Bayesian Estimation of DSGE Models: Is the Workhorse Model Identified?

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Abstract

As the model size increases, the estimation of DSGE model becomes more difficult. Among many reasons behind this, given non-linear nature of DSGE estimation, the identification problem is perhaps the most important concern by most macro researchers. Roughly speaking, the failure of identifying parameters in DSGE estimations is in parallel with the perfect collinearity in linear estimation, in which, if two data series X_1 and X_2 are perfectly collinear, coefficients β_1 and β_2 on them cannot be estimated separately. However, unlike linear cases, there is no simple analytical results to check identifiability; for example, it can be true that all parameters of a model can be estimated in certain parameter ranges, but not outside it. In addition, there are many other considerations in the case of DSGE estimations. First, the failure of parameter identification may be due to the model structure or due to the limitation of data availability. Also, even if it seems that all parameters are well identified, it could be simply because the prior is tight. Roughly speaking, Jacobian-based diagnostics detect the identification failure due to the model structure, while Hessian-based methods capture the effects of model structure and the data availability at the same time.

In this regard, we discuss the practicalities of the method proposed by Koop Pesaran and Smith (2011), which is Hessian-based diagnostic but it eliminates the effect of the prior in Bayesian estimation. They show that, if a parameter is well identified, the precision of the posterior should improve as the (artificial) data size T increases, and the indicator checks the speed at which precision improves. As it does not require any additional programming, a researcher just needs to generate artificial data and estimate the model with different T. We apply this indicator to the heavily cited Smets and Wouters' (2007) medium size US model, and find that while exogenous shock processes are well identified, most of the parameters in the structural equations are not. Some issues facing Bayesian estimation are explored.

KEYWORDS: Bayesian Estimation, Dynamic stochastic general equilibrium models, Identification.

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