

学位請求論文要旨

An application to macro econometrics with spatio-temporal model

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This dissertation examines to construct spatio-temporal models and apply these models to macro econometric analysis. Spatio-temporal (or space-time) statistical models are tools used when performing inference and prediction for processes in the physical, environmental and biological science. The models are essential as they have the advantage of capturing both spatial extension and temporal duration.

On the other hand, Paelinck and Klaassen (1979) performed the first comprehensive attempt in outlining the field of spatial econometrics and its distinct methodology. Since the seminal work of Anselin (1988), many studies have focused on a spatial dependency. or estimating spatial dependency among cross-sectional variables, these methods are applied to a variety of problems in economics, such as hedonic real estate pricing, agricultural harvests and disaster payments, voting behavior, identification of edge cities, and regional labor markets. However, researchers in economics are interested not only in spatial dependency but also the sequence of data points, which are typically measured at successive times with uniform time intervals. Therefore, the spatio-temporal model that considers both spatial dependence and temporal structure has been utilized in econometrics. Furthermore, some spatio-temporal models have been proposed. It is necessary to develop further these models to include the spatial and temporal structure for capturing the dynamics of activities in economics.

Based on the work of Giacomini and Granger (2004), a spatio-temporal model has recently been applied to an empirical analysis of macro econometrics. Giacomini and Granger showed that if dependent variables are the results of the aggregation of regional dependent variables, the spatio-temporal model can improve the performance of forecasting. This spatio-temporal model has been utilized in the areas of macro econometrics, such as unemployment, economic growth,

and business cycles. However, few studies exist about empirical analysis that includes spatio-temporal models. This dissertation attempts to not only construct spatio-temporal models but also apply such models in an empirical analysis of macro economic data. Therefore, the main purpose of this dissertation is to construct the spatio-temporal model for macro economic variables and investigate whether this approach of using spatio-temporal models is effective for empirical analysis. The construction of the dissertation is as follows:

Chapter 1. Introduction.

Chapter 2. Forecasting electricity demand in Japan: A Bayesian spatial autoregressive ARMA approach.

Chapter 3. Space-time model versus VAR model: Forecasting electricity demand in Japan.

Chapter 4. Estimation of regional business cycle in Japan with Markov switching spatial autoregressive-AR model.

Chapter 1 introduces a motivation of this dissertation and briefly reviews spatio-temporal approach: spatio-temporal data, a weight matrix, and spatio-temporal model. Moreover, we explain about Bayesian approach.

Chapter 2 examines the regional electricity demand in Japan and spatial interaction among the regions. We propose a Spatial Autoregressive-ARMA (SAR-ARMA) model to consider the features of electricity demand in Japan and a strategy of Markov chain Monte Carlo (MCMC) methods. Empirical results show that the spatio-temporal model improves the overall performance of forecasting future electricity demands in Japan.

In Chapter 3, we examine the forecasting performance of disaggregated data with spatial dependency, and apply it to forecasting the electricity demand in Japan. From a Bayesian perspective, we compare the performance of the SAR-ARMA model proposed in the Chapter 2 with that of the vector autoregressive (VAR), which is widely used in macro econometrics. On the basis of the empirical results, we can conclude that the SAR-ARMA model with contemporaneous aggregation

provide better forecasting performance than the VAR model.

In Chapter 4, we estimate the regional business cycle in Japan and the spatial interaction among the regions using the regional indices of industrial production (IIP). We propose a Markov switching-spatial autoregressive-AR (MS-SAR-AR) model, which has an advantage of simultaneously capturing both of the turning points of business cycle and spatial dependency. Empirical results show that spatial interaction plays an important role in estimating the regional business cycle in Japan.

In Chapter 5, we summarize the conclusions and examine the remaining issues for future work.