Research Statement

Yufan Leiluo

I am an econometrician who specialized in spatial econometrics. I am interested in both theoretical and applied works. My research mainly focuses on the spatial panel data model, and can be divided into two smaller topics: (i) testing and model selection of spatial models (ii) spatial analysis of economic growth. Specifically, the first line of research focuses on making inferences with spatial models and my aim is to offer statistic tools for practitioners to decide which type of model is more suitable for analyzing data. The second line of research is on evaluating growth models with a new perspective of spatial dependencies, and provide possible insights to the policy makers. I will summarize my papers and discuss my future research.

"Adjusted LM Tests for Spatial Dynamic Panel Data Models under both Parametric and Distributional Misspecifications (Job Market Paper)

In this paper, I propose adjusted Rao's score test statistics (Lagrange multiplier (LM) tests) for a spatial dynamic panel data (SDPD) model, which includes a contemporaneous spatial lag, a time lag and a spatial-time lag along with both time and individual fixed effects. The suggested tests can be used to test the significance of each of the three lag terms or test any combination of them jointly. The tests are robust in the sense that with the presence of both parametric and distributional misspecifications, the distribution of the test statistics will remain unaffected and thus maintain the power and size property. To construct the test, I first correct the asymptotic bias of the score function caused by the two fixed effects in the model, so the corrected score will have a 0 mean. Then, I robustify it by the large sample property of the score under the quasi maximum likelihood framework, so the tests are robust to non-normal distributions. Next, I further adjust the score function so the influence of the nuisance parameters being misspecified is canceled. I combine the adjusted score with the distributional misspecification robust tests to get the tests that are robust to both misspecificaitons. I conduct a Monte Carlo study to show my tests are working properly with finite samples. I also illustrate the application of my tests with an empirical example of capital productivity. One desired feature of my suggested tests is that the tests are calculated under the null restriction where all the lag terms are set to 0. The model degenerates to a simple two-way fixed effect model, and can be easily estimated. The testing procedure circumvents the computation burden for estimating the SDPD model.

"Robust LM tests for spatial dynamic panel data models

This paper is a joint work with Anil Bera, Osman Dogan and Suleyman Taspinar. Actually, it is a special case of my job market paper. We have two approaches to estimate the SDPD model.

For a direct approach, we plug in maximum likelihood estimator (MLE) of the fixed effects for estimation; for a transformation approach, the model is first transformed to wipe out the time fixed effects, and the individual fixed effect is then concentrated out using MLE. Comparing with the direct approach, the transformation approach has fewer requirements to sample size but is not applicable to a unnormalized weight matrix. In this paper, we suggest a parametric misspecification robust test based on the direct approach. My job market paper covers the transformation approach and the distributional misspecification that are not discussed in this paper. However, I also show in my job market paper that the tests in this paper are essentially equivalent to the distribution robust tests, so the tests in this paper share the advantage of the tests in my job market paper.

"Robust LM Tests for Spatial Dynamic Panel Data Models: The sdpdlm R Package

I write this R package and corresponding paper with Anil Bera, Osman Dogan and Suleyman Taspinar. As the aim of my deriving tests is to facilitate other researchers to make statistical inferences. We first take the tests from the "special case" paper, and extend the test to allow for time-varying spatial weight matrices. Then we wrap all the tests into this R package so other researchers can easily implement our tests. The R package is done before my job market paper. After the job market paper is finished, I also update the package with new tests. I am planning to keep updating the package, so that the package can be applied to various settings of the SDPD type models.

"Nested and Non-nested Tests of Nonlinear Spatial Volatility Model with Distributional and Parametric Misspecifications

The paper is written with Anil Bera. The fact that we observe no spatial correlation in Chicago housing return data, while the squared returns show significant spatial effects motivates the paper. We consider such spatial heteroskedasticity by a nonlinear SAR conditional heteroskedasticity (NSARCH) model. The added nonlinearity is introduced through the Box-Cox (BC) transformation. This model encompasses the linear and log linear form with BC parameter being 1 and 0, respectively. We derive various combinations of Rao's score (RS) tests for testing linear or log linear functional form and the presence of spatial correlation, in their original and robust forms, assuming normality. Then we relax that assumption and further robustify the tests under distributional misspecification. Non-nested tests for linear vs. log linear forms and vice-versa for selecting one of the models are also developed. The finite sample performance of the proposed tests is investigated by an extensive Monte Carlo simulation study. Finally, we illustrate the usefulness of our suggested test procedures with the Chicago housing return data that motivates this paper.

"A Spatial Binary Panel Analysis of Growth Accelerations"

In this joint work with Guzin Bayar and Bulent Guloglu, we examine the growth experience of 82 developed and developing countries for the period 1970-2014 using a binary spatial panel model as a relatively new approach. The literature on estimation of spatial binary models mainly focuses

on the static model instead of the panel data model. We introduce a new way of estimating the spatial binary panel data by combining McMillen (1992) with Mundlak (1978) and Chamberlain (1984). We first estimate each year of data with a static spatial probit model, and then use a minimum distance method to calculate the estimate for the whole panel data model. The approach avoids a complicated T dimensional integration problem that carries difficulty to the estimation of the spatial panel binary model. Another advantage of the suggested approach is that time-varying spatial weight matrix can be incorporated simply by using different matrices for each year. For the analysis of data, multiple distance measures to form the spatial weight matrix are applied in the paper. Among the distances we study, we find that economic growth globalization distance, which is a measure of distance based on trade openness, has the most significant coefficient for the corresponding weight matrix. The economic growth of countries mainly affect each other through trade activity, and such effect is even higher than countries that are geographically close. We also find that the human capital has the most positive coefficient, while the age dependency ratio has the most negative coefficient, with all weight matrix settings. We conclude that policy makers should keep investing in education and maintain a stable share of working age population to achieve economic growth acceleration. The influence of economic growth spread mainly through trade.

"A Spatial Geographically Weighted Panel Approach to Estimating Growth Models"

This paper is another joint work with Guzin Bayar and Bulent Guloglu. We use panel data of OECD countries for 1980-2014 to study the factors that contributes to GDP per capita which is a key variable in development economics. We consider allowing for the spatial heterogeneity in the parameters, so the parameters can be varying at different locations. To incorporate this feature of model, we adopted a geographically weighted regression (GWR) model, which is a generalized version of locally weighted regression. The estimation method puts more weight on data from neighboring countries. However, like the spatial binary model, little literature extends the GWR model to a panel data version. We combine the static estimates of GWR model using the minimum distance approach. By doing this, we can estimate a panel GWR model. For the estimates of the model, total factor productivity turns out to be the factors that have the greatest effect on income growth, followed by captial stock. Population variable has negative significant coefficient most probably due to the existence of not very high income but high population countries in the sample. We also find that the parameters for the same variable do change with locations. Country with high parameter can be 50% higher than other countries. This confirms that allowing for spatial heterogeneity can improve the estimation.

Future Research

For my next steps in this area, I plan to extend the current research in the following possible directions: (i) incorporate more model features to the SDPD model. This includes model with endogenous spatial weight matrix, model with unknown spatial weight matrix, spatial correlated error terms, SDPD model with heteroskedasticity, and model with multiple weight matrices. I am

interested in both estimation and testing of such models. (ii) analysis of economics growth with SDPD model. My previous empirical paper are mainly done by extending the static model with a minimum distance approach to be the panel data model. I am also interested in using the panel model directly to conduct such analysis, and dig the truth about economic growth. I am open to all related field research, so I would love to work with researchers from different backgrounds to further expand these topics.