker's loss function (h) is zero, so the discount factor (β) is irrelevant, target levels of output (y^*) and prices (p^*) are zero (in logs), and the structure of the economy is such as seen equation (6) and (7).

$$y_t = \gamma r_t + d_t - s_t,\ \gamma<0 \qquad \text{and} \tag{6}$$

$$p_t = -r_t + d_t + s_t, \tag{7}$$

where; d_t and s_t aggregate demand and aggregate supply shocks. While the two types of shocks are uncorrelated and the variance of the demand shocks is given by σ^2_d, the variance of the supply shocks was normalized to one and dropped from the equations. The parameter γ is a measure of the impact of policy innovations on output relative to their impact on prices and have to be less from zero. In this simple linear case, Cecchetti proposed that the policy rule will be as equation (8).

$$r_t = ad_t + bs_t. \tag{8}$$

Equation (8) implies that

$$\sigma^2_y = (\gamma a + 1)^2 \sigma^2_d + (\gamma b - 1)^2 \quad \text{and} \tag{9}$$

$$\sigma^2_p = (1 - a)^2 \sigma^2_d + (1 - b)^2 \tag{10}$$

To exact determining the policy rule, a and b coefficients that shows the relative effects of supply and demand shocks on interest rates must be clarified. These coefficients can be calculated by minimizing the loss function (L) as seen equation (12) and (13).

$$L = \alpha\sigma^2_p + (1 - \alpha)\sigma^2_y \text{'den} \tag{11}$$

$$a = \frac{\alpha - \gamma(1-\alpha)}{\alpha + \gamma^2(1-\alpha)} \quad \text{and} \tag{12}$$

$$b = \frac{\alpha + \gamma(1-\alpha)}{\alpha + \gamma^2(1-\alpha)}. \tag{13}$$

Substituting these into the variance expressions (9) and (10) yields σ^2_p and σ^2_y as functions of α, γ and σ^2_d. Thus, according to Cecchetti, to calculate the output and inflation variability, the last necessity is γ that shows output-inflation variability tradeoff.

MODEL ESTIMATES

In estimation (4) for the period of 1986: 01-1997: 06, five variables were used: Industrial production, wholesale price index, demand shock, supply shock and interest rates. There is a lack of historical monthly GDP data for Turkey, so "*Industrial Production Index"* was used to measure the monthly output. "*Wholesale Price Index"* was used in the study with the purpose of measuring the inflation. While demand shock was constructed by using "*Hodrick-Prescott Filter* (1997)" for broad money definition M2, supply shock was captured by using the same filter for "*Crude Oil Import Prices Per Barrel"*. To measure the interest rates, "*General Interest Rates on CBRT Discount and Advance Rates"* was used. All variables are in the log form. Lag length of the VAR system was determined as 1 (one) by using the "*Akaike* (1969) *Information Criterion*". Response charts of price and output for the impulses due to policy shocks are as seen Figure 1 through 6.

Cecchetti has shown that γ can be calculated by dividing the average of response of output to interest rate shock to average of response of prices to interest rate shock. Following this procedure, by assuming that the Central Bank uses the interest rate as a direct policy variable, the tradeoff parameter was founded out as 3.06. Nevertheless, this value is positive and is not fit to *a priori* inferences of the model. Therefore, it can be said that interest rates should not be used as a control variable. On the other hand, if the Central Bank used the demand or supply shock as an indirect control variable, then the tradeoff parameter would be –0.08 and –1.39 relatively. So, using the supply and/or demand shocks would be more logical preference then using the interest rates. Anyhow, any policymaker would not be intended to use a positive tradeoff parameter.

σ^2_d has calculated as 0.002632 from the data set. If a and b values that have been founded out by using γ parameters put into (9) and (10) with σ^2_d, and allowed α change, σ^2_y and σ^2_p could be estimated. Estimation results are as seen Figure 7 and 8.

The results show that the interest rate policy can not be used by policymakers, because it makes the tradeoff positive. In the case that demand shocks use as control variable, price variability reaches a huge value as 172%, and because of this, it increases the opportunity cost of the policy. Using the supply shocks as indirect control variable is seen the most logical preference. In the case that using the supply shocks, while if $\alpha = 1$ then output variability would be 4-5%, if $\alpha = 0$ then price variability would be 2.5-3%. Using the supply shocks makes the tradeoff clearly less than the other situations.

CONCLUSIONS

According to the recent theoretical and applied studies on stabilization policies, choosing price level target instead inflation rate target causes a less tradeoff between output and price variability. But this general idea is valid only when policymakers take care of pure price stability. In this study, when policymakers take care of not only price stability but also output stability, it has been tried to find out an answer for the question of which political variables should be used to construct a less tradeoff and the alternative policy instruments were searched to achieve a less tradeoff between output and price variability. The methodology was used in this study was developed by Cechetti (1998). Monthly data set for Turkish economy covers the period of 1986: 01-1997: 06. The obtaining results imply that interest rate policies can not be used for this purpose because it makes the tradeoff positive and demand shocks also are not suitable to achieve a less tradeoff because it causes a high tradeoff. Using the supply-side political variables clearly makes the tradeoff less between output and price variability.

