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The relative efficiency of various targeting regimes in Japan: A simulation study with linear quadratic dynamic programming

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Abstract

In this paper, we examine the relative efficiency of various targeting regimes by using linear quadratic dynamic programming given estimated parameters. This analysis yields two notable implications. First, in Japan, money supply growth targeting generates higher inflation volatility and higher GDP-gap volatility than other targeting regimes including inflation targeting and GDP-gap targeting. This conclusion differs from that of Rudebusch and Svensson [Rudebusch, G.D., Svensson, L.E.O., 2002. Eurosystem monetary targeting: lessons from U.S. data. European Economic Review 46, 417–442] for the US. Second, strict inflation targeting and flexible inflation targeting are more efficient than other targeting regimes including strict GDP-gap targeting.

JEL classification: E52; E58

Keywords: Inflation targeting; GDP-gap targeting; Money growth targeting; Linear quadratic dynamic programming; Efficiency frontier

1. Introduction

The adoption of various targeting regimes, especially inflation targeting, has been studied and discussed. Rudebusch and Svensson (2002) compare the relative performance of various targeting regimes (inflation targeting, output-gap targeting, and money growth targeting) under an empirical model in the US. Adopting their procedure, in this paper, we compare the relative performance of the various targeting regimes to determine which targeting regime is desirable in Japan.

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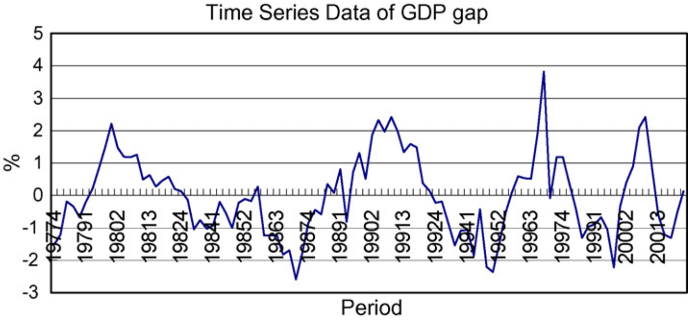

Fig. 1. Time series data of the inflation rate and the real GDP gap. Sample period is from 1978:1 to 2002:3. This real GDP gap is measured by the method in Appendix A.

The result of this analysis is interesting and yields two notable implications. First, in Japan, money supply growth targeting generates higher inflation volatility and higher GDP-gap volatility than other targeting regimes including inflation targeting and GDP-gap targeting. This conclusion differs from that of Rudebusch and Svensson (2002) for the US. Second, strict inflation targeting and flexible inflation targeting are more efficient than other targeting regimes including strict GDP-gap targeting.

This paper comprises four sections. In Section 2, we present the estimated model for Japan. In Section 3, we describe the theoretical method. In this section, we rewrite the model in matrix form, define the targeting regime of the central bank, and present an overview of the use of linear quadratic dynamic programming as a tool for evaluating the relative efficiency of targeting regimes. In Section 4, we evaluate the relative efficiency of the various targeting regimes by using the efficiency frontier based on the criterion of social loss. We then derive conclusions.

2. Specifying and estimating the economic model

2.1. Specifying the model

For an analysis of the relative efficiency of the various targeting regimes, we could have chosen either a vector autoregressive (VAR) model or a standard macroeconomic model; we chose the latter.[1] A simple example of such a model is the aggregate supply/aggregate demand model, which has been analyzed by Svensson (1997) and Rudebusch and Svensson (1998). Our model comprises an aggregate supply function (AS), an IS function (IS), a money demand function (MD), and a potential GDP-gap trend equation, which is based on the work of Rudebusch and Svensson (2002).

$$\text{AS function}: \quad \pi_{t+1} = \alpha_{\pi 1}\pi_t + \alpha_{\pi 2}\pi_{t-1} + \alpha_{\pi 3}\pi_{t-2} + \alpha_{\pi 4}\pi_{t-3} + \alpha_y y_t + \varepsilon_{t+1} \tag{1}$$

$$\text{IS function}: \quad y_{t+1} = \beta_{y1}y_t + \beta_{y2}y_{t-1} - \beta_r(\bar{i}_t - \bar{\pi}_t) + \eta_{t+1} \tag{2}$$

$$\text{MD function}: \quad \Delta m_{t+1} = -\kappa_m(m_t - \kappa_q q_t + \kappa_i i_t) + \kappa_1 \Delta m_t + \xi_{t+1} \tag{3}$$

[1] Sack (2000) uses a structured VAR method.