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Summary of Professional Work: 2001-2006
September 2006

1. Research

My primary area of research over the past five years has been spatial econometrics. My work in this field has been both theoretical and applied. I will first give a brief over-view of spatial econometrics, and then indicate the nature of some of my work.

Spatial Econometrics:

Spatial econometric models have become an important tool in economics, political science, sociology, regional science, and geography for analyzing a wide range of empirical issues. In spatial models interactions between cross sectional units are typically modeled in terms of some measure of distance between them. These interactions could be due to competition between cross sectional units, copy-cat policies, net-work issues, spill-overs, externalities, regional issues, etc. They could relate directly to the model dependent variable, to the exogenous variables, to the disturbance terms, or to various combinations of these three. Spatial distances could relate to geographic space, as well as other spaces such as product space, market space, input space, etc. Finally, these models are especially useful in a panel data setting in which the number of cross sectional units, N, is large, but the number of time periods, T, is small; indeed, in one case the value of $T = 1$.

As an over-view, a glance at my vita will indicate that since 2001 I have published twelve papers. Of these twelve published or forthcoming papers ten are theoretical in nature, while two are applied. The applied papers are based on applications of the spatial modeling approach. One, coauthored by G. Tavlas and G. Hondroyiannis and forthcoming in *Open Economies Review*, relates to contagion issues in foreign exchange markets. Among other things, this paper finds that contagion is a significant factor in exchange markets, and suggests new measures which relate to its extent. The other paper, coauthor by D. Robinson and published in *Contemporary Issues in Urban and Regional Economies*, 2005, relates to the study of demographic trends in US cities, 1970-1990. Among other things, this paper suggests and then computes multivariate measures which relate to issues as to whether or not cities converge in various ways to each other.

The ten theoretical published or forthcoming papers are all in spatial econometrics. Again, a glance at my vita will indicate that four of these papers are published or forthcoming in the *Journal of Econometrics;* of the other six, three are in regional journals, namely *Regional Science and Urban Economics*, *Journal of Regional Science*, and *Papers in Regional Science,* while the other three

are in conference volumes. For the sake of space limitations, I will briefly outline the four papers which were published in the *Journal of Econometrics,* and then still more briefly outline the nature of the other six papers.

In the paper forthcoming in the *Journal of Econometrics*: "HAC Estimation in a Spatial Framework", coauthored by Ingmar Prucha, we suggest a non-parameteric estimator of an asymptotic variance covariance matrix which would naturally arise in a spatial framework in which an IV procedure is used to estimate the model parameters. We show consistency, and give conditions under which our estimator would be positive-semidefinite in small samples. All HAC-type estimators are based on some distance measure. A unique characteristic of our HAC estimator is that we allow for more than one distance measure, and do not assume that the researcher knows which one is the true distance measure. We also allow for errors of measurement. We also demonstrate the applicability of our results in the context of a spatial model which is estimated by an IV procedure.

In the paper "Panel Data Models with Spatially Correlated Error Components" with M. Kapoor and I. Prucha which is also forthcoming in the *Journal of Econometrics* we consider a spatial model in a panel data framework and extend the usual error component specification so that it includes spatial correlation. For this model we first suggest a variety of estimators of the parameters of the disturbance process. These estimators differ in their computational burden. We formally demonstrate the consistency of our suggested estimators. We also demonstrate that the parameters of the disturbance process are nuisance parameters with respect to the estimation of the regression parameters.

Another important paper, coauthored with Ingmar Prucha, was published in the *Journal of Econometrics 2004 and* entitled "Estimation of Simultaneous Systems of Spatially Interrelated Cross Sectional Equations". In this paper we formally specify a system of simultaneous cross sectional equations in which there are spill-overs between the dependent variables, independent variables and in the error terms. We propose estimators for the parameters of this system and formally prove their consistency and asymptotic normally. We also suggest consistent procedures for obtaining small sample inferences. The system we consider is reasonably general so that it should accommodate models relating to a variety of interesting cases, such as cross sectional spill-overs involving wages and productivity, or housing prices and labor supply, or various budgetary expenditures of cities which compete with each other for firms or upper income citizens, etc.

The paper "On the Asymptotic Distribution of the Moran I Test Statistic with Applications", jointly coauthored with Ingmar Prucha was published in the *Journal of Econometrics 2001.* In this paper we give a new central limit theorem, which accounts for triangular arrays, an use it to derive the large sample distribution of the test statistic for spatial correlation that is typically used in spatial models, namely the Moran I statistic. Among other things, our results are general enough to permit the application of the Moran I test procedure to many qualitative and limited dependent variable models, sample selection models, and nonlinear models. Prior to our results, there were no

formal results relating to such models.

The remaining six papers in my vita dated since 2001, relate to a variety of estimation issues in spatial analysis when various special characteristics hold. These range from efficient estimation, as discussed in "Instrumental Variable Estimation of a Spatial Autoregressive Model with Autoregressive Disturbances", coauthored with I. Prucha and Y. Yuzefovich, to results which correspond to special cases of spatial models relating to particular specifications of the weighting matrix, as discussed in the two papers "Important Characteristics of Spatial Models whose Weighting Matrices have Blocks of Equal Elements", coauthored by I. Prucha and Y. Yuzefovich, and the paper "2SLS and OLS in Spatial Autoregressive Models with Equal Weights", coauthored with I. Prucha. The paper "Small Sample Properties of Estimators of Spatial Autoregressive Models with Autoregressive Disturbances", coauthored with D. Das and I. Prucha gives Monte Carlo results on parameter estimators in spatial models, notably a GM estimator, while the paper "Properties of Tests for Spatial Error Components: A Further Analysis, coauthored with Y. Yuzefovich describes certain theoretical issues in designs of Monte Carlo experiments. This paper also introduces various models which intertwine heteroskedasticity and spatial correlation. Such models had not previously been considered! Finally, the paper "The Influence of Spatially Correlated Heteroskedasticity on Tests for Spatial Correlation", coauthored with D. Robinson describes how it might be reasonable for the heteroskedasticity defining the disturbances to be spatially correlated, and then how this will effect the property of a test for spatial correlation.