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J. Japanese Int. Economies 22 (2008) 476–502
Journal of THE JAPANESE AND INTERNATIONAL ECONOMIES
www.elsevier.com/locate/jjie

Estimating a dynamic stochastic general equilibrium model for Japan ☆

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Received 10 April 2007; revised 18 September 2007

Available online 15 January 2008

Sugo, Tomohiro, and Ueda, Kozo—Estimating a dynamic stochastic general equilibrium model for Japan

We estimate a medium-scale dynamic stochastic general equilibrium model of the Japanese economy following Christiano et al. [Christiano, L., Eichenbaum, M., Evans, C., 2005. Nominal rigidities and the dynamic effects of a shock to monetary policy. J. Polit. Economy 113 (1), 1–45]. By using actual capital utilization data and modifying the formulation of utilization following Greenwood et al. [Greenwood, J., Hercowitz, Z., Huffmann, G.W., 1988. Investment, capacity utilization, and the real business cycle. Amer. Econ. Rev. 78 (3), 402–417], this paper succeeds in incorporating a negative correlation between capital utilization and rental costs to explain actual capital utilization rates. We find that an investment adjustment cost shock is as important as a productivity shock that affects business cycles. We also find hump-shaped and persistent behavior of inflation rates in response to a monetary policy shock, which Christiano et al. cast doubt upon. *J. Japanese Int. Economies* **22** (4) (2008) 476–502. Monetary Affairs Department, Bank of Japan, Japan.

JEL classification: E22; E32; E52

Keywords: DSGE model; Monetary policy; Capital utilization; Japan

1. Introduction

This paper constructs a medium-scale dynamic stochastic general equilibrium (hereafter DSGE) model by modifying the formulation of capital utilization following Greenwood et al.

☆ The views expressed here are those of the authors and do not reflect those of the Bank of Japan.

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0889-1583/$ – see front matter
doi:10.1016/j.jjie.2007.09.002

(1988), and estimates the model using Japanese data, including that on actual capital utilization.

There are similar empirical studies which estimate the medium-scale DSGE model developed by Christiano et al. (2005). Smets and Wouters (2003) is the first attempt to estimate a Christiano et al.'s model using Bayesian techniques. They apply the model to the Euro economy, and argue that the estimated parameters are more or less consistent with microeconometric findings and that their medium-scale DSGE model explains the actual economy almost as well as VAR. Their results were later confirmed by Onatski and Williams (2004). Levin et al. (2005) estimate a similar model for the US economy. As for applications to the Japanese economy, Iiboshi et al. (2006) have already estimated the model using Japanese data.

Although these studies seem to succeed in explaining the actual economy very well, we find that there are still unresolved problems relating to capital utilization rates which previous studies did not focus on. In Smets and Wouters (2003) and others, this variable is treated as unobservable, and inferred using the Kalman filter. Fig. 1 shows the inferred movement of capital utilization rates obtained using Japanese data (shaded areas represent recessions). Since there are available statistics on capital utilization rates, although these are limited to manufacturing firms in Japan, a comparison is instructive. We find that the two utilization rates are very different in terms of their movements and their amplitude.

Since we have data on capital utilization rates, it is quite natural to make use of this when estimating the model. This then generates another problem. The Christiano et al. (2005) model states that capital rental costs should positively affect capital utilization rates. This is because their model assumes that it is beneficial for capital lenders to increase capital utilization rates when capital rental costs are high. However, as is shown in Fig. 2, these two variables are in fact negatively correlated. Such a negative correlation is perfectly intuitive, and can be explained as follows. While capital rental costs are positively determined by the marginal product of effective capital, the latter depends negatively on the capital utilization rate, so a negative correlation will be observed.

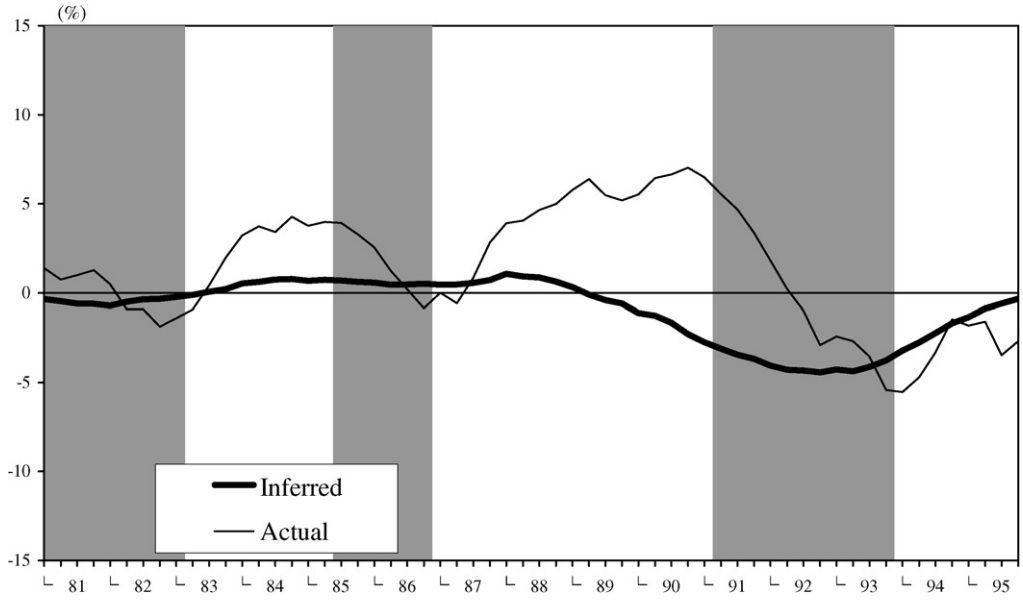

Fig. 1. Actual and inferred capital utilization rates.