論 文 の 要 旨

氏名　中西　正

論文題目　An Empirical Study of Japanese Monetary Policy Using Non-Gaussian SVAR Model
非ガウス型 SVAR モデル による日本の金融政策の実証研究

Abstract

Chapter 1

The purpose of this study is to analyze the effects of the so-called unconventional qualitative and quantitative monetary easing (QQE) policy that the Bank of Japan (BOJ) launched in April 2013 to overcome the long-term deflation in Japan. For this policy BOJ adopted the monetary base as a policy variable. Since the introduction of QQE, the MB has continued to rise rapidly, from about 49 trillion yen in April 2013 to about 651 trillion yen in May 2021. However, the inflation target of a stable 2 percent year-on-year increase in consumer prices by the BOJ has not been achieved on a sustainable basis. A review of actual data shows that although the inflation target was temporarily achieved at times, the effect was not as great as initially expected. In addition, since the introduction of QQE, there have been a number of negative effects, that is, the environment surrounding the Japanese economy has undergone major changes, including the expansion of QQE with negative interest rates, two consumption tax hikes, and COVID-19. Given these factors, we decided to analyze the impact of the increase in the MB using the structural vector autoregressive (SVAR) model.

Econometric methods are used to analyze monetary policy. Traditionally, the distribution of the structural error term has been assumed to be Gaussian. However, in analyses using actual data, the structural error terms are often non-Gaussian. Therefore, we proposed a new analysis method, which we call it “flexible quasi-log likelihood function approach” that assumes that the structural error term is non-Gaussian, and verify the effectiveness of the method by a Monte Carlo experiment. On the other hand, there already exists a R program called ‘id.ngml’ for NG-SVAR model analysis assuming a t-distribution. We also use id.ngml for comparison to our new method. Since both ‘id.ngml’ and our method use the ‘id.ngml’ Independent Component Analysis ICA we first briefly introduce ICA and associated algorithm called ‘fastICA’ and then explain how to apply ICA for NG-SVAR model

analysis.

Chapter 2

In this chapter, we analyzed the effects of Japan's monetary policy in three periods: before the introduction of QQE, after the introduction of QQE, and for the whole period including these periods. Moreover, we reviewed Japan's monetary policy to date and provides a survey of studies that have conducted empirical analyses of monetary policy. We introduced the accuracy of the estimation using the quasi-log-likelihood function of the t-distribution, referring to Maekawa (2021). We construct 5-variable models and summarize the results of each estimation based on the impulse response functions (IRF). We extend the 5-variable models to take into account the impact of the consumption tax hike and conduct an analysis.

In this chapter, following Miyao (2016), we estimated the 5-variable models that employed stock or exchange rates. In addition, the 6-variable models were estimated by adding a consumption tax variable to the previous 5-variable models. The effect of the increase in the MB of the policy variables was not enough to achieve the 2 percent inflation target set by the BoJ. As a result of our analysis, we cannot deny the possibility that even with unconventional monetary policy, the economy fell into a liquidity trap. Comparing the 5-variable model with the 6-variable model, the results of the 6-variable model analysis show that the impact of the increase in the MB is small and the impact of the consumption tax hike on the real economy is large.

We conducted our analysis assuming that the structural errors are a t-distribution. However, there remains the problem because t-distribution should be used. We had better to search a better p.d.f from a wider range of probability distributions family without assuming the t-distribution. We consider this problem in the next chapter.

Chapter 3

In this chapter we propose a new method of estimating NG-SVAR model named "flexible quasi-log likelihood function approach to calculate the quasi-maximum likelihood estimator (say, Flexible q-MLE)" and check the performance of it by Monte Carlo Experiments. In the experiments we generated the structural errors in NG-SVAR mode by the independent and identically distributed random error terms from the t-, Laplace-, and Hyperbolic Secant-distributions. Then assuming that we do not know this error distribution and estimate these errors. Next using estimated errors, we estimate the p.d.f of the structural errors. Then we adopt the estimated p.d.f as the approximate p.d.f of the structural errors. Finally, we construct the approximate log-likelihood function and estimate the target parameters in the NG-SVAR model.

