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Effects of the Bank of Japan's current quantitative and qualitative easing

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HIGHLIGHTS

- We examine how the Bank of Japan's QQE affects the Japanese economy.
- An MS-VAR model on daily data (January 2012–August 2014) is used in the analysis.
- The estimated regime-switching point coincides with the policy implementation.
- Monetary base expansion lowers short-term interest rates and raises inflation rates.
- Long-term government bond and ETF purchases increase economic activity.

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ABSTRACT

This paper examines how the Bank of Japan's current quantitative and qualitative easing affects the Japanese economy by using a Markov-switching vector autoregression model on daily economic data during January 2012–August 2014. The results reveal that quantitative easing by expanding the monetary base significantly lowers short-term interest rates and raises inflation rates. In addition, the lowered interest rates positively affect inflation rates. Qualitative easing through purchases of long-term government bonds and exchange-traded funds increases economic activity. Purchases of exchange-traded funds stimulate the stock and foreign exchange markets in Japan, while purchases of Japan real estate investment trusts do not have any effect.

1. Introduction

The Bank of Japan (BOJ) introduced a quantitative and qualitative easing (QQE) policy in April 2013 to overcome deflationary pressures and to stimulate the stagnant Japanese economy. To achieve a target inflation rate of 2%, the BOJ began to expand the monetary base, by increasing purchases of not only long/short-term government bonds but also risk assets, such as exchange-traded funds (ETFs) and Japan real estate investment trusts (J-REITs) to targeted levels.

Before the impacts of these policy changes on the real economy became apparent, stock prices rose and the Japanese yen depreciated against the US dollar, which may be a result of accumulated short-term responses to the monetary policy. Since these effects seem to stimulate the economy (Shirai, 2014), it is important to focus on short-term fluctuations in key economic variables in order to assess policy effects and their transmission mechanism. Thus, this paper attempts to reveal how certain macroeconomic variables respond on a daily basis to the BOJ's implementation of each policy instrument.

The effectiveness of quantitative easing (QE) was examined by Eggertsson and Woodford (2003) and Bernanke and Reinhart (2004). They discussed its positive impacts on the economy with a near-zero interest rate policy. For the case of Japan's QE, Fujiwara (2006), Inoue and Okimoto (2008), and Hayashi and Koeda (2014) applied a vector autoregression (VAR) model with a Markov-switching structure in their analyses. They discovered that in the past, a regime change in Japan occurred either in the initial stages of the liquidity trap (in 1996) or when the QE was introduced (in

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Table 1
Signs of the significant impulse responses.

		To					
		Current account balance	Repo rate	Output	Inflation rate	Stock price	Exchange rate
(a) Regime 1							
From	Current account balance	+	−		+		
	Repo rate		+		−		
	Output	−	+	+			
	Inflation rate				+		
	Stock price		−				
	Exchange rate						
(b) Regime 2							
From	Current account balance	+	−	−	(−)		
	Repo rate	−	+				(+)
	Output			+			
	Inflation rate			+	+		
	Stock price						
	Exchange rate			(+)		(+)	

Note: The signs + and − show the positive and negative values of the significant impulse responses. Each impulse response is considered significant if a value of zero is not contained within its confidence band for at least five periods. The signs (+) and (−) show that the impulse responses are significant only for two to four periods.

2001), and the macroeconomic variable responses were noticeably different between regimes.

The rest of this paper is organized as follows. Section 2 describes the Markov-switching VAR model and the data used in our analysis. Section 3 presents and briefly discusses the empirical results. Finally, Section 4 concludes.

2. Model and data

2.1. Markov-switching VAR model

We use the following m-state Markov-switching vector autoregression model (MS-VAR).

$$Y_t = \begin{cases} v_1 + B_{11}Y_{t-1} + \cdots + B_{p1}Y_{t-p} + A_1 e_t & \text{if } s_t = 1 \\ \vdots & \\ v_m + B_{1m}Y_{t-1} + \cdots + B_{pm}Y_{t-p} + A_m e_t & \text{if } s_t = m, \end{cases} \tag{1}$$

where Y_t is a $K \times 1$ variable vector, v_i is an intercept, and $B_{1i}, \ldots, B_{pi}$ and A_i are $K \times K$ coefficient matrices ($i = 1, \ldots, m$). e_t is a $K \times 1$ fundamental disturbance vector and $e_t \sim N(\mathbf{0}, \mathbf{I}_K)$. e_t is also assumed to be uncorrelated at all leads and lags. s_t is an unobservable state variable, which represents the probability that a regime will be selected. In particular, s_t is assumed to follow a hidden Markov chain process. Notably, the probability that regime i at the current period transitions to regime j at the next period is defined as the following conditional transition probability.

$$\Pr(s_{t+1} = j | s_t = i) = p_{ij}. \tag{2}$$

In our m-state model, the transition probability is expressed as the following $m \times m$ probability matrix.

$$\begin{bmatrix} p_{11} & p_{12} & \cdots & p_{1m} \\ p_{21} & p_{22} & \cdots & p_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ p_{m1} & p_{m2} & \cdots & p_{mm} \end{bmatrix}. \tag{3}$$

2.2. Impulse responses

The impulse responses obtained from the MS-VAR are regime-dependent. The endogenous variables display distinct regime-specific impulse responses when a one-standard deviation shock is applied to a fundamental disturbance in a regime. The impulse response in regime i is defined as follows (Ehrmann et al., 2003).

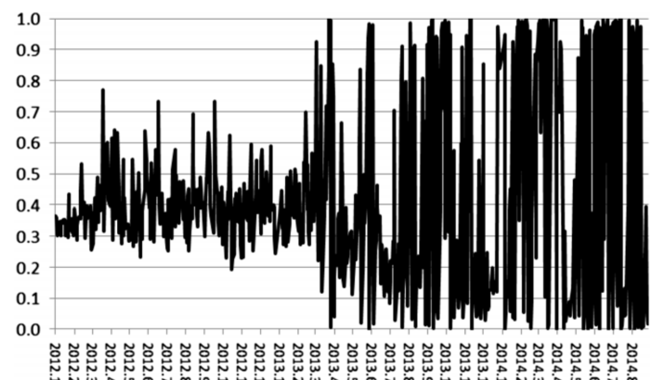

Fig. 1. Smooth probability of Regime 1.

$$\left.\frac{\partial E_t Y_{t+h}}{\partial e_{k,t}}\right|_{s_t = \cdots = s_{t+h} = i} = \theta_{ki,h} \quad \text{for } h \geq 0. \tag{4}$$

Eq. (4) represents the expected changes of variable Y at time $t + h$ when a one-standard deviation shock occurs in the kth fundamental disturbance at time t, conditional on regime i. Estimates of the impulse response can be calculated with the estimated parameter obtained from the MS-VAR with $\hat{A}_i$, where $\hat{A}_i$ is the estimated matrix of A_i. The following equations show the relationship between the estimated response vectors and estimated parameters.

$$\hat{\theta}_{ki,0} = \hat{A}_i e_0 \tag{5}$$

$$\hat{\theta}_{ki,h} = \sum_{j=1}^{\min(h,p)} \hat{B}_{ji}^{h-j+1} \hat{A}_i e_0 \quad \text{for } h > 0, \tag{6}$$

where $e_0 = (0, \ldots, 0, 1, 0, \ldots, 0)'$ is the initial disturbance vector, in which only the kth element is 1. $\hat{B}_{ji}$ is the estimated coefficient matrix of variable Y at the jth lag in Eq. (1). In this paper, the regime-dependent impulse responses and their confidence bands are obtained by the bootstrap method (Ehrmann et al., 2003).