Research Statement

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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.

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

In this paper, I introduce 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. The tests are robust to both parametric and distributional misspecifications, and can be used to test the significance of each of the three lag terms. It can also test any combination of them jointly. The quasi maximum likelihood estimator (QMLE) for the SDPD models suffers from an incidental parameter problem due to the individual and time fixed effects in the model. The score functions then can have asymptotic bias, and are not centered on zero. This paper shows how to make correction to the score functions, so they are centered at 0 using both transformation approach and direct approach for estimation of the model. Then, I derive LM test statistics that are valid under distributional misspecification, and LM tests that are robust to local parametric misspecification. Finally, the two derived tests are combined to construct new LM tests, which are robust to both parametric and distributional misspecifications. I illustrate the performance of the suggested test in a Monte Carlo study and empirical applications.

"Robust LM tests for spatial dynamic panel data models

This paper is a joint work with Anil Bera, Osman Dogan and Suleyman Taspinar. It is a special case of my job market paper. To estimate the SDPD model, we have two approaches. First, a direct approach, we plug in maximum likelihood estimator (MLE) of the fixed effects for estimation. Second, 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 also covers the transformation approach and the distributional misspecification that are not discussed in this paper. However, I 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 suggested in my job market paper.

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

I write this paper and corresponding R package with Anil Bera, Osman Dogan and Suleyman Taspinar. As the aim of my deriving tests is to facilitate making statistical inferences, we write the R package so our tests can be easily implemented. We take the tests from the "Robust LM tests" paper, and extend the test to allow for time-varying spatial weight matrices. Then, we wrap all the tests into this R package. The R package is finished before my job market paper, while I am also updating the package with new tests in my job market paper. 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 cross-sectional data model instead of the panel data model. We introduce a new way of estimating the spatial binary panel data by combining cross-sectional spatial probit model with a minimum distance method. We first estimate the data of each year as cross sectional data, and then use a minimum distance method to calculate the estimate for the whole panel data model. The approach avoids a complicated nT 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. To estimating the data, we apply several weight matrices based on difference distance measures. Among the distances we study, 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 cross-sectional GWR model to a panel data version. We combine the cross-sectional estimates of GWR model using the minimum distance approach to estimate a panel GWR model. We find that 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 change at different 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 or time-varying weight matrices. I am interested in both estimation and testing. (ii) analysis of economics growth with SDPD model. My previous empirical paper are mainly done by extending the cross-sectional model with a minimum distance approach to estimate panel data. 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.