To evaluate the performance of our estimator, we conducted Monte Carlo

experiments under the DGP, assuming that the structural error terms of the SVAR model follow three non-Gaussian distributions, namely, t-, Laplace-, and hyperbolic secant-distributions. For these three non-Gaussian distributions, we searched for the most suitable pdf from the Pearson family using the 'pearsonMSC' R function. Afterwards, we constructed the quasi-log-likelihood function using the selected pdf and calculated the quasi-log-likelihood estimator. Based on the experimental results, the quasi-log-likelihood estimator showed satisfactory performance. Finally, we applied our proposed method to an NG-SVAR model for the US economy with five macroeconomic variables to assess the effect of quantitative easing monetary policies, finding no serial correlations between structural and reduced-form errors. Although uncorrelatedness does not necessarily mean independence, we interpreted it as a weak measure of independence and proceeded with the analysis as customary.

Chapter 4

In this chapter, instead of assuming the distribution of the structural error term to be the t-distribution as in Chapter 2, we find a distribution that fits the data better from the Pearson distribution and adopt it as the approximate distribution of the structural error term. Using the approximate distribution so chosen, we construct the pseudo-likelihood function and calculate the maximum pseudo-maximum likelihood estimator of the coefficient matrix of the structural VAR model. The IRF is further estimated based on the results. We note that the scale and sing of IRF cannot be determined in ICA and its algorithm fastICA. This indeterminacy is inevitable in theory. Eventually, the only way to overcome this problem is to compare it with the actual data, to use the exogenous information such as economic theory and/or empirical knowledge.

In this chapter we used the IRF calculated from 'id.ngml', which assumes a t-distribution, as a reference to determine the sign using economic theory and to determine the effect of monetary policy. One standard deviation shock of the IRF is calculated from the data, the standard deviation of the MB in the after-period model is about 138.4 trillion yen, and the standard deviation of the MB in the whole-period model is about 169.9 trillion yen. From the IRFs, an increase in MB has a positive effect on Gross Domestic Product (GDP), although the degree of the effect varies. In fact, the GDP growth rate has continued to grow, albeit at a low rate. In addition, the rise in stock and the impact of the weaker yen on the exchange rate are consistent with actual economic conditions. In summary, the theoretical consistency of monetary policy is confirmed. However, although positive effects on inflation have been confirmed in some models, it is difficult to say that the effects have been sufficient to achieve the 2% inflation target set by the BoJ.

Chapter 5

Since all chapters are already summarized, we show here much shorter summary as follow.

Chap.2: We compared the IRFs of the 5-variable with stock variable data and 6-variable with stock variable and consumption tax data models. After considering the effect of the consumption tax hike and conducting the analysis, we found that the effect of the increase in MB is smaller and the effect of the consumption tax hike is larger.

Chap.3: The results of Monte Carlo experiments show that the pseudo-maximum likelihood method proposed in this paper yields better estimation results.

Chap.4: The IRF obtained both from our flexible quasi-log likelihood function method and from 'id.ngml' have a problem that the sign and scale are not uniquely determined. However, the IRF modified using economic theory is very similar to the IRF of 'id.ngml', indicating that the empirical analysis using the flexible pseudo-log likelihood function method is an effective analytical method.

Finally, we will mention future research. Although our quasi-maximum log-likelihood estimator showed satisfactory performance in both Monte Carlo experiences and empirical studies, little is mentioned the rationale in this dissertation. However, it seems possible to give the rationale asymptotically along the line of Lanne et al (2017). We will extend this paper towards this direction. Another direction of future research is to extend is to apply this research to a panel SVAR model. We will also use the panel NG-SVAR model to analyze the spillover effects of U.S. tightening monetary policy on emergent countries.