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Business cycles and monetary policy asymmetry: An investigation using Markov-switching models

Siow-Hooi Tan[a,*], Muzafar Shah Habibullah[b]

[a]Faculty of Management, Multimedia University, Jalan Multimedia, 63100 Cyberjaya, Selangor, Malaysia
[b]Department of Economics, Faculty of Economics and Management, Universiti Putra Malaysia, 43400, UPM Serdang, Selangor, Malaysia

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Abstract

This study assesses empirically the effects of monetary policy on four ASEAN economies in different states. The idea of asymmetry is being examined by using the relatively popular technique of non-linear modeling—Hamilton's Markov regime-switching model. The findings confirmed the existence of two-regimes in all economies under study. Additionally, the null hypothesis of symmetry had been rejected in the case of the four economies and to a great extent, monetary policy was confirmed to have had larger effects during recessions. These findings, thus, may imply the important role that credit market imperfections have on a firm's investment behavior, which in turn suggests that the financial accelerator is a relevant mechanism underscoring the observed asymmetry.

Keywords: Markov regime-switching; Symmetry; Non-linear

1. Introduction

It has long been proposed by theorists such as Mitchell [1] and Keynes [2], that the movement of certain macroeconomic variables across business cycles may be asymmetric. Nevertheless, most empirical and theoretical modeling in macroeconomics has incorporated explicitly linear adjustment mechanisms, which imply that responses to shocks are both continuous and symmetric.

Various sorts of non-linear models have been receiving increased attention in literature focusing on the econometric time series. Linear models, with their implied symmetry, have been shown to be deficient in dealing with certain traits of some economic series. They are unable, for instance, to fully capture the high volatility of certain financial variables [3] or the asymmetrical behavior of business cycles [4–8].

As mentioned in Hamilton [5], there is "accumulated evidence that departures from linearity are an important feature of many key macro series". Hamilton introduced a two-regime Markov-switching model with endogenous structural breaks to analyze the behavior of gross domestic product (GDP) data. His results

*Corresponding author. Tel.: +603 83125658; fax: +603 83125590.
E-mail addresses: shtan@mmu.edu.my (S.-H. Tan), muzafar@econ.upm.edu.my (M.S. Habibullah).

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matched the turning points (between recessions and booms) as shown in the data by the National Bureau of Economic Research.

Subsequently, the use of regime-switching model has proliferated in numerous areas of applied economics. Engel and Hamilton [9] used this model to explain the long swings in exchange rates. Pagan and Schwert [10] used it to model conditional stock volatility in stock returns. Diebold and Rudebusch [11] as well as Kim and Nelson [12] applied this framework in order to study dynamic factor models in business cycles. Garcia and Perron [13] and Bekdache [14] employed Markov-switching models to investigate the behavior of real interest rate. Ravn and Sola [15] studied the variables that can affect the transition probabilities in these models. Sims [16] used this structure to analyze monetary regimes.

In this study, the Markov regime-switching model developed by Hamilton [5], which shares the principle that the generating process of a series is a function of some states of nature, has been utilized to analyze the asymmetric effects of monetary policy in four ASEAN economies—Indonesia, Malaysia, the Philippines and Thailand. Having validated the existence of two-regimes in these economies, the model was extended as suggested by Garcia and Schaller [17] to include a measure of monetary policy shocks in order to examine if monetary policy has the same effect during a recessionary period as it does during an expansionary period.

By way of summary, the overall findings provided substantial evidence of the existence of two-regimes in all the economies over the sample period that ended in 2003:4. Most importantly, the results generated from this analysis lent credence to the asymmetric effects of monetary policy over business cycles for all the four economies. In particular, by looking at the monetary policy coefficients, the real impact on a recession period appeared greater than on an expansion period for all model specifications. Section 2 of this study is meant to offer a concise review of the Markov regime-switching approach, followed by Section 3 which discusses the methodology. Section 4 is centered on the empirical results and the relevant insights, while the closing Section 5 presents key conclusions and suggestions.

2. Markov regime-switching approach

2.1. Markov regime-switching model

The Markov regime-switching model explicitly takes into account the probabilistic nature of business cycle dating by treating the state of the economy (expansion/recession) as an unobserved latent variable. This is made clear the Hamilton [5] model:

$$\Delta y_t - \alpha_0 - \alpha_1 S_t = \phi_1(\Delta y_{t-1} - \alpha_0 - \alpha_1 S_{t-1}) + \cdots + \phi_r(\Delta y_{t-r} - \alpha_0 - \alpha_1 S_{t-r}) + \varepsilon_t \tag{1}$$

where S_t is the state variable, Δy_t is the growth rate of output, and α_1 and $\alpha_0 + \alpha_1$ are the mean growth rate conditional in state S_t, the parameters being $\phi_1, \ldots, \phi_r$ capture the autoregressive component of output growth and ε_t is distributed $N(0, 1)$. In the case of only one state, the model reduces to a standard linear reduced-form equation. Through this study, two states ($S_t = 0$ and 1) are allowed with the probabilities of changing from one regime to the other expressed by the following transition matrix:

$$\begin{bmatrix} \mathrm{p}_{00} & \mathrm{p}_{01} \\ \mathrm{p}_{10} & \mathrm{p}_{11} \end{bmatrix}, \tag{2}$$

where

$$\mathrm{p}_{ij} = \Pr[S_t = j | S_{t-1} = i], \text{ with } \sum_{j=0}^{1} \mathrm{p}_{ij} = 1 \text{ for all } i. \tag{3}$$

The element of the ith row and jth column describes the transitional probability p_{ij}. The individual p_{ij}'s represent the likelihood that the economy would switch from the ith state to the jth state. For instance, the value of p_{01} represents the probability that the economy will move from state 0 to state 1, given that the economy is in state 0.

In the case of a two-state model, the transition probabilities can be represented by a (2×1) vector, $\hat{\xi}_{t|t}$, whose first element is $\mathrm{P}(s_t = 1 | Y_t)$ where $Y_t = (Y_{t-1}, y_t)$ and Y_{t-1} contains past values of y_t. Given the value