Estimation of DSGE models with Shadow Rate

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The Zero Lower Bound (ZLB) on short nominal interest rates has imposed serious constraint on stimulating and stabilizing economy on major central banks. Analysis of monetary policy by Dynamic Stochastic General Equilibrium (DSGE) models under the existence of ZLB has also been an important issue from both practical and academic views for central banks and macroeconomists. However, the nonlinearity of ZLB constraint makes linear solution and estimation techniques of DSGE models unreliable and impractical. In many empirical works, it has been proved that the shadow rate can be used as an accurate proxy to represent the stance of unconventional monetary policy in the ZLB environment. We use shadow rate to estimate a medium-scale DSGE model based on the theoretical foundation proposed by Wu and Zhang (2016) and conduct counterfactual simulation exercises to quantify the macroeconomic effects of unconventional monetary policy implemented by Bank of Japan (BoJ). Compared with the estimation results of pre-ZLB sub-sample (1980Q1-1998Q4), the structural parameters estimated from full-sample (1980Q1-2016Q3) with the shadow rate still have very reasonable values that are consistent with most of related medium-scale DSGE literature. The statistical properties of model dynamics implied by two groups of estimation are also very close. Counterfactual simulation shows that without the unconventional monetary policy, macroeconomic variables would have worse performance then their actual realizations.

Key Word: shadow rate, DSGE estimation, unconventional monetary policy, counterfactual simulation