Research Statement

Tae Bong Kim

taebong.kim@duke.edu

My research area is primarily on macroeconomics and applied econometrics. I am interested in studying a change of macroeconomic implications from specifying DSGE models at a higher frequency than the standard quarterly models. As a first step to this agenda, a DSGE model specified at a monthly frequency deserves a special attention since it can be reasonably estimated with macro time series data. The methodological paper, "Mixed Frequency Estimation of DSGE Models: Bayesian Approach" demonstrates how to accommodate the mixed frequency dataset to estimate DSGE models in general by using Bayesian data augmentation technique. As an application of this procedure, my job market paper particularly focuses on a temporal aggregation issue on a New Keynesian model and concludes that the degree of the price stickiness estimated at a monthly frequency is quantitatively different from a standard quarterly model. This result suggests that studying New Keynesian models at a monthly frequency can have different policy implications since the degree of price stickiness determines the length of a propagation of macroeconomic variables in response to a monetary policy innovation.

A monthly DSGE model estimated with the data augmentation method not only addresses a temporal aggregation bias but also can explore various interesting questions in macroeconomic studies. For example, this data augmentation method can naturally conduct inferences on unobserved movements of GDP at a monthly frequency and thus potentially can tune the forecasts. Another policy application is studying a model in which a monetary authority changes interest rates at a monthly decision time interval and yet interested in stabilizing quarterly measures of the economy. In the following these research agenda are discussed in more details.

Job Market Paper : "Temporal Aggregation Bias and Mixed Frequency Estimation of a New Keynesian Model"

This paper asks whether frequency misspecification of a New Keynesian model results in temporal aggregation bias of the Calvo parameter. First, when a New Keynesian model is estimated at a quarterly frequency while the true data generating process is the same but at a monthly frequency, the Calvo parameter is upward biased and hence implies longer average price duration. This suggests estimating a New Keynesian model at a monthly frequency may yield different results. However, due to mixed frequency datasets in macro time series recorded at quarterly and monthly intervals, an estimation methodology is not straightforward. To accommodate mixed frequency datasets, this paper proposes a data augmentation method borrowed from Bayesian estimation literature by extending MCMC algorithm with "Rao-Blackwellization" of the posterior density. Compared to two alternative estimation methods in context of Bayesian estimation of DSGE models, this augmentation method delivers lower root mean squared errors for parameters of interest in New Keynesian model. Lastly, a medium scale New Keynesian model is brought to the actual data, and the benchmark estimation, i.e. the data augmentation method, finds that the average price duration implied by the monthly model is 5 months while that by the quarterly model is 20.7 months.

"Mixed Frequency Estimation of DSGE Models : Bayesian Approach" (Working paper)

This paper presents an estimation strategy for DSGE models when data is available at different time intervals. This method is based on a data augmentation technique within Bayesian estimation literature. The benefits achieved via this methodology will be twofold, a resolution of a time aggregation bias and an identification advantage. This paper works with a simple Real Business Cycle model and estimate a set of structural parameters : total factor productivity, discount factor, depreciation rate of capital and capital share in production technology. Monte-Carlo simulation shows that a quarterly estimation results in
downward biased total factor productivity persistent parameter and upward biased standard deviation when the true data generating process is monthly. The proposed method of estimating RBC model recovers the true values of those parameters. Also this method brings efficiency to the estimates compared to a coarse estimation.

“Bayesian Mixed Frequency VAR’s” (Working paper with J. Chiu, B. Eraker, A. Foerster and H. Seoane)

This paper discusses how to combine data of different frequencies in estimating Vector Autoregressions (VAR’s). The method is based on Bayesian Gibbs sampling using a missing data formulation for coarsely observed data. An example is presented to estimate a model for economic growth based on quarterly observations of GDP, monthly industrial production and yield curve data. This approach has two immediate advantages: First, it allows for efficient estimation using the entire set of available data, and second, it allows inference to be carried out for the low frequency components from the high frequency ones. Thus, for example, up-to-date estimates of GDP growth using monthly industrial production and yield curve data can be constructed.

“Monthly Taylor Rule Targeting Quarterly Inflation and Output” (Work in progress)

This paper asks a conventional question but in a modified specification: what is the determinacy region for Taylor rule parameters that targets quarterly measures in a monthly specified New Keynesian model? Standard quarterly DSGE models cannot model higher frequency behaviors of agents in the economy and thus cannot reflect higher frequency decisions of a monetary authority. When Taylor rule is specified in a monthly New Keynesian model and yet monetary authority is reacting to quarterly inflation gap and output gap, the lower bound of the determinacy region for the response parameter of inflation gap changes to 0.33 which is a lower value than one. This preliminary result suggests that more frequent adjustment of interest rates, while monetary authority’s objective is to stabilize quarterly inflation, allows monetary authority to respond to inflation gap less sensitively than what standard quarterly model implies.

“Forecasting Performance of Monthly DSGE Models” (Work in progress)

This paper asks if monthly DSGE models can have a better forecasting performance. In principle, a monthly model can update its forecasts more frequently than a quarterly model and thus monthly observations can tune the forecasts before quarterly observations are realized. A medium scale New Keynesian model (Fernandez-Villaverde, Guerron-Quintana & Rubio-Ramirez 2009) and Financial Friction model (Bernanke, Gertler & Gilchrist 1998) are estimated with data augmentation method proposed by Kim (2009) and tested for this exercise.

“Temporal Aggregation of DSGE Models” (Work in progress with Christian Mattes)

This paper asks whether DSGE model can be aggregated over frequency. Simple statistical model's temporal aggregation bias can be resolved by the correct specification under a conversion of frequencies. For example, monthly AR(1) is equivalent to quarterly ARMA(1,1). But unlike backward looking statistical models, it is not clear how to directly convert a monthly specified DSGE model to quarterly specification since DSGE model is a form of linear difference equations with expectations that has forward looking nature. However, this project seeks to find an indirect method of temporal aggregation of DSGE models. DSGE model can still be represented by a state space model which is a statistical model and thus can be aggregated. Once aggregated state space model is available, the quarterly structural model in the form a linear difference model with expectations can be recovered by reverse engineering the solution process under some restrictions. These restrictions can be thought as an identification scheme of a DSGE model analogous to structural VAR’s identification scheme.