Figure 1
Response of Output to Interest Rate Shock

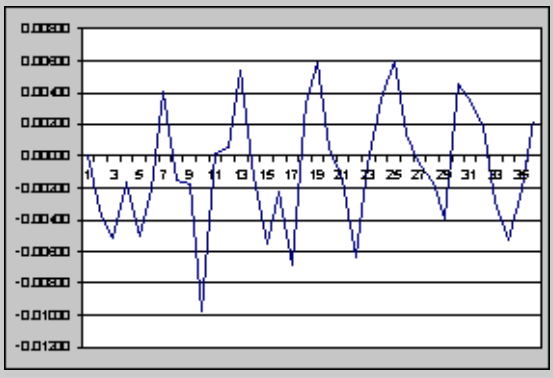


Figure 2
Response of Prices to Interest Rate Shock

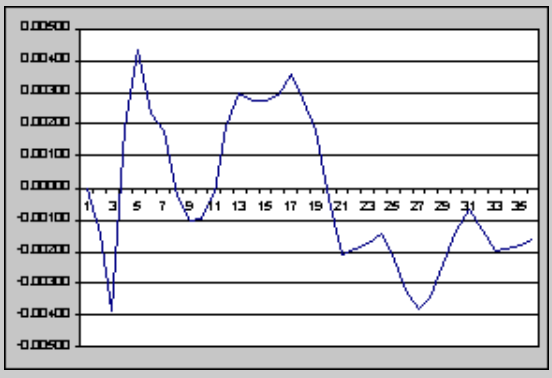


Figure 3

Response of Output to Demand Shock

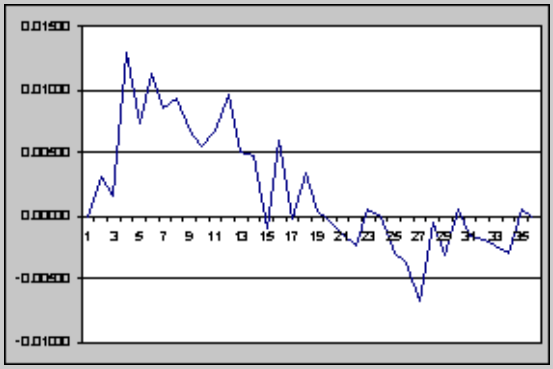


Figure 4

Response of Prices to Demand Shock

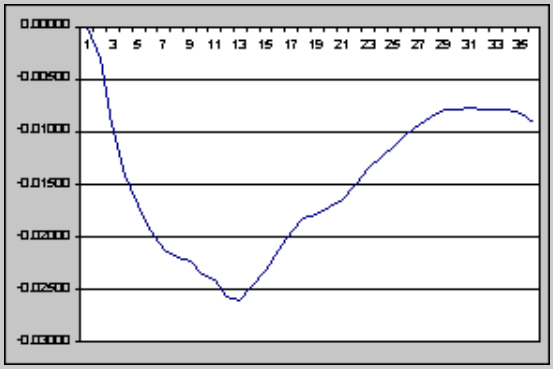


Figure 5

Response of Output to Supply Shock

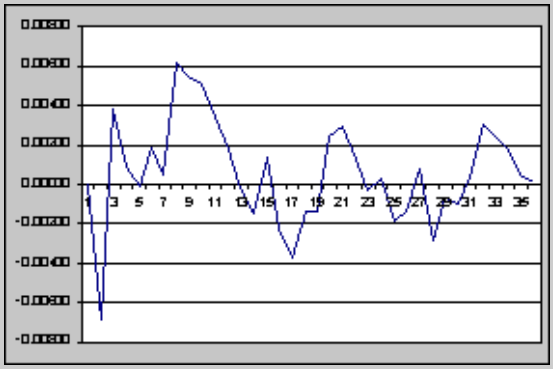


Figure 6

Response of Prices to Supply Shocks

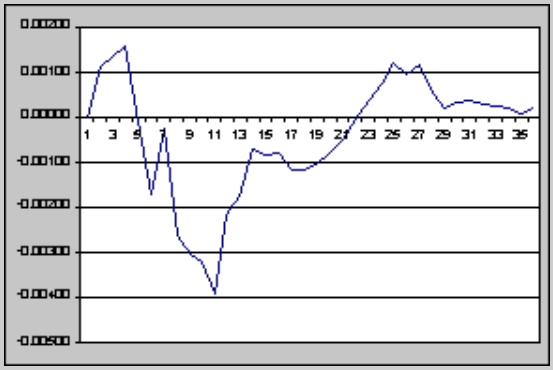


Figure 7

Output-Inflation Variability Tradeoff
(Using Supply-Side Variables)

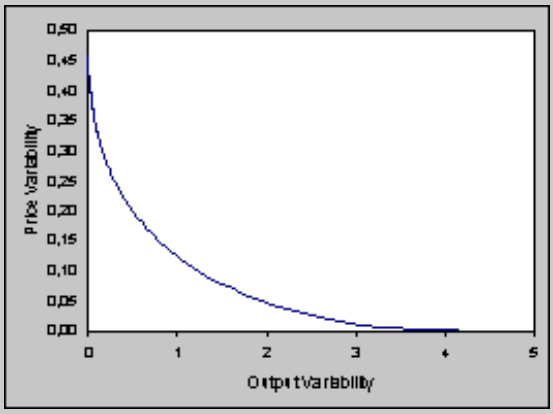
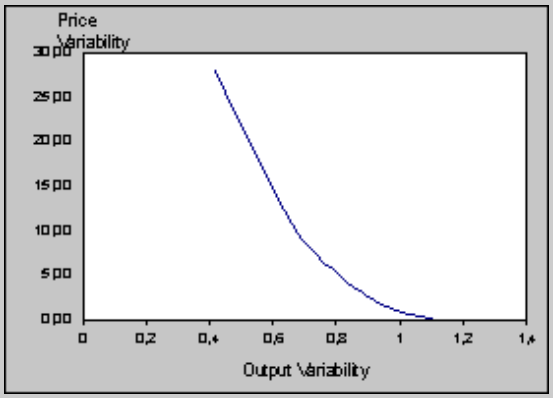


Figure 8

Output-Inflation Variability Tradeoff
(Using Demand-Side Variables)



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