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Did the Bank of Japan have a target zone for the inflation rate?

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Abstract

Piecewise linear policy reaction functions are estimated to examine the Bank of Japan's monetary policy during the period 1975–1995. The results indicate that the Bank of Japan implemented an implicit *inflation zone targeting* policy.

Keywords: Monetary policy; Policy reaction function

JEL classification: E52; E58

1. Introduction

To describe the Bank of Japan's (BOJ) conduct of monetary policy, recent empirical work has estimated its policy reaction functions (see, e.g., Jinushi et al., 2000; Clarida et al., 1998; Bernanke and Gertler, 1999; Chinn and Dooley, 1997). For the most part, the policy reaction functions used in these studies are restricte d to linearity in terms of inflation, output, and other factors. One of the justifications for adopting the *linear* policy reaction function is that there is a strong theoretical motivation for policymakers to do so when assuming a linear macroeconomic model and a quadratic loss function (see, e.g., Svensson, 1997).

However, as illustrated in Orphanides and Wieland (2000), the optimal rule for the central bank takes the form of a nonlinear rule in terms of inflation if the model deviates from the linear–quadratic paradigm. Specifically, the optimal rule has the characteristics of an *inflation zone targeting* policy where the policymaker responds more aggressively to inflation when it lies outside the target range, than

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when it lies inside the range. If actual BOJ's policy has such a characteristic, though it has never adopted an *explicit* inflation zone targeting strategy, estimating the usual linear policy reaction function cannot provide a good description of its behavior. In this paper, I test the linear policy function against the nonlinear function with an inflation zone targeting characteristic.[1]

2. Specification and methodology

Conventional linear policy reaction functions prescribe that the policymaker sets the nominal short-term interest rate, i_t, as a linear function of key macroeconomic variables. Specifically,

$$i_t = \alpha + \beta\pi_t + \gamma y_t + \mu z_t + v_t, \tag{1}$$

where π_t is the inflation rate, y_t is the output gap, z_t is the exchange rate gap, and v_t is a stochastic disturbance term. Here I define a policy reaction function that has different inflation coefficients, depending on whether inflation lies inside or outside the target zone as follows:

$$i_t = \alpha + \beta^{\mathrm{oz}}\pi_t + \left(\beta^{\mathrm{iz}} - \beta^{\mathrm{oz}}\right)D_t\pi_t + \gamma y_t + \mu z_t + v_t, \tag{2}$$

where D_t is a dummy variable taking a value of unity if inflation is within the target zone and a value of zero if inflation is outside the target zone, β^{oz} is the coefficient of outside-target-zone inflation, and β^{iz} is the coefficient of inside-target-zone inflation. If $\beta^{\mathrm{oz}} > \beta^{\mathrm{iz}}$, then Eq. (2) corresponds to the approximate form of the optimal nonlinear rule in Orphanides and Wieland (2000), which has the characteristic of inflation zone targeting.[2] If $\beta^{\mathrm{oz}} = \beta^{\mathrm{iz}}$, then it collapses into a linear policy reaction function (1). Therefore, estimating Eq. (2) enables a test of the linear specification against the nonlinear inflation-zone-targeting specification.[3]

Two estimation problems are likely to arise in this formulation. First, measurement error in each explanatory variable of Eq. (2) would arise because the policymaker is unable to obtain absolutely accurate information about the current values of these variables at the time the interest rate is set. Following much of the recent literature I address the measurement error problem by estimating Eq. (2) with Generalized Method of Moments (GMM).

Second, the other problem in estimation is that a target zone for inflation cannot be estimated by the usual GMM method. The following method is employed to *indirectly* estimate the target zone, but to *directly* estimate the coefficients of Eq. (2). First, a number of target zones included in the 0.0–3.0% range of inflation and with a width of at least 1.0%, are created as candidates for the true target zone.[4] Second, GMM estimations are repeatedly run, for each of these target zones. Third, the likelihood-ratio (LR) test statistic for the null hypothesis that β^{oz} equals β^{iz} (i.e., a linear specification) is calculated. Fourth, the maximum LR test statistic is selected from the estimations satisfying $\beta^{\mathrm{oz}} > \beta^{\mathrm{iz}} \geq 0$. If the BOJ actually conducted an inflation zone targeting policy, then the target zone associated with the maximum

[1] Tachibana (2005) has examined whether the US Federal Reserve conducted implicit inflation zone targeting.

[2] This paper focuses on the nonlinearity of the policy response to inflation and does not investigate nonlinearity relating to the output gap and exchange rates, because Orphanides and Wieland's (2000) optimal rule is nonlinear only in the inflation rate. In the future research, however, I would like to theoretically and empirically investigate nonlinearity in terms of the output gap and exchange rates.

[3] I do not include lags of the interest rate that capture interest rate smoothing behavior, since Eq. (2) itself includes interest rate smoothing behavior if $\beta^{\mathrm{oz}} > \beta^{\mathrm{iz}}$ and β^{iz} is near zero, these conditions being shown below to be satisfied for the BOJ's policy.

[4] The grid interval for the middle point of the target zone is 0.1% and the one for the width of the target zone is 0.2%.